M3 Junction 9 Improvement

Scheme Number: TR010055

6.1 Environmental Statement Chapter 5 Air Quality (Rev 1) Tracked

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6.1 ENVIRONMENTAL STATEMENT - CHAPTER 5: AIR QUALITY

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5 Air Quality

5.1 Introduction

5.1.1 This chapter presents the findings of the assessment of the construction and operation of the M3 Junction 9 Improvement Scheme (hereafter referred to as the Scheme) on air quality. This chapter outlines legislative, policy framework and guidance, describes the assessment methodology, study area, baseline conditions, an overview of potential impacts, mitigation measures, likely residual effects, monitoring and a summary. This chapter has been prepared by a competent expert, further details are provided in **Appendix 1.1 (Competent Expert Evidence)** of the **ES (Document Reference 6.3).**

5.1.2 This chapter should be read in conjunction with **Environmental Statement (ES) Figures 5.1 – 5.6** (**Document Reference 6.2**) and **Appendices 5.1 to 5.4** of the **ES (Document Reference 6.3)** which comprise:

- ES Appendix 5.1: Air Quality Methodology and Verification
- ES Appendix 5.2: Human Receptors, Backgrounds and Operational Phase Results
- ES Appendix 5.3: Designated Habitats, Backgrounds and Operational Phase Results
- ES Appendix 5.4: Traffic Data

5.1.3 This chapter should be read in parallel to **Chapter 8 (Biodiversity)**, **Chapter 12 (Population and Human Health)** and **Chapter 15 (Cumulative Effects)** of the **ES (Document Reference 6.1)**.

5.2 Consultation

5.2.1 Consultation and engagement have informed the air quality assessment. Comments and responses to the Scoping Opinion received in November 2020 are provided in **Appendix 4.2 (Scoping Comments and Responses)** of the **ES (Document Reference 6.3)** and comments and responses received during the 2021 statutory consultation are provided in **Appendix K of the Consultation Report (Document Reference 5.1).**

5.2.2 **Table 5.1** outlines further engagement that has been undertaken to inform the Scheme and the assessment.

Table 5.1: Consultation undertaken relevant to air quality

Reference	Comment	Response
Eastleigh Borough Council (email from Environmental Health)	*Reiterated concerns as to impact on Eastleigh and AQMA. Requested consideration of impacts on allotments near M3*	The Air Quality assessment reported in this chapter includes consideration of impacts on a selection of representative receptors within Eastleigh (see **Figure 5.5 (Human Receptors and 2027 Do-Something NO_2 annual average concentration)** of the **ES (Document Reference 6.2)).** Receptors (R25,26,27) modelled in the vicinity of the allotments indicate no exceedance of relevant air quality thresholds.
Winchester City Council (phone call)	Reiterated concerns as to changes in traffic flows through the city centre (and AQMA) during construction and focus on receptors along Easton Lane, Wales Street and North Walls.	The extent to which traffic management during construction could result in increased traffic through Winchester City centre has been assessed through traffic modelling and reported in this chapter in accordance with DMRB LA 105, (Highways England, 2019). Receptors (R46, R54, R55, and R56) have been added to the assessment (in addition to R06 and R07) to clarify impacts in the areas identified by Winchester City Council (see **Figure 5.5 (Human Receptors and 2027 Do-Something NO_2 annual average concentration)** of the **ES (Document Reference 6.2))**.

5.3 Legislative, policy framework and guidance

5.3.1 This assessment has been undertaken considering current legislation, together with national, regional and local plans and policies. A list is provided below and further detail regarding National Policy can be found in the **National Policy Statement for National Networks Accordance Table (Document Reference 7.2):**

- Environmental Protection Act 1990

- The Environment Act 1995 The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020
- The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019
- The Air Quality (England) Regulations 2000
- The Air Quality Standards Regulations 2010
- National Policy Statement for National Networks 2014
- The Air Quality Strategy 2007
- The Clean Air Strategy 2019
- National Air Pollution Plan for NO_2 in the UK (Defra) 2018
- National Planning Policy Framework 2021
- Planning Practice Guidance (online resource)
- Winchester District Local Plan Part 1 – Joint Core Strategy 2013
- Winchester District Local Plan Part 2 – Development Management and Site Allocations 2017
- South Downs Local Plan 2019
- Winchester City Council Air Quality Action Plan 2017
- Winchester District Draft Local Plan 2018 -2038 (emerging)
- Winchester City Council Air Quality Supplementary Planning Document – 2021

5.3.2 In addition to the legislation and national and local planning policies listed above, this assessment has also been carried out in accordance with the following professional standards and guidance:

- DMRB LA 105 Air Quality (Highways England) 2019
- Local Air Quality Management Technical Guidance (LAQM.TG (22)) (Defra) 2022

5.4 Assessment methodology

Scope of assessment

5.4.1 The assessment follows the approach set out in DMRB LA 105 Air Quality (Highways England, 2019) and comprises:

- Review of traffic modelling data to identify the nature and magnitude of predicted changes to traffic flows resulting from the Scheme to define the 'Affected Road Network' (ARN)
- Characterisation of existing baseline conditions within proximity to the Affected Road Network
- Assessment of the likely effect on local air quality during construction due to both construction dust and traffic related emissions
- Assessment of significance of the local air quality effects during operations, including an assessment of compliance with the Air Quality Regulations
- Assessment of the likely changes in nitrogen deposition rates due to NO_2 during operation at designated habitats
- Identification of the need for mitigation measures where appropriate, and assessment of residual effects following the application of mitigation

Study area and baseline approach

5.4.2 The study area is defined within **Section 5.5** and comprises the ARN. The screening criteria for defining the affected roads (during either construction or operational phases) are set out in DMRB LA 105 Air Quality (Highways England, 2019) which defines the following criteria when comparing the Do-Something scenario (with the Scheme) and the Do-Minimum scenario (without the Scheme) in the opening year (2027 – see **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)** for further detail):

- Annual average daily traffic (Annual Average Daily Traffic (AADT)) >=1000 (increase or decrease)
- Heavy duty vehicle (HDV) AADT >=200 (increase or decrease)
- A change in speed band
- A change in carriageway alignment by >=5m

5.4.3 Roads that exceed one or more of the above criteria would be classed as 'affected' and along with other roads included in the traffic model within 200m, constitute the ARN as shown in **Figure 5.2 (Affected Road Network)** of the **ES (Document Reference 6.2).**

5.4.4 Baseline data (and identification of sensitive receptors) is outlined in **Section 5.6**. The baseline has been informed through gathering available desk-based information, data from stakeholders. It has been characterised with reference to the following data sources:

- Local Air Quality Management (LAQM) published reports, primarily those by Winchester City Council (WCC) and Eastleigh Borough Council (EBC)

- Defra background air pollution mapping
- National modelling undertaken by Defra using the Pollution Climate Mapping (PCM) model
- Nitrogen deposition background modelling provided by the online Air Pollution Information System (APIS) for designated habitats.

Approach to design, mitigation and enhancement measures

5.4.5 Embedded mitigation is listed within **Chapter 4 (Environmental Assessment Methodology)** of the **ES (Document Reference 6.1).** Essential mitigation measures have been identified within this chapter. Mitigation is also included within the **first iteration Environmental Management Plan (fiEMP) (Document Reference 7.3)**.

Assessment approach - air quality objectives for human receptors

5.4.6 The relevant air quality objectives for human receptors, used in the assessment, are presented in **Table 5.2.**

Table 5.2: Relevant Air Quality objectives and limit values

Pollutant	Time Period	Objective/limit	Source
NO_2 (nitrogen dioxide)	1-hour mean	200 microgram per cubic meter (µg/m^3) not to be exceeded more than 18 times a year	NAQO and limit value
	Annual mean	40 µg/m^3	NAQO and limit value
PM_{10}	24-hour mean	50 µg/m^3 not to be exceeded more than 35 times a year	NAQO and limit value
	Annual mean	40 µg/m^3	NAQO and limit value
$PM_{2.5}$	Annual mean	20 µg/m^3	Limit value

5.4.7 As per paragraph 2.21.4 of DMRB LA 105 Air Quality (Highways England, 2019), the PM_{10} modelling (combined with $PM_{2.5}$ background concentrations) has been used to demonstrate that the Scheme would not adversely affect compliance with the $PM_{2.5}$ air quality threshold.

5.4.8 For designated habitats, the impacts of the deposition of NO_2 and ammonia (NH_3) have been assessed against relevant critical loads for nitrogen deposition as per DMRB LA 105 (Highways England, 2019) as presented in **Appendix 5.3 (Designated Habitats, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3).**

Assessment approach - construction phase dust

5.4.9 During construction of the Scheme, dust from on-site activities and off-site trackout by construction vehicles has the potential to impact on sensitive receptors; the main potential impacts are loss of amenity (as a result of dust soiling) dust annoyance and locally elevated concentrations of PM_{10}.

5.4.10 In accordance with DMRB LA 105 (Highways England, 2019), the construction dust assessment study area includes a 200m buffer around anticipated construction works (which represents the area most at risk of being impacted in relation to construction dust), including haul routes, compound areas and soil storage areas.

5.4.11 All sensitive receptors (human and designated habitats) within distance bands 0-50m, 50-100m and 100-200m of the construction works have been identified and are presented in **Figure 5.3 (Construction Dust Buffer)** of the **ES (Document Reference 6.2)**. To provide a precautionary approach, it has been assumed that construction activities could occur up to the extents of the Application Boundary.

5.4.12 To inform the identification of appropriate mitigation measures the 'dust risk potential' of Scheme has been defined as per **Table 5.3**.

Table 5.3: Construction dust risk potential (as per DMRB LA 105 (Highways England, 2019))

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.

5.4.13 The criteria presented in **Table 5.4** has then been applied to determine the sensitivity of the receiving environment to construction dust.

Table 5.4: Receiving environment sensitivity to construction dust (as per DMRB LA 105 (Highways England, 2019))

Construction Dust Risk Potential	Distance of sensitive receptors from construction activities		
	0 –50 m	>50 – 100 m	>100 – 200 m
Large	High	High	Low
Small	High	Low	Low

5.4.14 The 'construction dust risk potential' has then been used to inform the best practice mitigation measures in the **fiEMP** (**Document Reference 7.3**). These mitigation measures would seek to suppress the dust generation rate and also mitigate its dispersion and maximise the use of existing vegetation barriers where practicable.

5.4.15 With the application of appropriate best practice mitigation in place, dust impacts associated with construction are considered unlikely to result in a significant effect.

Assessment approach – construction phase road traffic vehicle emissions assessment

5.4.16 DMRB LA 105 (Highways England, 2019) recommends that the impact of construction activities on road vehicle movements should be assessed where construction activities are programmed to last for more than two years.

5.4.17 As detailed in **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)**, the overall Scheme construction activities are programmed to last for in excess of three years (from autumn 2024 to winter 2027), and therefore in accordance with DMRB LA 105 (Highways England, 2019), an assessment of construction phase traffic impacts has been undertaken.

5.4.18 To investigate the impact of the construction activities on traffic flow, microsimulation modelling of the junction has been undertaken for the key construction phases. This identified that 'phase 3A' of the construction works (as defined in **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)** resulted in the greatest impacts within the microsimulation model and has therefore been tested in the Strategic Transport Model to ascertain potential impacts on the wider transport network.

5.4.19 Further details on the construction traffic flows and the nature of traffic management measures across the three main construction periods can be found in the **Transport Assessment Report (Document Reference 7.13)**.

5.4.20 In addition to the modelled effect of traffic management measures on traffic flows, the impact on traffic flows as a result of 'temporary traffic diversions' (as detailed in the **Construction Traffic Management Plan (Document Reference 7.8)** and **Figure 2.4 (Temporary Traffic Diversions)** of the **ES (Document Reference 6.2)**) and on-road vehicle movements associated with the construction phase (i.e. staff commuting, material deliveries etc) have also been considered.

5.4.21 DMRB LA 105 (Highways England, 2019) further recommends that the assessment of construction traffic impacts on sensitive receptors should be proportionate and limited to areas of key risk of exceeding air quality thresholds.

5.4.22 Therefore, the 'traffic scoping criteria'; (see **Paragraph 5.4.2**) are applied to the construction related traffic to identify a 'construction ARN'. The 'construction

ARN' has then been compared to the operational modelling results to identify areas of potential exceedance, considered to be where the 2027 Do-Minimum scenario indicated receptors where the annual average NO_2 concentration exceeds 36 µg/m^3.

5.4.23 Where this 'construction ARN' coincides with areas at risk of exceeding air quality thresholds, the potential impacts have been quantified in accordance with DMRB LA 105 (Highways England, 2019) (see **Paragraphs 5.4.29 to 5.4.55**).

Assessment approach - operational phase road vehicle emissions assessment

5.4.24 The local air quality assessment of operational traffic emissions has considered the following scenarios:

- Baseline (2015), the traffic model validation year, for model verification
- Projected base year (2015 traffic data with 2027 background concentrations and vehicle emissions to inform the 'gap analysis' of uncertainty in future decrease in NOx emission from vehicle exhausts)
- Opening Year (2027) Do-Minimum
- Opening Year (2027) Do-Something

5.4.25 As stated within the PEIR, it is not considered necessary to also quantify air quality impacts at the design year of 2047 as the decrease in pollutant emissions (from traffic and other sources) in the interim period, results in 2027 representing the worst case due to higher background concentrations and emissions, as is standard practice and as per DMRB LA 105 (Highways England, 2019) (note to paragraph 2.89).

Identification of study area

5.4.26 Representative sensitive receptors have been identified within 200m of the ARN and include residential properties, schools and hospitals (as shown in **Figure 5.2 (Affected Road Network)** of the **ES (Document Reference 6.2)**), which have been used for the assessment against relevant annual mean air quality thresholds.

5.4.27 Representative sensitive receptors have been selected, following the methodology agreed (as stated in paragraphs 2.18 – 2.21 of DMRB LA 105 (Highways England))-and through consultation with the Environmental Health Departments at WCC and EBC, to reflect locations with the highest pollutant concentrations, or which are anticipated to experience the highest level of change in pollutant concentrations as a result of the Scheme. Additional sensitive receptors (where deemed necessary) have been chosen to include all sensitive receptors which show an exceedance of relevant air quality thresholds within the Do-Minimum or Do-Something scenarios.

5.4.28 All identified designated habitats (with features sensitive to air pollution) within 200m of the ARN have been included as receptors and impacts modelled at 10m spacing along a transect 200m in length as per DMRB LA 105 (Highways England, 2019). For veteran trees located outside of any other designation, a single receptor has been applied.

Quantification of emissions

5.4.29 The strategic transport model has been used to provide predictions of traffic flows, the proportion of HDV and speed bandings for differing time periods (AM period (7AM to 10AM), PM period (4PM to 7PM), inter-peak period (10AM to 4PM) and overnight period (7PM to 7AM)) for each of the scenarios.

5.4.30 This data has been used to calculate emissions of NOx and PM_{10} from each link of the ARN in accordance with LA 105 (Highways England, 2019) using speed band emission factors generated by National Highways (provided within IAN185-13 v4.3) from the Emissions Factor Toolkit (EFT) v11. EFT provides emission factors for 2018 to 2050, and the developers of the tool (Bureau Veritas) provided National Highways with a version to allow speed band emissions to be calculated for 2015 based on EFTv11. Emissions were defined according to the speed band category of the road and the road type and location..

Prediction of impacts

5.4.31 The resultant concentrations of pollutants (NOx, PM_{10}) due to the vehicle emissions from the ARN are predicted at identified sensitive receptor locations using the ADMS-Roads dispersion model with meteorological data from Southampton Airport meteorological station for 2015 (the verification year).

5.4.32 The dispersion model was constructed by digitising links from the transport model to the Ordnance Survey (OS) MasterMap Highways Network and assigning road widths based on OS MasterMap Highways Network data and design.

Processing of model results

5.4.33 In accordance with LAQM.TG(22) (Defra, 2022), modelled road-based concentrations of NOx were converted to annual mean NO_2 using the 'NOx to NO_2' calculator (Defra, 2020c). It should be noted that the latest Defra 'NOx to NO_2 calculator (Version 8)' only allows conversions to be calculated for 2018 to 2030, however for 2015 base year has applied 2018 data with the fraction of primary NO_2 (f-NO_2) adjusted to reflect 2015 fleet composition.

5.4.34 The traffic mix (e.g. whether urban road or motorway) used for the conversion from NOx to NO_2 was selected depending on the modelled receptor location and road types.

Background concentrations

5.4.35 Total air pollutant concentrations comprise a background and a local road component, both of which are 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 component of the background is affected by emissions from sources such as roads and chimney stacks, which are less well mixed locally, and add to the background concentration.

5.4.36 For the purposes of this assessment the background concentrations for 2018 (Defra, 2020a) were obtained from the Defra UK-AIR website and were compared and adjusted against data obtained from background monitoring sites to generate 2015 background concentrations as described in **Appendix 5.1 (Air Quality Modelling Methodology and Verification)** of the **ES (Document Reference 6.3)**.

5.4.37 Background nitrogen (N) deposition data has been obtained from the APIS database (Centre for Ecology and Hydrology, 2022) to predict N deposition at ecological designated habitats and represents a three-year average deposition rate to moorland (applicable to short vegetation such as grassland) or forest (applicable to tall vegetation) over the period 2018 to 2020. The background deposition rate was selected according to whether the ecological receptor modelled was associated with short or tall vegetation and no predictions of future decreases in background nitrogen deposition rates are provided by APIS and therefore remain constant.

Model verification

5.4.38 The predicted road contribution of air pollutants for the 2015 scenario have been compared to local air quality monitoring results to derive appropriate verification factors, which are then applied to the modelled concentrations to benchmark the model in accordance with Defra TG22 guidance (Defra, 2022).

5.4.39 The verified road contribution of modelled pollutants has been combined with appropriate background pollutant concentrations to determine the overall pollutant concentration at each sensitive receptor.

Consideration of future trends

5.4.40 Vehicle emission factors assume that air quality improves in future years, as older vehicles are replaced with modern cleaner vehicles. However, historically the monitored roadside NO_2 concentrations have generally not declined as would be expected, although more recent trends align better with predictions. The deviation from predictions was heavily influenced by some Euro V and VI diesel vehicles, which emitted more NOx in the real world than expected, they also have higher primary NO_2 emissions than petrol vehicles.

5.4.41 To address this uncertainty and to ensure that future pollutant concentrations generated by the air quality model are not overly optimistic, DMRB LA 105

(Highways England, 2019) provides an approach to uplift modelled future NO_2 concentrations. The approach requires a 'gap analysis' to be undertaken whereby adjustment factors are applied to uplift the modelled results to account for the gap between measured roadside NO_2 concentrations and the concentrations predicted in the future when using Defra air quality modelling tools.

5.4.42 The DMRB LA 105 (Highways England) approach involves adjustment of modelled NO_2 for both the opening year (2027) Do-Minimum and the Do-Something scenarios. This adjustment is undertaken by using the base year (2015) NO_2 and an alternative scenario (termed the projected base year), which is the base year traffic data with opening year emissions and background air quality. National Highways provided a gap analysis tool (LTTv1.1) to assist with the calculation.

Assessment of short-term NO_2 and PM_{10} concentrations

5.4.43 LAQM.TG (22) (Defra, 2022) advises that exceedances of the 1-hour mean NO_2 Air Quality Standard (AQS) objective (of 200µg/m^3) are unlikely to occur where the annual mean is less than 60µg/m^3. Therefore, exceedances of 60µg/m^3 as an annual mean are used as an indicator of potential exceedances of the 1-hour mean NO_2 AQS objective.

5.4.44 Similarly, an empirical relationship has been used to determine daily mean PM_{10} concentrations. In accordance with LAQM.TG (22) (Defra, 2022), the following formula was used:

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

5.4.45 Based on this formula, an exceedance of the 24-hour mean PM_{10} AQS (of 50µg/m^3 not to be exceeded more than 35 times a year) objective is unlikely to occur where the annual mean PM_{10} concentration is less than 32 µg/m^3.

Impacts at designated habitats

5.4.46 For designated habitats located within 200m of the ARN, the predicted (post verification of 'road-NOx' and 'gap analysis' applied to road-NO_2) annual average NO_2 and NH_3 concentrations have been used to calculate the resultant nitrogen deposition rate in accordance with LA 105 (Highways England, 2019) and National Highways 'Ammonia N deposition tool v2'. The assessment of nitrogen deposition comprises the following key stages:

- Obtaining background nitrogen deposition rates from the APIS database for the 5km by 5km grid square(s) corresponding with the designated habitat receptor and habitat type, whether short vegetation or tall vegetation
- Calculation of annual mean road NO_2 concentrations (post verification and gap analysis) at the designated habitat receptor for the base year, Do-Minimum and Do-Something scenarios

- Conversion of road NO_2 concentrations to nitrogen deposition (1µg/m^3 of NO_2 = 0.14kgN/ha/yr for short vegetation type habitats and 1µg/m^3 of NO_2 =0.29kgN/ha/yr for tall vegetation type habitats)

- Modelled LDV and HDV road NOx concentrations (post verification) have been input to the *'Highways England Ammonia Nitrogen Deposition Tool V2'* to calculate ammonia concentrations and resulting nitrogen deposition rates.

- Adding the road nitrogen deposition (due to both NO_2 and ammonia) to the APIS background nitrogen deposition and comparing with the lower critical load for the habitat in question. Critical loads for nitrogen deposition represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge).

Assessment approach - significance of effects

5.4.47 The assessment of the significance of the effects of road traffic emissions on air quality, and compliance with the Air Quality Regulations has been undertaken in accordance with DMRB LA 105 (Highways England, 2019).

5.4.48 A conclusion of no likely significant effect on air quality would be recorded where the:

- Outcomes of the air quality modelling for sensitive receptors indicate that concentrations are less than the air quality thresholds and/or

- Difference in concentrations is imperceptible, for example less than 1% of the air quality threshold

5.4.49 Where predicted changes greater than 1% of the air quality thresholds are predicted at receptors which exceed the relevant air quality thresholds, then the magnitude of change at these receptors would be assigned to the categories of small (>0.4µg/m^3 change), medium (>2µg/m^3 change) or large (>4µg/m^3 change).

5.4.50 The number of sensitive receptors in each 'magnitude of change' category are then used to identify potential significant air quality effects as per the framework **Table 5.5**.

Table 5.5: Guideline band for the number of properties informing a judgement of significant air quality effects (as per DMRB LA 105)

Magnitude of change in annual mean NO_2 or PM_{10} ($\mu g/m^3$)	Total 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

5.4.51 Where the total number of receptors in each category are less than the lower extent of the guideline band for all six magnitude of change categories, the project is considered unlikely to trigger a significant air quality effect for human health.

5.4.52 Where the total number of receptors in each category are greater than the upper extent of the guideline band in any category, the project is considered to trigger a significant air quality effect for human health.

5.4.53 Where the number of properties resides between the lower and upper guideline bands for any of the magnitude of change criteria, the following factors have been applied to determine if the impacts trigger a significant air quality effect for human health:

- The absolute concentration at each receptor
- How many receptors are there in each of the magnitude of change criteria i.e. does the project create more worsening than improvements
- The magnitude of change in concentration at each receptor

5.4.54 The assessment of the significance of potential effects on designated habitats has been undertaken by the competent expert, reported in **Chapter 8 (Biodiversity)** of the **ES (Document Reference 6.1)** of the ES drawing on the modelled air quality results.

5.4.55 The assessment of significance of potential effects on health has been undertaken by the competent expert in human health **Chapter 12 (Population and Health)** of the **ES (Document Reference 6.1)** of the ES drawing on the modelled air quality results where there is the potential for an impact to health.

Assessment approach - compliance risk assessment

5.4.56 In line with the DMRB LA 105 (Highways England, 2019), the assessment has determined whether the Scheme affects the UK's reported ability to comply with the Air Quality Regulations in the shortest timescale possible.

5.4.57 This 'compliance risk assessment' is limited to links modelled by Defra in its PCM model (this is the basis that Defra use to report zonal compliance with the AQ Regulations), which overlap with roads that trigger the DMRB criteria for ARN.

5.4.58 The compliance risk assessment identifies qualifying features, which include areas of public access (i.e. footpaths) and sensitive receptors (e.g. residential properties, schools, hospitals) that are located within 15m of the running lane or kerb (but not within 25m of a junction) of PCM model roads that exceed the ARN criteria. It should be noted that these qualifying features are not entirely consistent with how human health receptors are identified with respect to AQS objectives.

5.4.59 Where such qualifying features are identified, for pollutants where there is considered a potential risk of non-compliance (i.e NO_2) the air quality model would be used to predict annual average NO_2 concentrations for the nearest qualifying feature and at a location 4m from the running lane (in the direction of the qualifying feature) for comparison against the national PCM modelled point. The outcome of this modelling would be used to identify if the Scheme would affect the reported ability of the zone to comply with the Air Quality Regulations.

Reasonable worse case parameters for assessment

5.4.60 In terms of the modelling undertaken, receptor locations have been selected to be representative of locations which would experience the highest concentrations of traffic related pollutants (due to traffic flow, congestion and proximity to the road) and the greatest degree of change as a result of the Scheme (due to changes in traffic flows). Therefore, impacts at other locations would be lower.

5.4.61 Furthermore, the application of the 'gap analysis' approach between the 'verification year' of 2015 and opening year of 2027 largely discounts the reduction in emissions of air pollutants that are known to have occurred and be ongoing. Similarly, the application of current background deposition rates of nitrogen deposition (provided by APIS) discounts any reductions.

5.4.62 An assessment has been conducted within the Limits of Deviation (LoD) outlined within **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)**. The vertical and lateral LoD for the Scheme have been reviewed with respect to sensitive receptors identified within this ES chapter. The vertical and lateral LoD are not considered to have the potential to affect the conclusions of the assessment reported in this chapter.

Assessment assumptions and limitations

5.4.63 The key inputs to the air quality assessment are sourced from the traffic model in terms of vehicle flow rates for differing time periods, percentage HDV and speed (and speed band) for each link within the traffic model domain. This traffic model considers long-term trends in traffic generation and distribution and cannot represent short-term fluctuations due to temporary road closures or diversions (i.e. overnight or weekend).

5.4.64 This data is then used to generate pollutant emission profile for each link within the ARN by applying National Highway's Speed Band Emission Factors which are derived from Defra's Emission Factor Toolkit.

5.4.65 An atmospheric dispersion model has then been applied to calculate the dispersion of these emissions and the impact at receptor locations using historical meteorological data.

5.4.66 As with any study that seeks to predict future conditions, there is inherent uncertainty in the predictions made. The estimates produced, while considered to appropriately represent the complex factors involved, are subject to uncertainty and verification of model prediction against local monitored concentrations of air pollutants is applied to mitigate this.

5.4.67 One such uncertainty relates to the rate at which emissions of NOx from vehicle exhaust would decrease over time. The guidance set out in LA 105 (Highways England, 2019) advises on how to take account of recent trends on roadside pollution concentrations and evidence on future vehicle emissions by consideration of a projected base year and derivation of a 'gap factor' to uplift modelled NO_2 concentrations to ensure a robust assessment of potential local air quality impacts.

5.4.68 It is therefore considered that the limitations have been addressed and do not compromise the robustness of the findings of the assessment.

5.5 Study areas

Assessment of construction dust

5.5.1 The study area for the assessment of construction dust is defined as up to 200m from the Application Boundary as shown in **Figure 5.3 (Construction Dust Buffer)** of the **ES (Document Reference 6.2).**

Assessment of construction phase traffic emissions

5.5.2 The assessment of construction phase traffic emissions is focussed on areas that have the potential to both exceed limit values at locations in close proximity to roads that are predicted to experience changes in traffic flows above the DMRB LA 105 (Highways England, 2019) criteria as presented in **Section 5.4.2**.

Assessment of operational traffic emissions

5.5.3 The operational traffic model flows have been analysed to identify roads exceeding the DMRB LA 105 (Highways England, 2019) criteria as presented in **Section 5.4.2** and a 200m buffer from these roads used to define the Affected Road Network area as presented in **Figure 5.2 (Affected Road Network)** of the **ES (Document Reference 6.2).**

5.5.4 The ARN (see **Figure 5.2 (Affected Road Network)** of the **ES (Document Reference 6.2)** extends along the A34 towards the south of Newbury in the north, several roads within Winchester, the M3 south to Junction 12 and the A272 and B3047 to the east. As shown in **Figure 1.4 (Comparison of Indicative Traffic Flows)** of the **ES (Document Reference 6.2)** (where roads with decreased traffic flows are coloured blue), it is important to note that the majority of roads considered by the traffic model within Winchester experience a decrease in traffic flows as a result of the Scheme.

5.5.5 In relation to designated habitats, there are a large number within 200m of the ARN as shown in **Figure 5.3 (Ecological Designated Habitats – Receptor Transects)** of the **ES (Document Reference 6.2).**

5.6 Baseline conditions

5.6.1 The baseline conditions, including the local monitoring data, AQMAs and 2021 PCM results are presented within **Figure 5.1 (Air Quality Constraints)** of the **ES (Document Reference 6.2).**

Local air quality monitoring

5.6.2 Winchester City Council and Eastleigh Borough Council monitoring locations within approximately 1km of the ARN and M3 are shown in **Table 5.6** and **Figure 5.1 (Air Quality Constraints)** of the **ES (Document Reference 6.2).**

5.6.3 In previous years, exceedances of the air quality threshold for annual mean NO_2 were measured at several locations primarily within Winchester City Centre and Eastleigh in proximity to the M3, both of which are declared as AQMAs. However, reflecting trends in reducing concentrations, in 2019, one exceedance of the air quality threshold for annual mean NO_2 was measured within Winchester City Centre AQMA at the ‘Site 23’ on Romsey Road; this is outside of the ARN.

5.6.4 2020 and 2021 monitoring data is not presented as it has not been applied within the assessment due to the significant effect of COVID-19 related travel restrictions.

Table 5.6: Local authority monitoring (2015 -2019) within 1km of the Air Quality study area of annual mean nitrogen dioxide concentrations (µg/m^3)

Exceedances of air quality thresholds for nitrogen dioxide (40 µg/m^3) are shown in bold.

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
Continuous Monitoring										
St George's Street	Winchester	448062	129537	Roadside	YES (Winchester Town Centre)	-	-	38.5	**41.0**	37.0
Chesil Street	Winchester	448664	129257	Roadside	YES (Winchester Town Centre)	-	-	29.7	30.0	28.0
Romsey Road	Winchester	447544	129543	Roadside	YES (Winchester Town Centre)	-	-	-	-	32.0
Passive (Diffusion Tube) Monitoring										
ES2	Eastleigh	443959	119673	Urban Background	NO	-	29.3	27.0	28.5	26.1
LRPR	Eastleigh	444864	119174	Roadside	YES (Eastleigh No.1 A335)	30.2	32.4	31.9	32.9	31.6
OX	Eastleigh	444543	120187	Urban Background	NO	19.9	22.0	20.8	20.1	18.6
HG	Eastleigh	445347	120367	Urban Background	NO	18.8	20.6	19.2	19.0	17.1
WA	Eastleigh	444483	119443	Roadside	NO	34.1	35.9	34.0	35.0	31.5

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
SC	Eastleigh	443959	119673	Urban Background	NO	26.6	-	-	-	-
SCA	Eastleigh	443959	119673	Urban Background	NO	-	25.8	23.3	24.1	22.6
SCB	Eastleigh	443959	119673	Urban Background	NO	-	25.2	23.4	25.7	23.0
SCC	Eastleigh	443959	119673	Urban Background	NO	-	26.0	22.9	25.4	22.5
BEL	Eastleigh	443778	119303	Urban Background	YES (Eastleigh No.2 M3)	24.7	26.5	23.5	26.0	24.4
LR13	Eastleigh	443842	119526	Roadside	YES (Eastleigh No.1 A335)	38.0	**43.6**	**41.3**	**41.4**	39.0
MC	Eastleigh	444239	120060	Urban Background	YES (Eastleigh No.2 M3)	24.7	27.6	25.5	26.4	24.4
PC	Eastleigh	444656	120775	Urban Background	YES (Eastleigh No.2 M3)	25.5	-	-	-	-
PCA	Eastleigh	444656	120775	Urban Background	YES (Eastleigh No.2 M3)	-	27.5	25.7	27.7	24.0
PCB	Eastleigh	444656	120775	Urban Background	YES (Eastleigh No.2 M3)	-	30.1	24.9	27.7	-
NH	Eastleigh	445121	122183	Urban Background	NO	23.7	28.4	22.3	26.0	26.0
CC	Eastleigh	443054	118962	Roadside	NO	26.5	29.9	29.4	28.2	28.0
SSQ	Eastleigh	443483	118612	Urban	YES (Eastleigh No.2 M3)	26.6	30.4	29.2	28.2	24.3

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
				Background						
DD	Eastleigh	443559	118751	Urban Background	YES (Eastleigh No.2 M3)	31.0	-	-	-	-
DDA	Eastleigh	443559	118751	Urban Background	YES (Eastleigh No.2 M3)	-	33.9	31.5	31.2	25.7
DDB	Eastleigh	443559	118751	Urban Background	YES (Eastleigh No.2 M3)	-	33.3	31.0	29.8	26.4
DDC	Eastleigh	443559	118751	Urban Background	YES (Eastleigh No.2 M3)	-	34.8	26.3	-	-
PA	Eastleigh	444340	118696	Roadside	NO	-	31.5	27.5	30.0	26.1
Site 1 (City Study)	Winchester	448563	129391	Roadside	YES (Winchester Town Centre AQMA)	37.6	36.8	30.9	28.9	27.9
Site 2 (City Study)	Winchester	448566	129560	Roadside	YES (Winchester Town Centre AQMA)	31.5	30.0	27.5	26.2	24.6
Site 3 (City Study)	Winchester	448426	129523	Roadside	YES (Winchester Town Centre AQMA)	25.9	26.9	23.9	23.8	22.2
Site 4 (City Study)	Winchester	448227	129504	Roadside	YES (Winchester Town Centre AQMA)	37.6	37.1	33.0	30.6	27.9
Site 5 (City Study)	Winchester	448666	129258	Roadside	YES (Winchester Town Centre AQMA)	38.2	37.2	32.1	29.8	28.4
Site 6 (City Study)	Winchester	448666	129258	Roadside	YES (Winchester Town Centre AQMA)	38.2	38.6	31.7	30.8	28.4
Site 7 (City Study)	Winchester	448666	129258	Roadside	YES (Winchester Town Centre AQMA)	38.2	37.7	31.9	30.6	29.0

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
Site 8 (City Study)	Winchester	448106	129541	Roadside	YES (Winchester Town Centre AQMA)	**50.2**	**49.8**	**46.8**	39.5	39.3
Site 9 (City Study)	Winchester	448163	129512	Roadside	YES (Winchester Town Centre AQMA)	**52.6**	**48.9**	**46.5**	**41.4**	38.5
Site 10 (City Study)	Winchester	448046	129692	Roadside	YES (Winchester Town Centre AQMA)	**40.6**	**41.7**	38.7	35.9	31.0
Site 11 (City Study)	Winchester	447918	129413	Roadside	YES (Winchester Town Centre AQMA)	37.7	37.0	31.6	28.8	28.3
Site 12 (City Study)	Winchester	447804	129741	Roadside	YES (Winchester Town Centre AQMA)	33.9	37.3	28.0	29.0	29.0
Site 13 (City Study)	Winchester	447963	129875	Roadside	YES (Winchester Town Centre AQMA)	36.7	33.8	31.6	28.8	28.2
Site 14 (City Study)	Winchester	448297	129789	Roadside	YES (Winchester Town Centre AQMA)	30.0	29.7	28.2	25.7	24.1
Site 15 (City Study)	Winchester	448842	129820	Roadside	YES (Winchester Town Centre AQMA)	30.5	31.5	29.8	26.1	23.4
Site 16 (City Study)	Winchester	449563	129439	Other	NO	37.0	38.4	33.0	34.6	30.0
Site 17 (City Study)	Winchester	448679	129068	Roadside	YES (Winchester Town Centre AQMA)	36.4	39.9	37.6	34.7	35.3
Site 18 (City Study)	Winchester	447534	130006	Roadside	YES (Winchester Town Centre AQMA)	21.2	24.8	23.7	20.0	18.7
Site 19 (City Study)	Winchester	448092	130411	Roadside	YES (Winchester Town Centre AQMA)	24.2	22.8	20.0	23.3	20.8
Site 20 (City Study)	Winchester	448092	130411	Roadside	YES (Winchester Town Centre AQMA)	24.2	23.8	22.2	23.8	21.0

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
Site 21 (City Study)	Winchester	448092	130411	Roadside	YES (Winchester Town Centre AQMA)	24.2	22.9	20.4	23.7	21.6
Site 22 (City Study)	Winchester	447842	129050	Roadside	YES (Winchester Town Centre AQMA)	35.3	33.4	32.5	19.3	20.2
Site 23 (City Study)	Winchester	447495	129511	Roadside	YES (Winchester Town Centre AQMA)	**48.8**	**56.6**	**50.8**	**47.6**	**46.5**
Site 24 (City Study)	Winchester	447898	130065	Roadside	YES (Winchester Town Centre AQMA)	33.5	32.9	32.4	30.6	26.5
Site 25 (City Study)	Winchester	448427	129401	Roadside	YES (Winchester Town Centre AQMA)	33.7	30.4	28.0	22.7	21.7
Site 2 (District Study)	Winchester	446680	124644	Other	NO	28.5	29.4	27.1	25.2	22.2
Site 3 (District Study)	Winchester	449647	132669	Roadside	NO	-	-	**56.0**	**40.5**	34.6
Site 9 (District Study)	Winchester	445700	124877	Other	NO	-	-	-	12.3	-
Mill Lane	Winchester	449752	132674	Roadside	NO	-	-	-	20.0	15.4
Kings Worthy Cottage	Winchester	449650	132673	Roadside	NO	-	-	-	22.9	19.1
Old School House	Winchester			Roadside	NO	-	-	-	20.7	18.2
National Highways Passive (Diffusion Tube) Monitoring										
M3J9J13_001	Eastleigh	444172	119909	Roadside	Eastleigh AQMA No. 2 (M3)	34.1	-	-	-	-
M3J9J13_003	Eastleigh	444625	120709	Roadside	Eastleigh AQMA No. 2	29.2	-	-	-	-

Site ID	Local Authority	X (m)	Y (m)	Type	In AQMA?	2015	2016	2017	2018	2019
					(M3)					
M3J9J13_004	Eastleigh	444647	120381	Roadside	NO	22.4	-	-	-	-
M3J9J13_005	Eastleigh	444946	121559	Roadside	NO	31.1	-	-	-	-
M3J9J13_012	Winchester	445958	123740	Roadside	NO	23.7	-	-	-	-
M3J9J13_013	Winchester	446388	124287	Roadside	NO	26.6	-	-	-	-
M3J9J13_014	Winchester	446521	124459	Roadside	NO	28.9	-	-	-	-
M3J9J13_015	Winchester	446631	124762	Roadside	NO	32.7	-	-	-	-
M3J9J13_019	Winchester	449500	128984	Roadside	NO	23.5	-	-	-	-
M3J9J13_020	Winchester	449582	129425	Roadside	NO	30.6	-	-	-	-
M3J9J13_021	Winchester	449561	129596	Roadside	NO	21.4	-	-	-	-
M3J9J13_024	Winchester	449008	132219	Roadside	NO	33.2	-	-	-	-
M3J9J13_025	Winchester	448770	132714	Roadside	NO	21.6	-	-	-	-
M3J9J13_026	Winchester	449945	131951	Roadside	NO	19.8	-	-	-	-
M3J9J13_029	Winchester	447816	126687	Roadside	NO	27.9	-	-	-	-

Scheme specific modelled 2015 baseline concentrations

5.6.5 The 2015 scheme specific modelled baseline concentrations at the identified representative sensitive receptors are presented **Appendix 5.2 (Human Receptors, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3)** which confirm historic exceedances of the NO_2 annual average air quality thresholds at locations within the AQMAs.

Defra pollution climate mapping (PCM) model

5.6.6 The PCM model is used by Defra (in combination with monitoring data) for the assessment of compliance with Air Quality Regulations limit values.

5.6.7 PCM data are available from Defra's UK-Air website (Defra, 2020b), there are no roadside exceedances predicted by the Defra PCM within the Air Quality study area from 2021 for NO_2. The M3 (where it falls within 2km of the Application Boundary) is not currently identified by Defra as a PCM link.

Defra background mapping

5.6.8 Background annual average pollutant concentrations for the assessment from the mapped data provided by Defra (Defra, 2020a) on a 1km x 1km grid covering the UK in 2020 for NO_2, PM_{10} and $PM_{2.5}$ at receptor locations are presented **Appendix 5.2 (Human Receptors, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3)**.

5.6.9 The background concentrations of NO_2, PM_{10} and $PM_{2.5}$ within the Air Quality study area are below the air quality thresholds.

Designated habitats

5.6.10 The identified designated habitats within the study area are summarised in **Appendix 5.3 (Designated Habitats, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3)** and their locations presented **Figure 5.4 (Ecological Designated Habitats – Receptor Transects)** of the **ES (Document Reference 6.2),** and the predicted annual NOx background concentration and background nitrogen deposition rate are presented in **Appendix 5.3 (Designated Habitats, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3)**. The background levels exceed the relevant thresholds for some habitats.

Baseline evolution

5.6.11 Consideration of the baseline evolution has included changes in air quality due to forecasted traffic growth (see the **Combined Modelling Appraisal Report (Document Reference 7.10)**), changes in emissions due to newer vehicles and changes to background levels due to changes in emissions from other sources.

5.6.12 To forecast the future air quality conditions likely without the Scheme, annual mean NO_2 and PM_{10} concentrations at all receptors selected for the operational

assessment in the Scheme's opening year Do-Minimum scenario have been predicted. These future baseline receptor concentrations are presented in **Appendix 5.2 (Human Receptors, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3).**

5.6.13 The predicted baseline annual average concentrations of NOx and nitrogen deposition at designated habitats (presented in **Appendix 5.3 (Designated Habitats, Backgrounds and Operational Phase Results)** of the **ES (Document Reference 6.3)** are exceeded in close proximity (within 10-20m) to the road network; whilst they decline to background levels, these still exceed the relevant thresholds for some habitats.

5.6.14 **Appendix 15.1 (Long List of Cumulative Developments)** of the **ES (Document Reference 6.3)** provides a full list of schemes which have been identified as being likely to be in operation prior to the construction of the Scheme. Where relevant, these schemes therefore form part of the future baseline scenario and have been taken into account in the assessment of likely significant effects from the Scheme (construction and operation) presented in this chapter.

5.7 Potential impacts

Construction (including site preparation)

5.7.1 Air quality impacts due to construction would be short term and could include an increase in emissions of dust from earthworks and general construction activity and changes to traffic flows due to traffic management, temporary diversions as well as construction related vehicle movements.

Construction phase dust

5.7.1 There is the potential for elevated dust deposition and soiling at properties within 200m of the Application Boundary as a consequence of the works, if dust raising activities are not effectively controlled and mitigated. The level and distribution of dust emissions would vary according to the duration and location of activity, weather conditions, and the effectiveness of suppression measures.

5.7.2 Best practice mitigation measures reflecting the overall construction dust risk have been proposed to minimise the dust effects at receptors, as outlined in **Section 5.9.**

Construction plant

5.7.3 Exhaust emissions of pollutants including NO_2 and PM_{10} would occur from onsite plant (or non-road mobile machinery (NRMM)) and onsite haulage of surplus spoil to areas for landscaping. Emissions from NRMM and onsite haulage would be temporary and given the temporary duration of individual plant operating in any given area, these emissions are considered unlikely to

have the potential to result in a significant air quality effect (as per paragraph 7.26 of Defra TG22 guidance (Defra, 2022).

Construction phase traffic emissions

5.7.4 During the construction phase there would be changes to traffic flows, both in relation to the effect of traffic management (and temporary diversion) measures, and vehicles (staff and material movements) associated with the physical construction activities. These impacts are discussed in **Section 5.9.**

Operation

5.7.5 During the operational phase there would be changes to traffic flows and resultant changes to emissions from traffic using the roads. These impacts are discussed in **Section 5.9.**

5.8 Design, mitigation and enhancement measures

5.8.1 Mitigation measures incorporated in the design of the Scheme are reported as embedded mitigation in **Chapter 4 (Environmental Assessment Methodology)** of the **ES (Document Reference 6.1)**. This section outlines essential mitigation required. Essential mitigation is outlined within the **fiEMP (Document Reference 7.3).** Prior to the implementation of mitigation, the Scheme has the potential to have air quality impacts during construction and operation.

Essential mitigation

Construction (including site preparation)

5.8.2 As described in DMRB LA 105 (Highways England, 2019), best practice mitigation would be required to control dust emissions from construction works and plant during the construction phase, considering the sensitivity of relevant human and ecological receptors. These mitigation measures would seek to suppress the dust generation rate and also mitigate its dispersion and maximise the use of existing vegetation barriers where practicable.

5.8.3 The precise measures would depend on the intended construction methods and the degree of dust generation at each site and detailed in the **fiEMP (Document Reference 7.3)**. Such measures may include but would not necessarily be limited to:

- Regular water-spraying and sweeping of unpaved and paved roads to minimise dust and remove mud and debris
- Using wheel washes, shaker bars or rotating bristles for vehicles leaving the site where appropriate to minimise the amount of mud and debris deposited on the roads

- Sheeting vehicles carrying dusty materials to prevent materials being blown from the vehicles whilst travelling
- Enforcing speed limits for vehicles on unmade surfaces to minimise dust entrainment and dispersion
- Ensuring any temporary site roads are no wider than necessary to minimise their surface area
- Damping down of surfaces prior to their being worked
- Storing dusty materials away from site boundaries and in appropriate containment (for example, sheeting, sacks, barrels etc.)
- If necessary, monitoring parameters and a programme would be established

Operation

5.8.4 The assessment of impacts and significance of the Scheme on air quality, (presented in **Section 5.9**) demonstrates that it does not have a significant air quality impact and nor does it affect reported compliance with the Air Quality Regulations and therefore mitigation during operation is not required.

Enhancements

5.8.5 There are no specific enhancement measures included in the scheme for air quality.

5.9 Assessment of likely significant effects

5.9.1 This section presents the assessment of likely significant effects for construction and operation on air quality. The assessment of effects takes into account the potential impacts to each receptor following the implementation of embedded and essential mitigation measures to determine the significance of the residual effects.

Construction (including site preparation)

5.9.2 Sensitive receptors within 200m of the Application Boundary are shown in **Figure 5.3 (Construction Dust Buffer)** of the **ES (Document Reference 6.2)**. The Scheme has the potential for construction dust to affect approximately 580 receptors, the majority of which are located to the west of the Application Boundary in Winchester, Kings Worthy, Abbots Worthy and Headbourne Worthy. There are also receptors identified north of the B3404 (adjacent to the A272), along Easton Lane (east of Junction 9) and along Long Walk.

5.9.3 The River Itchen SAC and SSSI are also located within 50m of the Application Boundary.

5.9.4 The prevailing winds recorded at Southampton Airport meteorological station (approximately 15km south of the Scheme) are from the south-west as shown in the windrose in **Appendix 5.1 (Air Quality Methodology and Verification)** of the **ES (Document Reference 6.3)**. The highest windspeeds are also recorded from this direction. This suggests that the wind is more likely to transport dust raised on site towards the north-east of the construction works.

5.9.5 The dust risk potential of the Scheme is classified as 'high' (in accordance with the DMRB methodology) given the proposed construction activities and the sensitivity of the receiving environment ('high'); therefore, the overall dust risk potential is rated 'large' (based on DMRB LA 105 classification) according to **Table 5.5.**

5.9.6 It should be noted however, that the risk of adverse dust effects occurring at any given receptor would vary widely across the study area depending on the nature of construction activities occurring within the vicinity of the receptor, and the distance of the receptor from those activities.

5.9.7 Any adverse air quality effects due to construction would be short-term and can be suitably minimised by the application of standard and appropriate mitigation measures (as set out in paragraph 5.8.3). On this basis, there is unlikely to be a significant effect on air quality due to the construction of the Scheme.

Construction phase traffic emissions

5.9.8 Microsimulation traffic modelling of the junction, which considers the effect of traffic management measures, identified that Phase 3A of the construction programme resulted in the greatest impacts in terms of travel time through the Scheme and therefore greatest risk of impact on wider traffic routing.

5.9.9 This scenario was tested in the Strategic Transport Model which identified that the potential offsite impacts on traffic flows (above the DMRB LA 105 (Highways England, 2015) threshold) are limited to the A33 (Basingstoke Road) and B3047 (Worthy Road).

5.9.10 These roads are the only locations where the Strategic Transport Model predicted increases in traffic flows above 1,000 AADT during this worst phase of construction and they are not located in areas that are at risk of an exceedance of the relevant limit values based on the 2015 predicted annual average NO2 concentrations of less than 15µg/m3 at R48, R49 and R50 (located at residential properties adjacent to the A33) presented in Appendix 5.2 (Human Receptors, Backgrounds and Operational Phase Results) of the ES (Document Reference 6.3).

5.9.11 An increase in vehicle movements (beyond that considered explicitly within the traffic modelling) is expected to occur during the construction period, as a result of workers and heavy goods vehicles (HGVs) travelling to and from site.

5.9.12 It is anticipated that the maximum number of HGV movements, calculated on an annual daily average basis, would occur during phases 1 and 2 of the construction programme and would be less than 150 2-way trips (75 vehicles) per day. This is the number of daily movements averaged over a year; whilst some days may exceed this average, movements on other days would be lower and the overall annual daily average is not expected to be exceeded. The routing of these HGV movements is anticipated to be overwhelmingly limited to the trunk road network (i.e. M3 and A34) due to the location of material supply locations to the north and south.

5.9.13 Additional LGV deliveries (less than 50 2-way trips per day on an annual average basis) and staff commuting (100 staff car parking spaces and 200 operative parking spaces are anticipated to be required daily) would result in less than 1,000 movements per day (on an annual average basis). The routing of these movements would be more dispersed than the HGV movements and would primarily be determined by the home address of staff.

5.9.14 In relation to temporary diversions (as summarised in **Chapter 2 (The Scheme and its Surroundings)** of the **ES** (Document Reference 6.1)), a vast majority of these are overnight closures and diversions. Given the timing of these closures and their short duration, the potential resultant impacts on air quality are considered not to have the potential to result in 'significant' air quality effects as per DMRB LA105.

5.9.15 In relation to diversions with a longer duration:

- The closure of the M3 (**Figure 2.5 (Temporary Traffic Diversion Routes – Sheet 12 of 12)** of the **ES (Document Reference 6.2)**) would be required over a number of weekends, whilst this would result in short term changes to wider traffic flows, the resultant impact on air quality are not considered to have the potential to be significant given that the frequency and duration of these closures would have limited capacity to change the annual average traffic flows.

- The M3 northbound on-slip road from J9 (**Figure 2.5 (Temporary Traffic Diversion Routes – Sheet 6 of 12)** of the **ES (Document Reference 6.2)** would be closed for over 12 months, however the effect of this on traffic flows is assessed within the Strategic Transport modelling of Phase 3A.

5.9.16 Throughout the main periods of construction (phases 1, 2 and 3), traffic management would include a reduction in speed limit (from 70 mph to 50 mph) on the M3 through the Scheme. This is likely to result in vehicles traveling at a free flow speed of 50 miles per hour with fewer speed variations compared to normal operation. As emissions from traffic are inherently dependent on acceleration and speed (as per the speed band emission factors within IAN185-13 which indicate free-flow conditions result in lower emissions than congested or high speed conditions), the free flow speed coupled with a reduction in speed limit from 70 miles per hour to 50 miles per hour is likely to cause a reduction in vehicle emissions which would lead to reduced emissions to air within this area.

5.9.17 It is therefore considered that the effects of construction activities only have the potential to result in changes to traffic flows above the DMRB LA 105 (Highways England, 2019) criteria (of 200 HDV per day and 1,000 AADT criteria) within the Application Boundary, adjoining sections of the M3 and A34, and the A33 and Worthy Road. These areas are not at risk of exceeding the relevant limit values due to the low background concentrations and therefore it is not considered that there is a risk of them resulting in significant air quality impacts at relevant receptor locations.

5.9.18 Therefore, given the magnitude and duration of potential impacts, a quantitative assessment is not considered to be proportionate in accordance with DMRB LA 105 section 2.62 (Highways England, 2019).

Operation

Human Receptors – NO_2

5.9.19 The details below relate to modelled annual mean NO2 results following model verification and gap analysis using LTTE6. This is a conservative approach. Results for all receptors, following model verification and gap analysis using LLTE6 are presented in Appendix 5.2 (Human Receptors, Backgrounds and Operational Phase Results) of the ES (Document Reference 6.3) and Figure 5.5 (Human Receptors and 2027 Do-Something NO2 annual average concentration) of the ES (Document Reference 6.2) and Figure 5.6 (Sensitive Human Receptors and predicted change in NO2 annual average concentration) of the ES (Document Reference 6.2).

5.9.20 In the opening year, the modelling predicts that the Scheme results in both increases and decreases in the annual average NO_2 concentrations at receptor locations, with the majority of decreases occurring within Winchester City Centre and increases occurring in proximity to the M3 and Easton Lane (and adjoining roads) due to predicted increase on traffic flows on these routes as summarised in the following sections (as shown in **Figure 5.6 (Sensitive Human Receptors and predicted change in NO_2 annual average concentration)** of the **ES (Document Reference 6.2)).**

Winchester City Centre (excluding Easton Lane/Wales Street and B3404)

5.9.21 At 11 receptors within Winchester City Centre (R01, R02, R03, R04, R05, R34, R35, R39, R40, , R52, R53), a perceptible improvement in annual average NO_2 concentration is predicted (reduction >1% of the air quality threshold).

5.9.22 The predicted decreases in annual average NO_2 concentrations occur within Winchester City Centre as a result of decreased modelled traffic flows on the B3420 (reduction in traffic flows of over 1,300 AADT) and Bar End Road (reduction in traffic flows of over 1,200 AADT); this is considered to be a consequence of the increased capacity at M3 Junction 9 delivered by the Scheme resulting in less through traffic accessing the M3 at Junctions 10 and 11.

5.9.23 At R04 (on Bar End Road) the reduction in predicted annual average NO_2 concentrations (as a result of this decrease in modelled traffic flows) exceeds 1.5µg/m^3 however the overall concentration does not exceed the air quality threshold and is therefore not classified as significant in accordance with the DMRB LA 105 methodology.

Easton Lane/Wales Street and B3404

5.9.24 Within Winchester City, the traffic model predicts that flows would increase on the following roads:

- Easton Lane (over 4000 AADT increase north of Industrial Estate, which is over 25% increase in flows due to the Scheme),
- Wales Street (over 1900 AADT increase which is over 20% increase in flows due to the Scheme)
- a section of the B3404 (over 750 AADT increase which is approximately a 10% increase in flows due to the Scheme)

5.9.25 These increased traffic flows are considered to be a consequence of the increased capacity at M3 Junction 9 delivered by the Scheme resulting in less congested access to the M3 and A34 via junction 9 along these routes.

5.9.26 At 6 receptors (R6, R7, R9, R41, R49 and R50) located in proximity to these roads, perceptible increases in annual average NO_2 concentrations are predicted (increase >1% of the air quality threshold).

5.9.27 At none of these receptors the total predicted annual average NO2 concentrations exceed the air quality threshold.

5.9.28 The maximum predicted increase in annual average NO_2 concentration of 2.5 µg/m^3 (6.31% of the air quality threshold) occurs at R41 located along Wales Street. However, the overall concentration is 26.9µg/m^3 which is well below the air quality threshold of 40µg/m^3.

M3 Corridor (Winchester)

5.9.29 The traffic model predicts increased traffic flows on the M3 between Junction 9 and Junction 11 as a result of the Scheme (less than 5,000 AADT increase, which is less than 5% increase in flows due to the Scheme); north of M3 Junction 9 there is limited change in traffic flows as a result of the Scheme.

5.9.30 At 4 receptors (R10, R28, R47 and R48) located in proximity to these roads, imperceptible increases in annual average NO_2 concentrations are predicted (increase <1% of the air quality threshold).

5.9.31 The total predicted annual average NO2 concentrations do not exceed the air quality thresholds at any of these receptors.

M3 Corridor (South of Winchester)

5.9.32 The traffic model predicts increased traffic flows on the M3 between Junction 9 and Junction 11 as a result of the Scheme (less than 5,000 AADT increase, which is less than 5% increase in flows due to the Scheme); north of M3 Junction 9 there is limited change in traffic flows as a result of the Scheme.

5.9.33 At the 8 receptors (R18, R19, R20, R21, R22, R23, R24, R54) located in proximity to this section of the M3, imperceptible increases in annual average NO_2 concentrations are predicted (increase <1% of the air quality threshold) at all receptors and overall concentration are well below the air quality threshold of 40µg/m^3.

Kings Worthy (A34 and A33)

5.9.34 The traffic model predicts increased traffic flows on the A34 (between M3 Junction 9 and the A272 junction) as a result of the Scheme (approximately a 6,500 AADT increase, which is approximately a 10% increase in flows due to the Scheme). The predicted traffic flows on the A33 increase by approximately 1,500 AADT which is a 15% increase due to the Scheme, however the alignment of the carriageway is further from residential properties in Kings Worthy.

~~5.9.34~~5.9.35 At the seven receptors (R11, R12, R13, R43, R44, R45 and R46) located in proximity to these sections of the A34 and A33, imperceptible decreases in annual average NO_2 concentrations are predicted (decrease <1% of the air quality threshold) due to reduced emissions resulting from less congestion. Overall concentrations are well below the air quality threshold of 40µg/m^3.

~~5.9.35 At the 7 receptors (R11, R12, R13, R43, R43, R45 and R46) located in proximity to these sections of the A34 and A33, imperceptible decreases in annual average NO_2 concentrations are predicted (decrease <1% of the air quality threshold) due to reduced emissions resulting from less congestion. Overall concentration are well below the air quality threshold of 40µg/m^3.~~

A34 corridor (north of Winchester)

5.9.36 The traffic model predicts increased traffic flows on the A34 (between the A272 junction and the A303) as a result of the Scheme (approximately a 2,500 AADT increase, which is less than 5% increase in flows due to the Scheme). North of the A303, the increased flows on the A34 are approximately 1,200 AADT which is a 2.5% increase due to the Scheme.

5.9.37 At the 6 receptors (R14, R15, R16, R17, R33 and R42) located in proximity to this section of the A34, imperceptible increases in annual average NO_2 concentrations are predicted (increase <1% of the air quality threshold) at all receptors and overall concentration are well below the air quality threshold of 40µg/m^3.

East of Winchester (A272 and B3047)

5.9.38 The traffic model predicts increased traffic flows on the A272 (east of the A31 interchange) as a result of the Scheme (approximately 1,250 AADT increase, approximately a 10% increase in flows due to the Scheme). On the B3047, flows are predicted to decrease by approximately 1,000 AADT, approximately a 15% decrease due to the Scheme.

5.9.39 At 3 of the receptors (R29, , R31 and R32) located in proximity to this section of the A272, imperceptible increases in annual average NO_2 concentrations are predicted (increase <1% of the air quality threshold). At R30 where an increase of 0.5 µg/m^3 is predicted although overall concentrations are well below the air quality threshold of 40µg/m^3.

5.9.40 At the 2 receptors (R37 and R38) located in proximity to this section of the B3047, imperceptible decreases in annual average NO_2 concentrations are predicted (decrease <1% of the air quality threshold) and overall concentrations are well below the air quality threshold of 40µg/m^3.

Overall significance of impacts

5.9.41 At all receptor locations the total predicted annual average NO_2 concentrations do not exceed the air quality threshold.

5.9.42 The significance of the predicted annual average NO2 impacts in accordance with DMRB LA 105 are summarised in **Table 5.7**.

Table 5.7: Predicted Annual Average NO_2 Impact Classification as per DMRB LA 105

Magnitude of change in annual mean NO_2 (µg/m^3)	**Total 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)	0	0
Medium (>2)	0	0
Small (>0.4)	0	0

5.9.43 In line with Defra's technical guidance LAQM.TG (22), there are not expected to be any receptors with exceedances of the 1-hour mean air quality threshold with the Scheme, given that annual mean NO_2 concentrations at all receptor locations are estimated to be below 60 µg/m^3.

5.9.44 In accordance with DMRB LA 105 (Highways England, 2019) the Scheme is not predicted to result in a significant effect on Air Quality.

Human Receptors – PM_{10} and $PM_{2.5}$

5.9.45 There are not predicted to be any exceedances of the PM10 or PM2.5 annual mean or PM10 daily mean AQS objectives.

5.9.46 The changes in annual mean PM10 concentrations are classified as imperceptible at all except for 6 receptors. Predicted annual average PM10 impacts at R07, R41, R49 and R50 increase by >1% of the air quality threshold and at R04 and R35 decrease by more than 1% of the threshold, however overall concentrations are less than 20 µg/m3 and therefore not considered to be significant in accordance with the DMRB LA 105 (Highways England, 2019) methodology.

5.9.47 In accordance with DMRB LA 105 (Highways England, 2019) the Scheme is not predicted to result in a significant effect on Air Quality.

Compliance risk assessment

5.9.48 Compliance with the Air Quality Regulations has considered where Defra PCM model links coincide with roads predicted to exceed the DMRB LA 105 (Highways England, 2019) criteria (of 1,000 AADT).

5.9.49 According to the PCM datasets there are no roadside exceedances of the annual average limit values predicted by the Defra PCM within the Air Quality study area from 2021.

5.9.50 There are no PCM links within the Study Area that are predicted to experience a change in traffic flow in excess of 1,000 AADT.

5.9.51 Therefore, it is considered that the Scheme represents no risk to the reported date of compliance with the requirements of the Air Quality Regulations.

Designated habitats

5.9.52 Air quality impacts on designated habitats (due to nitrogen deposition) are presented in Appendix 5.3 (Designated Habitats, Backgrounds and Operational Phase Results) of the ES (Document Reference 6.3) which identifies the background concentration and locations where the Scheme contribution exceeds 1% of the relevant critical load.

5.9.53 The significance of effects resulting from the change in nitrogen deposition is considered in **Chapter 8 (Biodiversity)** of the **ES (Document Reference 6.1)** and accompanying **Appendix 8.3 (Assessment of Operational Air Quality Impacts on Biodiversity)** of the **ES (Document Reference 6.3)**. Furthermore, the likely significance of effects on European designated habitats (e.g. River Itchen SAC) is considered in the **Habitats Regulations Assessment (Document Reference 7.5).**

5.9.54 In total 65 designated habitats were identified within the Study Area and modelled as 71 receptor transects; several designated sites overlap and for some designated sites multiple transects were applied to allow consideration of impacts at differing locations within the designated site in proximity to an affected road.

5.9.55 The predicted changes in nitrogen deposition as a result of the Scheme were <1% of the critical load for the majority of receptor locations and therefore impacts are classified in accordance with DMRB LA105 as 'not significant'.

5.9.56 At locations where the predicted change in nitrogen deposition as a result of the Scheme exceeds 1% of the relevant critical load, the competent expert for Biodiversity has considered the potential for adverse impacts where the increase in nitrogen deposition due to the Scheme exceeds 0.4 kgN/ha/yr.

5.9.57 As reported in **Appendix 8.3 (Assessment of Operational Air Quality Impacts on Biodiversity)** of the **ES (Document Reference 6.3)** the competent expert for Biodiversity has concluded that the predicted impacts are 'not significant' at any designated site.

5.10 Monitoring

5.10.1 The assessment of effects from the Scheme has not identified effects which are considered likely to be significant. No monitoring is therefore required in relation to Air Quality.

5.11 Summary

5.11.1 This chapter provided an assessment of the potential air quality effects of the Scheme during construction and operation following DMRB LA 105 standards. The air quality effects are summarised below.

Construction phase

5.11.2 Properties located within 200m of construction activities have the potential to be adversely affected by construction dust. These effects would however be short-term and with the application of industry best practice mitigation measures, as defined in the EMP, are not considered to be significant.

5.11.3 During the construction phase there would be changes to traffic flows, both in relation to the effect of traffic management (and temporary diversion) measures, and vehicles (staff and material movements) associated with the physical construction activities.

5.11.4 Throughout the main periods of construction (phases 1, 2 and 3), traffic management would include a reduction in speed limit (from 70 mph to 50 mph) on the M3 through the Scheme. This is likely to result in vehicles travelling at a free flow speed of 50 mph with fewer speed variations compared to normal operation. The free flow speed coupled with a reduction in speed limit from 70

mph to 50 mph is likely to cause a reduction in vehicle emissions which would lead to reduced emissions to air within this area.

5.11.5 It is therefore considered that the effects of the construction activities (apart from temporary diversions which are not considered to have the potential to affect annual average flows due to their low frequent and limited duration) only has the potential to result in changes to traffic flows above the DMRB LA 105 criteria (of 200 HDV per day and 1,000 AADT criteria) within the application boundary, adjoining sections of the M3 and A34, and the A33 and Worthy Road.

5.11.6 These areas are not at risk of exceeding the relevant limit values due to the low background concentrations and therefore it is not considered that there is a risk of significant air quality impacts at relevant receptor locations.

Operational phase

5.11.7 The operational traffic model flows have been analysed to identify roads exceeding the DMRB LA 105 (Highways England, 2019) criteria and a 200m buffer used to define the ARN.

5.11.8 The ARN (**Figure 5.2 (Affected Road Network)** of the **ES (Document Reference 6.2)**) extends along the A34 towards Newbury in the north, several roads within Winchester, the M3 south to Junction 12 and the A272 and B3047 to the east. As shown in **Chapter 2 (The Scheme and its Surroundings)** of the **ES (Document Reference 6.1)** (where roads with decreased traffic flows are coloured blue), it is important to note that a majority of roads considered by the traffic model within Winchester experience a decrease in traffic flows as a result of the Scheme.

5.11.9 Air quality modelling of these changes to traffic flows indicates that the Scheme results in both predicted increases and decreases in the annual average NO_2 and PM_{10} concentrations at receptor locations, with the majority of decreases occurring within Winchester City Centre and increases occurring in proximity to the M3 and Easton Lane (and adjoining roads) due to predicted increase in traffic flows on these routes.

5.11.10 In the proposed Scheme opening year (2027), a perceptible increase in annual average NO_2 concentrations is predicted (impacts >=1% of the air quality threshold) at 9 out of 55 modelled receptors in comparison to the Do-Minimum scenario.

5.11.11 At all of these receptors the total annual average NO_2 concentrations do not exceed the air quality threshold.

5.11.12 The maximum predicted increase in annual average NO_2 concentration occurs at R41, located along Wales Street, however the overall concentration is 26.9µg/m^3 well below the air quality threshold of 40µg/m^3.

5.11.13 At 13 receptors a perceptible decrease in annual average NO_2 concentration is predicted (reduction >1% of the air quality threshold). The decreased annual average NO_2 concentrations primarily occur within Winchester City Centre as a result of decrease traffic flows on the B3420 and Barn End Road.

5.11.14 At R04 (on Bar End Road) the reduction exceeds 1.5µg/m^3 however the overall concentration does not exceed the air quality threshold.

5.11.15 The changes in annual mean PM_{10} concentrations are classified as imperceptible at all except for 6 receptors. Predicted annual average PM_{10} impacts at R07, R41, R49 and R50 increase by >1% of the air quality threshold and at R04 and R35 decrease by more than 1% of the threshold, however overall concentrations are less than 20 µg/m^3 and therefore are not considered to be significant in accordance with the DMRB LA 105 (Highways England, 2019) methodology.

5.11.16 In accordance with DMRB LA 105 as no exceedances of the relevant air quality thresholds have been predicted, the Scheme is not predicted to result in a significant effect on Air Quality.

5.11.17 As reported in **Appendix 8.3 (Assessment of Operational Air Quality Impacts on Biodiversity)** of the **ES (Document Reference 6.3)** the competent expert for Biodiversity has concluded that the predicted impacts are ‘not significant’ at any designated site.