Appendix 8

AIR QUALITY

Public

8.1 GLOSSARY OF TERMS AND ACRONYMS

GLOSSARY OF TERMS AND ACRONYMS

Term	Definition
AADT	Annual Average Daily Traffic - A daily total traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
ARN	Affected Road Network - All roads that trigger the traffic screening criteria and adjoining roads within 200 metres.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive subgroups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
APIS	Air Pollution Information System (APIS) - An online searchable database that provides information on air pollutants and their impacts on habitats and species.
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy
ASR	Annual Status Report
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of DEFRA
CEMP	Construction Environment Management Plan
Conservative	Tending to over-predict the impact rather than under-predict.
DC	Data Capture - The percentage of all the possible measurements for a given period that were validly measured.
DEFRA	Department for Environment, Food and Rural Affairs.
Deposition	The main pathway for the removal of pollutants from the atmosphere through settling.
DFT	Department for Transport
DMP	Dust Management Plan
EFT	Emissions Factor Toolkit
Emission rate	The quantity of a pollutant released from a source over a given period.

Term	Definition
EU	European Union
EU Limit Value	EU Limit values are legally binding EU parameters that must not be exceeded. Limit values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Some pollutants have more than one limit value covering different endpoints or averaging times
Exceedance	A period where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV / HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
LAQM.TG16	Local Air Quality Management Technical Guidance.
LDV / LGV	Light Duty Vehicle / Light Goods Vehicle.
Mitigation	The measures taken to avoid, reduce or otherwise address the potential negative effects due to air quality impacts.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
NPPF	National Planning Policy Framework
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Receptor	An identified location where an effect may occur.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Specific Scientific Interest
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95 probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy' and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
$\mu g/m^3$	A measure of concentration in terms of mass per unit volume. A concentration of 1 g/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

8.2 LEGISLATION, POLICY AND GUIDANCE

LEGISLATION

European Union Directive on Ambient Air Quality (2008/50/EC)[1]

The EU Directive on ambient air quality (2008/50/EC)[1] is the primary driver for managing and improving air quality for each member state of the European Union (EU). The EU Directive[1] sets legally binding limit values for concentrations in ambient (outdoor) air of pollutants that can impact public health, including NO_2 and particulates (PM_{10}, $PM_{2.5}$).

EU Limit Values are set for individual pollutants and comprise a concentration value, an averaging time over which it is to be measured, the number of allowed exceedances per year (if any), and a date by which it must be achieved. Some pollutants (e.g. PM_{10}) have more than one limit value covering different averaging times.

Member states are required to report on the status of air quality and to assess compliance with the EU Directive[1] on an annual basis. DEFRA carries out this task on behalf of the UK government and published the latest submission to the EU Commission in September 2019. Compliance assessment modelling is carried out using a series of national models known collectively as the Pollution Climate Mapping (PCM) model.

The Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland, 2007[2]

The Government's policy on air quality within the UK is set out in the Air Quality Strategy[2] for England, Scotland, Wales, and Northern Ireland (AQS). The AQS[2] provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation[1].

The AQS[2] also sets standards and objectives for nine key air pollutants to protect health, vegetation, and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Table 8-1: Relevant Air Quality Strategy Objectives (Volume II of the ES).**

The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.

The air quality objectives are medium-term policy-based targets set by the UK Government, which consider economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

---

1 European Parliament, Council of the European Union (2008). *Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe* [online] Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050

2 Department for Environment, Food and Rural Affairs (DEFRA) (2007). *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland Volumes 1 and 2* [online] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69336/pb12654-air-quality-strategy-vol1-070712.pdf

For the pollutants considered in this assessment, there are both long-term (annual mean) and short-term standards. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

The AQS[2] contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}. Local Authorities are required to work towards reducing emissions / concentrations of particulate matter within their administrative area.

Air Quality Regulations (England)

Many of the objectives in the AQS[Error! Bookmark not defined.] have been made statutory in England with the Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] for LAQM.

These Regulations require that likely exceedances of the AQS[Error! Bookmark not defined.] objectives are assessed in relation to:

'…the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…'

The Air Quality Standards Regulations 2010[5] (with minor amendments made in 2016[6]) transpose the EU Directive on ambient air quality (2008/50/EC[1]) into law in England.

The Directive sets legally binding Limit Values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The Limit Values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS[Error! Bookmark not defined.] objectives and the Limit Value for $PM_{2.5}$ is a concentration of 25 $\mu g/m^3$.

The Environment Act, 1995

Under Part IV of the Environment Act 1995[7], local authorities are required to periodically review and document local air quality conditions within their jurisdiction by way of staged appraisals and respond accordingly through the LAQM regime, with the aim of meeting the AQS[Error! Bookmark not defined.] objectives defined in the Air Quality Regulations[4,5,6].

Local authorities carry out review and assessments of local air quality and are predominately focused around areas where national policies to reduce emissions from road transport and industrial development are not likely to constitute in air quality meeting the UK Government's objectives by the required timeframe.

3 UK Statutory Instruments (2000) *The Air Quality (England) Regulations 2000 SI 2000 / 928* [online] Available at: https://www.legislation.gov.uk/uksi/2000/928/contents/made

4 UK Statutory Instruments (2002) *The Air Quality (England) (Amendment) Regulations 2002* SI 2002 / 3043 [online] Available at: https://www.legislation.gov.uk/uksi/2002/3043/contents/made

5 UK Statutory Instruments (2010) *The Air Quality Standards Regulations 2010 SI 2010 / 1001* [online] Available at: https://www.legislation.gov.uk/uksi/2010/1001/contents/made

6 UK Statutory Instruments (2016) *The Air Quality Standards (Amendment) Regulations 2016 SI 2016 / 1184* [online] Available at: https://www.legislation.gov.uk/uksi/2016/1184/contents/made

7 UK Public General Acts (1995) Environment Act Part IV – Air Quality [online] Available at: https://www.legislation.gov.uk/ukpga/1995/25/part/IV

Where the objectives are not likely to be achieved, a local authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

Environmental Protection Act, 1990 - Control of Dust and Particulates associated with Construction

Section 79 of the Environmental Protection Act 1990[8] gives the following definitions of statutory nuisance relevant to dust and particles:

'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance' and,

'Any accumulation or deposit which is prejudicial to health or a nuisance'.

Following this, Section 80[9] says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

There are no statutory limits for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

PLANNING POLICY

A summary of the planning policy relevant to the proposed development and air quality is provided below.

National Planning Policy Framework (NPPF), 2021

The Government's overall planning policies for England are described in the National Planning Policy Framework[10] (NPPF). The core underpinning principle of the NPPF[10] is the presumption in favour of sustainable development, defined as:

"… meeting the needs of the present without compromising the ability of future generations to meet their own needs."

One of the three overarching objectives of the NPPF[10] is that planning should '*contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*"

References to air quality in the NPPF include:

- Paragraph 55 *'…Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations.*

---

8 UK Public General Acts (1990) *Environmental Protection Act 1990, Statutory Nuisances Section 79* online Available at: https://www.legislation.gov.uk/ukpga/1990/43/section/79/2005-12-21

9 UK Public General Acts (1990) *Environmental Protection Act 1990, Statutory Nuisances Section 80* online Available at: https://www.legislation.gov.uk/ukpga/1990/43/section/80/2005-12-21

10 Ministry of Housing, Communities and Local Government (2021) *National Planning Policy Framework* online Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf

- Paragraph 105 *'…Significant development should be focused on locations which are or can be made sustainable';*
- Paragraph 174 *'…Planning policies and decisions should contribute to and enhance the natural and local environment';*
- Paragraph 185 *'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment';*
- Paragraph 186 *'Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants';*
- Paragraph 188 *'…The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land.*

Clean Air Strategy, 2019[11]

The Clean Air Strategy[11] outlines the Government's plan to tackle all sources of air pollution. The strategy sets out the comprehensive action that is required from across all parts of government and society. New legislation will create a stronger and more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

Relevant information contained within the Clean Air Strategy[11] includes:

'Understanding the Problem

a) We (UK Government) are investing £10 million in improving our modelling, data and analytical tools to give a more precise picture of current air quality and the impact of policies on it in future.
b) We will increase transparency by bringing local and national monitoring data together into a single accessible portal for information on air quality monitoring and modelling, catalysing public engagement through citizen science.

Protecting the Nation's Health

c) We will provide a personal air quality messaging system to inform the public, particularly those who are vulnerable to air pollution, about the air quality forecast, providing clearer information on air pollution episodes and accessible health advice.
d) We will back these goals up with powers designed to enable targeted local action in areas with an air pollution problem.
e) We will work to improve air quality by helping individuals and organisations understand how they could reduce their contribution to air pollution, showing how this can help them protect their families, colleagues and neighbours.
f) We have published updated appraisal tools and accompanying guidance to enable the health impacts of air pollution to be considered in every relevant policy decision that is made.
g) We will progressively cut public exposure to particulate matter pollution as suggested by the World Health Organization. We will set a new, ambitious, long-term target to reduce people's exposure to

11 DEFRA (2019) *Clean Air Strategy 2019* [online] https://www.gov.uk/government/publications/clean-air-strategy-2019

$PM_{2.5}$ and will publish evidence early in 2019 to examine what action would be needed to meet the WHO annual mean guideline limit of 10 µg/m^3.

h) By implementing the policies in this Strategy, we will reduce $PM_{2.5}$ concentrations across the UK, so that the number of people living in locations above the WHO guideline level of 10 µg/m^3 is reduced by 50% by 2025.

i) By taking action on air pollution we can help people live well for longer, as set out in the Department of Health and Social Care's recently published 'Prevention is Better than Cure' document, which sets the scene for the development of a prevention green paper.

Protecting the Environment

j) We will monitor the impacts of air pollution on natural habitats and report annually so that we can chart progress as we reduce the harm air pollution does to the environment.

k) We will provide guidance for local authorities explaining how cumulative impacts of nitrogen deposition on natural habitats should be mitigated and assessed through the planning system.

l) We will commit to a new target for the reduction of damaging deposition of reactive forms of nitrogen and review what longer term targets should be to further tackle the environmental impacts of air pollution.

Action to Reduce Emissions from Transport

m) New legislation will enable the Transport Secretary to compel manufacturers to recall vehicles and non-road mobile machinery for any failures in their emissions control system, and to take effective action against tampering with vehicle emissions control systems.

n) We will reduce emissions from rail and reduce passenger and worker exposure to air pollution. By the spring 2019, the rail industry will produce recommendations and a route map to phase out diesel-only trains by 2040.

o) We are working with the Treasury to review current uses of red diesel and ensure its lower cost is not discouraging the transition to cleaner alternatives.

p) We will explore permitting approaches to reduce emissions from non-road mobile machinery, particularly in urban areas.'

NWBC Local Plan[12], 2021,

The North Warwickshire Local Plan was adopted on 29 September 2021. Air quality is considered under policy LP29, criterion 9, which states that:

Development should meet the needs of residents and businesses without compromising the ability of future generations to enjoy the same quality of life that the present generation aspires to. Development should:

9) avoid and address unacceptable impacts upon neighbouring amenities through overlooking, overshadowing, noise, light, air quality or other pollution;

In addition, the Local Plan has a pertinent policy on parking in which there is a subsection relating to promoting electric charging points within developments:

LP34 - Parking, Electric Vehicle Charging Points

12 North Warwickshire Borough Council (2021) *Adopted Local Plan (September 2021)* online Available at:https://www.northwarks.gov.uk/downloads/file/8839/local plan adopted september 2021

Electric charging points will be provided as part of all relevant developments to an agreed specification and location dependent on the scheme proposed and applicable technical guidance. Rapid charging points will be provided on sites when located in the public realm. On housing sites homes with on- site parking will provide an electric charging point in an accessible location close to the parking space(s). On commercial sites there will be employee and visitor rapid charging points.

8.3 CONSTRUCTION PHASE ASSESSMENT

METHODOLOGY

Dust comprises particles typically in the size range 1-75 micrometres (μm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited near the source of emission. Larger dust particles are therefore unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

The smaller particles of dust (less than 10 μm in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5 μm). As these particles are at the smaller end of the size range of dust particles, they remain suspended in the atmosphere for a longer period than the larger dust particles and can therefore be transported by wind over a wider area. PM_{10} and $PM_{2.5}$ are small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health.

The IAQM has developed best practice guidance with reference to the assessment of dust from demolition and construction[13]. The methodology is outlined below.

Step 1 - Screening the Need for a Detailed Assessment

An IAQM construction phase dust assessment[13] will normally be required where there are:

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

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible*.

Step 2A - Define the Potential Dust Emission Magnitude

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a class). Other criteria may be used if justified in the assessment.

13 Institute of Air Quality Management (IAQM) (2016) *Guidance on the assessment of dust from demolition and construction* [online] Available at: https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf version 1.1

Table 8.3-1 - Examples of Human Receptor Sensitivity to Construction Phase Impacts

Dust Emission Magnitude	Activity	Criteria
Large	Demolition	More than 50,000 m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition More than 20 m above ground level
	Earthworks	More than 10,000 m^2 site area, dusty soil type (e.g. clay), More than 10 earth moving vehicles active simultaneously More than 8 m high bunds formed, More than 100,000 tonnes material moved
	Construction	More than 100,000 m^3 building volume, on site concrete batching, sandblasting
	Trackout	More than 50 HDVs out / day, dusty surface material (e.g. clay), More than 100 m unpaved roads
Medium	Demolition	20,000 - 50,000 m^3 building demolished, dusty material (e.g. concrete), 10-20 m above ground level
	Earthworks	2,500 - 10,000m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4 m – 8 m high bunds, 20,000 - 100,000 tonnes material moved
	Construction	25,000 - 100,000 m^3 building volume, dusty material e.g. concrete, on site concrete batching
	Trackout	10 - 50 HDVs out / day, moderately dusty surface material (e.g. clay), 50 - 100 m unpaved roads
Small	Demolition	Less than 20,000 m^3 building demolished, non-dusty material (e.g. metal cladding), Less than 10 m above ground level, work during wetter months
	Earthworks	Less than 2,500 m^2 site area, soil with large grain size (e.g. sand), □5 earth moving vehicles active simultaneously, Less than 4 m high bunds, Less than 20,000 tonnes material moved, earthworks during wetter months
	Construction	Less than 25,000 m^3, non-dusty material (e.g. metal cladding or timber)
	Trackout	Less than 10 HDVs out / day, non-dusty soil, Less than 50 m unpaved roads

Step 2b - Define the Sensitivity of the Area

The tables below present the IAQM Error! Bookmark not defined. assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The guidance provides the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table 8.3-2 - Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Up to 20	Up to 50	Up to 100	Up to 350
High	More than 100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table 8.3-3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			Up to 20	Up to 50	Up to 100	Up to 200	Up to 350
High	More than 32	More than 100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	More than 100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	More than 100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	Less than 24	More than 100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	More than 32	More than 10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	More than 10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	More than 10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	Less than 24	More than 10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table 8.3-4 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Sources	
	Up to 20m	Up to 50m
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C - Define The Risk of Impacts

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table 8.3-5 - Risk of Dust Impacts

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

Step 3 - Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is a low, medium or high-risk site. The IAQM construction phase dust guidance[Error! Bookmark not defined.] details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

Step 4 - Determine Significant Effects

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

ASSESSMENT

Table 8.3-6: Potential Dust Emissions Magnitudes, Table 8.3-7: Sensitivity of the study area and **Table 8.3-8: Summary Dust Risk table to define Site Specific Mitigation** outlines the potential dust emission magnitudes, the sensitivity of the study area and the subsequent summary dusk risk table used to determine site specific mitigation, pertinent to the Proposed Development and supplemental to the pertinent information provided in **Section 8.5: Identification and Valuation of Key Impacts (Construction And Operational)** of the ES.

Table 8.3-6 - Potential Dust Emissions Magnitudes

Activity	Dust Emission Magnitude
Demolition	Not Applicable
Earthworks	Large
Construction	Large
Trackout	Medium

Table 8.3-7 - Sensitivity of the study area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Not Applicable	Low	Low	Low
Human Health	Not Applicable	Low	Low	Low

Table 8.3-8: **Summary Dust Risk table to define Site Specific Mitigation** provides a summary of the risk of dust impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 8.3-8 - Summary Dust Risk table to define Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Not Applicable	Low Risk	Low Risk	Low Risk
Human Health	Not Applicable	Low Risk	Low Risk	Low Risk

8.4 OPERATIONAL PHASE ASSESSMENT

ATMOSPHERIC DISPERSION MODEL

The predicted impacts on local air quality associated with changes to road vehicle exhaust emissions because of the operation of the Proposed Development were assessed using the Cambridge Environmental Research Consultants (CERC) atmospheric dispersion modelling system for roads (ADMS-Roads v5.0.0.1). ADMS-Roads applies advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of long and short-term air pollutant concentrations within the given model domain.

MODEL PROCEDURE

The following procedures were carried out to facilitate in the compilation of the dispersion model and subsequent operational phase assessment:

- Collation of input data – traffic data (flows, speeds, percentage of HDVs), road network mapping, sensitive receptor coordinates and meteorological data□
- Input of data in to the ADMS-Roads model for the scenarios to be modelled□
- Calculation of emissions for each pollutant to be assessed through ADMS-Roads and incorporating the DEFRA's EFT[14].(version 10.1)□
- Running the ADMS-Roads model for each considered scenario□
- Conversion of modelled NO_x concentrations to NO_2 concentrations using DEFRA's NO_x to NO_2 calculator[15] (version 8.1) and addition of DEFRA background concentrations[16] to the modelled concentrations□
- Verification and adjustment of modelled road-NO_x contributions from the assessed road through analysing the ADMS-Roads modelled road-NO_x outputs versus local authority monitored road-NO_x for the baseline scenario of 2019□
- Comparison of predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations at all considered receptors to the relevant air quality objectives in each scenario□and
- Analysis of changes in pollutant concentrations between the *'Without Proposed Development'* and *'With Proposed Development'* scenarios to assess the significance of impacts associated with the Proposed Development on local air quality.

A summary of the dispersion modelling parameters included in the ADMS-Roads dispersion models is included in **Table 8.4-1: ADMS-Roads Model Inputs**.

Table 8.4-1 - ADMS-Roads Model Inputs

Parameter	Study Area
Latitude	52.6
Surface Roughness	0.5
Monin-Obukhov Length (m)	30.0

14 DEFRA (2020) *Emissions Factor Toolkit (EFT) version 10.1* □online□Available at: https://laqm.defra.gov.uk/documents/EFT2020□v10.1.xlsb

15 DEFRA (2020) *NO_x to NO_2 Calculator (version 8.1)* □online□Available at: http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html□NOxsector

16 DEFRA (2018) *Background Mapping data for local authorities – 2018* □online□Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps□year□2018

MODEL VALIDATION

ADMS-Roads is commonly used in the UK for an array of air quality management and assessment studies. ADMS-Roads is continually validated against available measured data obtained from real world conditions, field studies and research experiments which improves model performance.

However, any model validation carried out by CERC is unlikely to have been carried out for the same type of study area which encompasses the Proposed Scheme.

Therefore, a comparison of the modelling results against representative monitoring data is required to minimise model uncertainties, by revising modelled results with an adjustment factor to give greater confidence in the final outputs and to confirm that the final pollutant concentrations predicted are representative of the local monitoring information from the study area.

MODEL VERIFICATION

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions.

The following are examples of potential causes of such uncertainties:

- Estimates of background pollutant concentrations
- Meteorological data uncertainties
- Traffic data uncertainties
- Model input parameters, such as 'roughness length'; and
- Overall limitations of the dispersion model.

LAQM.TG16[17] states that,

"Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects."

Through appropriate adjustment of the modelled road NO_x contribution, uncertainties such as those identified above can be minimised where possible to progress consistency with available measured data. An adjustment factor has been derived and applied to all scenario model outputs.

MODEL PRECISION

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

The quantification of model precision provides an estimate of how the final predictions may deviate from monitored pollutant concentrations at the same location over the same period.

---

17 DEFRA (2016) *Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG16* Updated in 2018 online Available at: https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

Measured data from the proposed scheme specific monitoring programme has been used for the verification process, which is presented below.

MODEL PERFORMANCE

An evaluation of model performance has been undertaken to establish confidence in the model results. LAQM.TG16[17] identifies several statistical procedures that are appropriate to evaluate model performance and assess the uncertainty.

These include:

- Root mean square error (RMSE)□
- Fractional bias (FB)□and
- Correlation coefficient (CC).

These parameters estimate how the model results agree or diverge from the observations.

These calculations can be carried out prior to, and after adjustment, or based on different options for adjustment, and can provide useful information on model improvement.

A brief explanation of each statistic is provided in **Table 8.4-2: Statistical parameters for describing Model Performance**, and further details can be found in Box 7.17 of LAQM.TG16[17].

Table 8.4-2 - Statistical parameters for describing Model Performance

Statistical Parameter	Comment	Ideal Value
Root Mean Square Root (RMSE)	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are equivalent to the quantities compared. If the RMSE values are higher than 25□, of the objective being assessed, it is recommended that the model inputs and verification should be revisited to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40□g/m^3, if an RMSE of 10□g/m^3 is determined for a model, it is advised to revisit the model parameters and model verification. Ideally, an RMSE within 10□ of the air quality objective would be derived, which equates to 4□g/m^3 for the annual mean NO_2 objective.	0.00
Fractional Bias (FB)	FB is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between □2 and -2 and has an ideal value of zero. Negative values suggest a model overprediction and positive values suggest a model under-prediction.	0.00
Correlation Coefficient (CC)	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a series of modelled and observed data points.	1.00

To assess the uncertainty of a model, the RMSE is the simplest parameter to calculate providing an estimate of the average error of the model in the same units as the modelled predictions.

ASSESSMENT VERIFICATION PROCESS

Approach

The model verification process contains a review of the modelled pollutant concentrations against corresponding monitoring data to determine how well the air quality model performed. Depending on the outcomes of the initial review, it may be considered that the model has performed to an adequate level and that no further adjustment is required to be carried out for the modelling results, as per LAQM.TG16[17].

Alternatively, the model may have performed outside of the ideal performance limits quoted within LAQM.TG16[17] (i.e. model agrees within +/-25% of monitored equivalent, but ideally within +/- 10%). There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered as practical, then the modelled results require adjustment to best align with the monitoring data. This may either be a single verification adjustment factor to be applied to the modelled concentrations across the entire study area, or a range of different adjustment factors to account for different zones such as motorway, urban or rural areas or for each identified local authority's jurisdiction.

Model verification is predominantly undertaken based on concentrations of nitrogen dioxide (NO_2). Most NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2), in accordance with LAQM.TG16[17]. As such, adjustment has been applied to the road NO_x source contribution, thus ensuring that any adjustment has been applied prior to being converted from NO_x to NO_2.

Monitoring Data for Assessment Verification Process

The dispersion model was set to predict the 2019 annual mean road-NO_x contribution at identified monitoring locations to carry out an appropriate model adjustment exercise.

The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentrations measured using the diffusion tube data for each considered monitoring location, utilising the NO_x from NO_2 calculator provided by DEFRA[15] and the NO_2 background concentration[16] (from the DEFRA background pollutant mapping).

Considering the location of the monitoring sites, roadside and background site status, traffic data network coverage, and data capture, 8 North Warwickshire Borough Council diffusion tube monitoring locations and 1 Tamworth Borough Council diffusion monitoring location were selected for the initial model verification process.

The spatial location of each of the monitoring sites are presented in **Figure 8-2: Monitoring Location Plan**. These sites were positioned adjacent to the local road network where respective traffic data were available for the proposed scheme.

The respective monitoring location results used in the verification process are contained in **Table 8.4-3: NO_2 Model Verification Procedure – No Adjustment** which presents the initial model verification exercise of applying no adjustment to Road-NO_x contributions.

It contains a comparison of the monitored and modelled NO_2 results for the base year of 2019 to ascertain whether any further adjustment would be required, based on the guidance provided in LAQM.TG16[17].

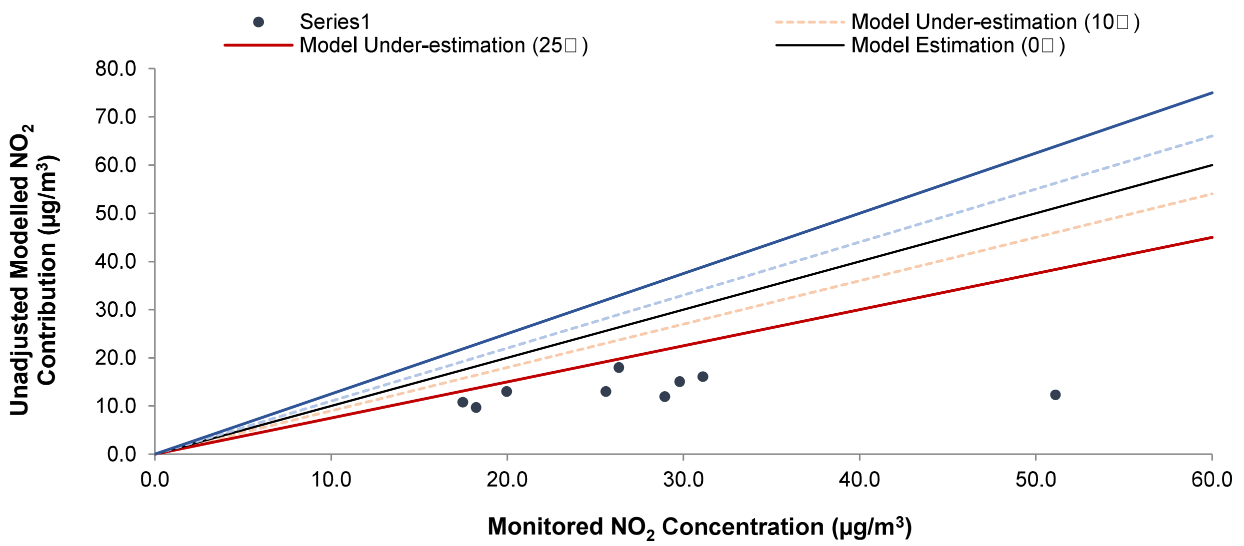
Table 8.4-3 – NO_2 Model Verification Procedure – No Adjustment to Road-NO_x

Model Verification Procedure	Monitoring Data – Diffusion Tube								
	1	2	3	5	6	7	18	19	q5
2019 Background NO_x (µg/m³)	14.0	10.5	10.5	11.1	11.1	11.1	14.6	14.6	13.6
2019 Background NO_2 (µg/m³)	10.6	8.1	8.1	8.6	8.6	8.6	11.0	11.0	10.3
2019 Monitored Total NO_2 (From Diff.Tube Results) (µg/m³)	20.0	17.5	18.2	29.8	28.9	51.1	26.3	31.1	25.6
2019 Monitored Road NO_2 (µg/m³)	9.4	9.4	10.1	21.2	20.4	42.6	15.3	20.1	15.3
Monitored Road NO_x (from NO_x to NO_2 Calc for Diff.Tubes) (µg/m³)	17.6	17.4	18.9	41.4	39.7	91.9	29.5	39.5	29.4
Modelled Road Cont. NO_x (from ADMS-Roads) (µg/m³)	4.5	5.0	2.9	12.0	6.2	6.9	13.0	9.4	5.0
Ratio of Monitored to Modelled Road Cont. NO_x	4.0	3.5	6.5	3.5	6.4	13.4	2.3	4.2	5.9
Adjustment Factor	**1.00**								
Adjusted Road Cont. NO_x (µg/m³)	19.7	22.0	12.8	52.9	27.3	30.4	57.4	41.7	22.0
Adjusted Modelled Total NO_x (µg/m³)	33.7	32.4	23.3	64.1	38.4	41.5	72.1	56.4	35.6
Modelled Total NO_2 based on Empirical NO_x to NO_2 Relationship (from NO_x to NO_2 Calc) (µg/m³)	21.0	19.8	15.1	35.0	23.0	24.5	39.2	32.1	21.9
Monitored Total NO_2 (µg/m³)	20.0	17.5	18.2	29.8	28.9	51.1	26.3	31.1	25.6
% Difference ((Modelled - Monitored / Monitored) x 100)	5.4	13.4	-17.4	17.6	-20.7	-52.1	48.7	3.3	-14.3

Data reported to 1 decimal place

Figure 8.4-1: NO_2 Verification Process – No Adjustment shows the comparison of unadjusted modelled total NO_2 against the monitored NO_2 concentrations (see **Table 8.4-3: NO_2 Model Verification Procedure – No Adjustment**) with all the identified monitoring locations considered for the model verification exercise.

Figure 8.4-1 - NO_2 Verification Process – No Adjustment



Box 7.14 of LAQM.TG16[17]outlines the following:

'If your checks confirm that:

- *There is no systematic under or over prediction;*
- *Predictions at sites where monitoring shows concentrations are close to the objective show good comparison; and*
- *The majority of results are within 25% as a minimum, but preferably within 10%, of monitored concentrations.*

Then you do not necessarily need to adjust your modelling results. However, you may consider model adjustment as this can lead to further improvements in the results obtained, for example where all results move to within 10% of monitored concentrations.'

The model verification exercise showed that the difference between the total modelled NO_2 and total monitored NO_2 at all identified diffusion tube monitoring locations are above 25 when processed and no adjustment is made to the modelled road-NO_x contributions (see **Table 8.4-3: NO_2 Model Verification Procedure – No Adjustment**).

As such, it was deemed necessary to carry out adjustment to the modelled road-NO_x contributions to gain improvements in the dispersion modelling results relative to the monitored values, as per LAQM.TG16[17].

Preliminary Model Adjustment

Table 8.4-4; NO_2 Model Verification Procedure – Preliminary Adjustment presents the preliminary model adjustment exercise, which considers the comparison of modelled and monitored total annual mean NO_2 once adjustment was made to the modelled road-NO_x contributions.

Table 8.4-4 – NO_2 Model Verification Procedure – Preliminary Adjustment

Model Verification Procedure	Monitoring Data – Diffusion Tube								
	1	2	3	5	6	7	18	19	q5
2019 Background NOx (µg/m³)	14.0	10.5	10.5	11.1	11.1	11.1	14.6	14.6	13.6

Model Verification Procedure	Monitoring Data – Diffusion Tube								
	1	2	3	5	6	7	18	19	q5
2019 Background NO_2 (µg/m³)	10.6	8.1	8.1	8.6	8.6	8.6	11.0	11.0	10.3
2019 Monitored Total NO_2 (From Diff.Tube Results) (µg/m³)	20.0	17.5	18.2	29.8	28.9	51.1	26.3	31.1	25.6
2019 Monitored Road NO_2 (µg/m³)	9.4	9.4	10.1	21.2	20.4	42.6	15.3	20.1	15.3
Monitored Road NO_x (from NO_x to NO_2 Calc for Diff.Tubes) (µg/m³)	17.6	17.4	18.9	41.4	39.7	91.9	29.5	39.5	29.4
Modelled Road Cont. NO_x (from ADMS-Roads) (µg/m³)	4.5	5.0	2.9	12.0	6.2	6.9	13.0	9.4	5.0
Ratio of Monitored to Modelled Road Cont. NO_x	4.0	3.5	6.5	3.5	6.4	13.4	2.3	4.2	5.9
Adjustment Factor	4.42 (4.4193)								
Adjusted Road Cont. NO_x (µg/m³)	19.7	22.0	12.8	52.9	27.3	30.4	57.4	41.7	22.0
Adjusted Modelled Total NO_x (µg/m³)	33.7	32.4	23.3	64.1	38.4	41.5	72.1	56.4	35.6
Modelled Total NO_2 based on Empirical NO_x to NO_2 Relationship (from NO_x to NO_2 Calc) (µg/m³)	21.0	19.8	15.1	35.0	23.0	24.5	39.2	32.1	21.9
Monitored Total NO_2 (µg/m³)	20.0	17.5	18.2	29.8	28.9	51.1	26.3	31.1	25.6
% Difference ((Modelled - Monitored / Monitored) x 100)	5.4	13.4	-17.4	17.6	-20.7	-52.1	48.7	3.3	-14.3

Data reported to 1 decimal place

Figure 8.4-2: NO_2 Verification Process - Preliminary Adjustment - Road-NO_x Model Adjustment below presents the calculation to derive the road-NO_x model adjustment factor for the preliminary adjustment exercise. This factor was then applied to the modelled road-NO_x concentration for the monitoring locations to provide adjusted modelled road-NO_x values to then be compared to the total NO_2 monitoring concentrations, once converted from NO_x to NO_2.

Figure 8.4-2 - NO_2 Verification Process - Preliminary Adjustment - Road-NO_x Model Adjustment

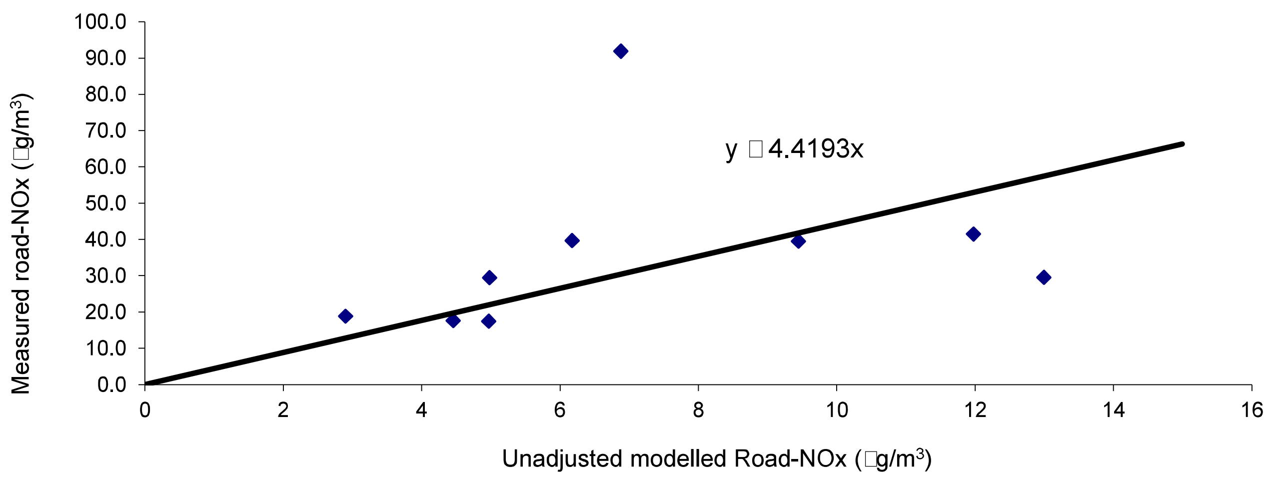
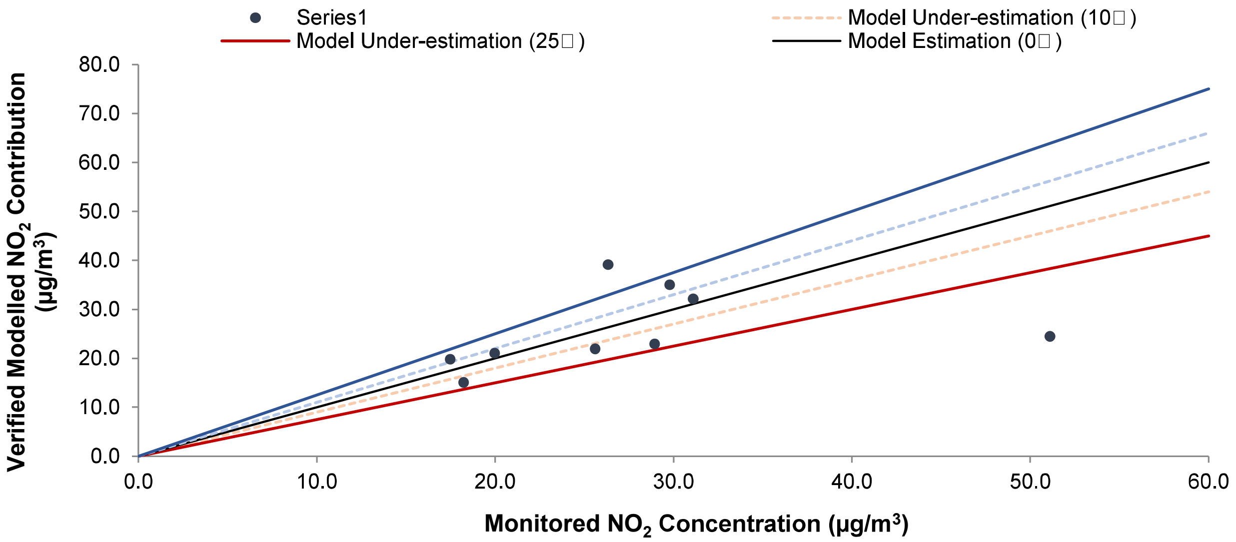


Figure 8.4-3: NO_2 Verification Process - Preliminary Adjustment - Post Adjustment below presents the comparison of monitored versus modelled NO_2 for each monitoring locations in the preliminary model adjustment procedure, with the adjustment factor of **4.42** applied to the modelled road-NO_x contributions.

Figure 8.4-3 - NO_2 Verification Process - Preliminary Adjustment - Post Adjustment



Revised Model Adjustment

Table 8.4-5: **NO_2 Model Verification Procedure –Revised Adjustment** provides the relevant data required to generate the revised adjustment exercise, following removal of **two** outliers from the model verification procedure, due to their performance of remaining above 25 when processed.

Table 8.4-5 – NO_2 Model Verification Procedure –Revised Adjustment

Model Verification Procedure	Monitoring Data – Diffusion Tube						
	1	2	3	5	6	19	q5
2019 Background NO_x (µg/m³)	14.0	10.5	10.5	11.1	11.1	14.6	13.6
2019 Background NO_2 (µg/m³)	10.6	8.1	8.1	8.6	8.6	11.0	10.3
2019 Monitored Total NO_2 (From Diff.Tube Results) (µg/m³)	20.0	17.5	18.2	29.8	28.9	31.1	25.6
2019 Monitored Road NO_2 (µg/m³)	9.4	9.4	10.1	21.2	20.4	20.1	15.3
Monitored Road NO_x (from NO_x to NO_2 Calc for Diff.Tubes) (µg/m³)	17.6	17.4	18.9	41.4	39.7	39.5	29.4
Modelled Road Cont. NO_x (from ADMS-Roads) (µg/m³)	4.5	5.0	2.9	12.0	6.2	9.4	5.0
Ratio of Monitored to Modelled Road Cont. NO_x	4.0	3.5	6.5	3.5	6.4	4.2	5.9
Adjustment Factor	**4.25 (4.2473)**						
Adjusted Road Cont. NO_x (µg/m³)	18.9	21.1	12.3	50.9	26.2	40.1	21.1
Adjusted Modelled Total NO_x (µg/m³)	32.9	31.6	22.8	62.0	37.4	54.8	34.7

Model Verification Procedure	Monitoring Data – Diffusion Tube						
	1	2	3	5	6	19	q5
Modelled Total NO_2 based on Empirical NO_x to NO_2 Relationship (from NO_x to NO_2 Calc) (µg/m^3)	20.7	19.4	14.8	34.1	22.4	31.4	21.5
Monitored Total NO_2 (µg/m^3)	20.0	17.5	18.2	29.8	28.9	31.1	25.6
% Difference ((Modelled - Monitored / Monitored) x 100)	3.4	10.9	-18.9	14.5	-22.5	0.9	-16.0

Data reported to 1 decimal place

Figure 8.4-4: NO_2 Verification Process - Revised Adjustment - Road-NO_x Model Adjustment below presents the calculation to derive the road NO_x model adjustment factor for the revised model verification exercise. This factor was then reapplied to the modelled road-NO_x concentration for the remaining monitoring locations to provide adjusted modelled road-NO_x values in the revised model verification exercise.

Figure 8.4-4 - NO_2 Verification Process - Revised Adjustment - Road-NO_x Model Adjustment

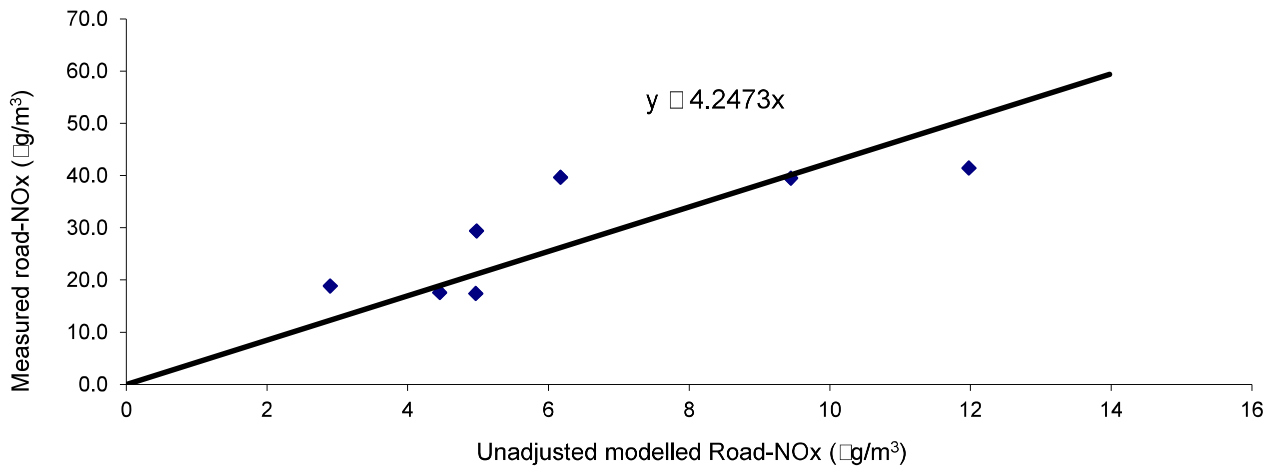
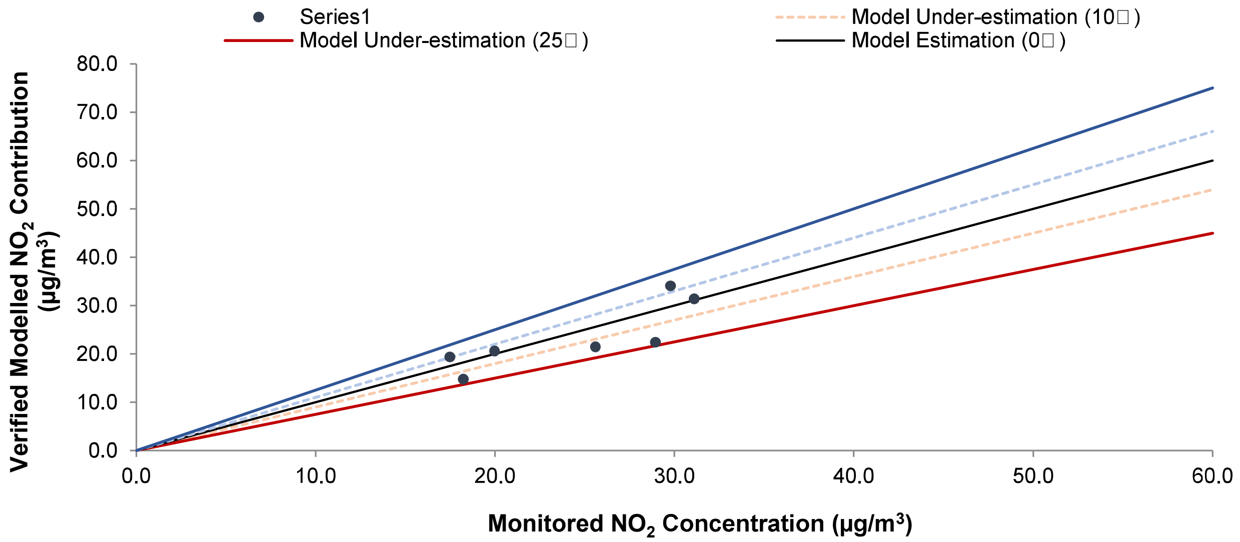


Figure 8.4-5: **NO_2 Verification Process - Revised Adjustment - Post Adjustment** below presents the comparison of monitored versus modelled NO_2 for each monitoring locations in the revised model verification procedure.

Figure 8.4-5 - NO_2 Verification Process - Revised Adjustment - Post Adjustment



The remaining sites demonstrated broad agreement within □25□ once the revised adjustment factor is applied with two of the monitoring locations maintaining an agreement to within □10□. As such, the air quality model, after appropriate verification, can be considered suitable for use in the modelling of each assessment scenario reported in Chapter 8 of the ES.

Figure 8-2: Monitoring Location Plan presents the spatial locations of the monitoring utilised in the model verification process.

Summary

The summary of model performance statistics, as outlined in LAQM.TG16[17] are provided in **Table 8.4-6**: **Model Performance Statistics** below.

Table 8.4-6 – Model Performance Statistics

Model Verification Step	No. Sites	No. of Sites within +/- 25%	No. of Sites within +/- 10%	Root Mean Square Error (RMSE)		Fractional Bias (FB)	Correlation Co-efficient (CC)
				µg/m³	% AQO		
No Adjustment	9	0	0	17.1	42.8	0.7 (0.69)	0.2 (0.21)
Preliminary Adjustment	9	7	2	10.4	26.0	0.1 (0.07)	0.3 (0.30)
Revised Adjustment	7	7	2	3.7	9.3	0.0 (0.04)	0.8 (0.83)

A comparison of the performance of the modelled total NO_2 concentrations against the monitoring data used in each model verification step has been carried out.

The RMSE value calculated when no adjustment to the modelled road-NO_x contribution was 17.4 □g/m³, equating to 42.8□ of the annual mean NO_2 objective. The FB value is calculated as 0.69 and the CC is calculated as 0.21. None of the considered monitoring locations are preforming at an adequate level (within □/- 25□) and therefore it was deemed necessary to complete a model adjustment exercise.

When the preliminary adjustment was made to the road-NO_x contributions, the RMSE value calculated reduced to 10.4µg/m^3, equating to 26.0% of the annual mean NO_2 objective. The FB value is calculated as 0.07 and the CC is calculated as 0.30.

On interpretation of these statistics, two of the considered monitoring locations contained within the preliminary adjustment exercise would be judged to not be performing within a suitable range of agreement (within +/- 25%).

Once those relevant monitoring locations were removed and the revised modelled road-NO_x adjustment factor derived, the RMSE value calculated reduces to 3.7µg/m^3, which is 9.3% of the annual mean air quality objective. The FB value is calculated as 0.04 and the CC is calculated as 0.83.

The RMSE sits within the ideal value of 4.0 µg/m^3 or within 10% of the annual mean NO_2 objective, representing an improvement in model performance and demonstrating a near-ideal value for FB (i.e. no tendency for the model to over or under predict) and an improvement for CC (model predictions exhibiting more of an absolute relationship).

Consequently, a road-NO_x verification factor of **4.25 (4.2473)** has been applied in order to adjust the modelled concentrations for each scenario included in the road vehicle exhaust emissions assessment.

PM_{10} and $PM_{2.5}$ Adjustment

There were no identified PM_{10} or $PM_{2.5}$ monitoring locations situated adjacent to the modelled road network.

As such, the verification factor determined above for adjusting the road-NO_X contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with the guidance set out in LAQM.TG16[17] which states:

"In the absence of any PM_{10} data for verification, it may be appropriate to apply the road-NO_x adjustment to the modelled road-PM_{10}. If this identifies exceedances of the objective, then it would be appropriate to monitor PM_{10} to confirm the findings."

MODELLING UNCERTAINTY

Further modelling uncertainty could be reduced with the refinement of the dispersion model, in particular in areas where traffic may experience reduced speeds on the approach to all junctions contained within the dispersion model, which may improve the overall model performance.

The overall modelling assessment has been carried out with using AADT traffic flow and associated speed and composition data. To reduce further uncertainty, time period modelling may have been carried out which may have highlight periods of congestion.

Given the size of the study area included within the air quality model, the spread of available monitoring data applicable to the local air quality assessment study area, uncertainty associated with the traffic model, and assumptions inherent to the air quality model (e.g. meteorological data representative at all monitoring sites, surface roughness and minimum measure of atmospheric stability consistent throughout modelled domain), the adjusted model is considered to be performing adequately within the context of the input parameters.

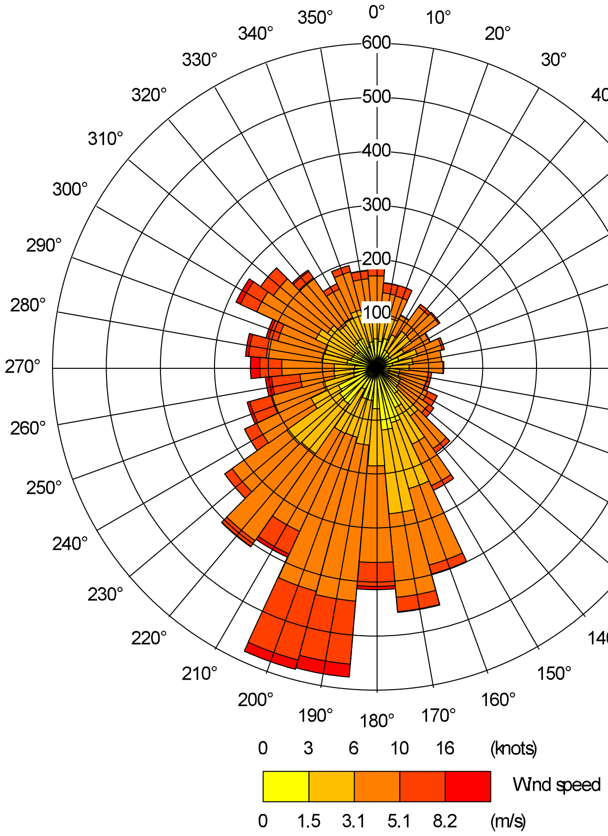
However, the results of the local air quality assessment do need to be viewed within the limitations of the model uncertainty.

METEOROLOGICAL DATA

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

Meteorological data input to the model were obtained from the closest meteorological station, Coleshill, for the year 2019. The 2019 data was used to be consistent with the base / verification traffic year and were applied to the remaining scenarios for the assessment. The 2019 wind rose is presented below:

Coleshill Meteorological Station – 2019



8.5 SCHEDULE OF DISPERSION MODEL RESULTS

HUMAN HEALTH

Opening Year: 2026

Table 8.5-1 – Predicted Annual Mean NO_2 Concentrations – 2026

Receptor	2019 Base (µg/m^3)	2026 DM (µg/m^3)	2026 DS (µg/m^3)	Change (µg/m^3)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	22.8	14.8	15.0	0.2	37.4	0.4	Negligible
R2	22.6	14.6	14.8	0.2	37.0	0.5	Negligible
R3	23.1	14.4	14.0	□0.1	34.9	□0.5	Negligible
R4	28.6	17.2	16.5	□0.1	41.4	□0.5	Negligible
R5	28.0	17.5	18.2	0.7	45.5	1.7	Negligible
R6	24.0	14.8	14.9	□0.1	37.2	0.3	Negligible
R7	27.0	16.2	16.4	0.2	40.9	0.3	Negligible
R8	31.4	18.9	19.4	0.5	48.5	1.3	Negligible
R9	38.0	22.2	22.6	0.4	56.5	0.9	Negligible
R10	51.1	28.5	29.5	1.0	73.7	2.5	Negligible
R11	31.5	18.3	18.8	0.5	46.9	1.2	Negligible
R12	51.8	29.3	29.9	0.6	74.8	1.5	Negligible
R13	14.5	9.8	9.9	□0.1	24.7	0.1	Negligible
R14	37.9	21.4	21.6	0.2	54.1	0.6	Negligible
R15	24.7	15.1	15.2	□0.1	38.0	0.3	Negligible
R16	17.0	11.9	11.9	□0.1	29.7	□0.5	Negligible
R17	18.1	12.5	12.6	□0.1	31.4	0.2	Negligible
R18	17.3	12.3	12.4	□0.1	31.0	0.2	Negligible
R19	21.6	14.2	14.4	0.2	35.9	0.4	Negligible
R20	15.5	11.1	11.2	□0.1	28.0	0.1	Negligible
R21	17.0	11.5	11.6	□0.1	29.1	0.2	Negligible
R22	16.9	12.6	12.7	□0.1	31.7	0.1	Negligible
R23	21.9	14.6	14.6	□0.1	36.5	□0.5	Negligible
R24	16.2	12.3	12.3	□0.1	30.8	0.1	Negligible
R25	17.4	12.9	12.9	□0.1	32.3	0.1	Negligible
R26	22.5	15.4	15.5	□0.1	38.8	0.2	Negligible
R27	20.5	14.5	14.6	□0.1	36.5	0.2	Negligible
Proposed Receptors							
PR1	-	-	19.8	-	49.4	-	Negligible

Receptor	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
PR2	-	-	21.3	-	53.3	-	Negligible
PR3	-	-	21.6	-	54.1	-	Negligible

Note: AQAL □Air Quality Assessment Level. AQO □Air Quality Objective.

Table 8.5-2 – Predicted Annual Mean PM_{10} Concentrations – 2026

Receptor	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	17.3	16.3	16.4	□0.1	41.0	□0.5	Negligible
R2	17.5	16.6	16.6	□0.1	41.6	□0.5	Negligible
R3	17.4	16.5	16.6	□0.1	41.4	□0.5	Negligible
R4	18.6	17.7	17.8	0.1	44.6	□0.5	Negligible
R5	16.4	15.6	15.7	0.1	39.2	□0.5	Negligible
R6	15.4	14.5	14.5	□0.1	36.2	□0.5	Negligible
R7	15.9	15.0	15.0	□0.1	37.5	□0.5	Negligible
R8	16.2	15.2	15.3	□0.1	38.3	□0.5	Negligible
R9	17.4	16.4	16.5	□0.1	41.3	□0.5	Negligible
R10	22.9	22.0	22.3	0.3	55.6	1.0	Negligible
R11	17.3	16.4	16.5	0.1	41.2	□0.5	Negligible
R12	21.5	20.5	20.7	0.2	51.6	□0.5	Negligible
R13	14.0	13.1	13.1	□0.1	32.7	□0.5	Negligible
R14	19.9	19.1	19.2	0.1	48.0	□0.5	Negligible
R15	16.3	15.4	15.5	□0.1	38.7	□0.5	Negligible
R16	14.1	13.1	13.1	□0.1	32.8	□0.5	Negligible
R17	14.3	13.3	13.4	□0.1	33.4	□0.5	Negligible
R18	13.6	12.7	12.7	□0.1	31.6	□0.5	Negligible
R19	14.3	13.3	13.3	□0.1	33.3	□0.5	Negligible
R20	13.8	12.9	12.9	□0.1	32.2	□0.5	Negligible
R21	13.8	12.8	12.8	□0.1	32.1	□0.5	Negligible
R22	13.9	12.9	12.9	□0.1	32.3	□0.5	Negligible
R23	15.0	13.9	13.9	□0.1	34.7	□0.5	Negligible
R24	13.8	12.8	12.8	□0.1	32.0	□0.5	Negligible
R25	14.1	13.1	13.1	□0.1	32.8	□0.5	Negligible
R26	14.8	13.8	13.8	□0.1	34.6	□0.5	Negligible

Receptor	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
R27	14.9	13.9	14.0	□0.1	34.9	□0.5	Negligible
Proposed Receptors							
PR1	-	-	18.8	-	47.1	-	Negligible
PR2	-	-	18.9	-	47.2	-	Negligible
PR3	-	-	17.6	-	44.0	-	Negligible

Note: AQAL □ Air Quality Assessment Level. AQO □ Air Quality Objective.

Table 8.5-3 – Predicted Annual Mean $PM_{2.5}$ Concentrations – 2026

Receptor	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	10.9	10.2	10.2	□0.1	40.8	□0.5	Negligible
R2	10.9	10.1	10.1	□0.1	40.5	□0.5	Negligible
R3	10.5	9.7	9.8	0.1	39.1	□0.5	Negligible
R4	11.2	10.4	10.5	□0.1	41.9	□0.5	Negligible
R5	10.4	9.6	9.7	□0.1	38.8	□0.5	Negligible
R6	9.9	9.0	9.0	□0.1	36.2	□0.5	Negligible
R7	10.2	9.3	9.3	□0.1	37.3	□0.5	Negligible
R8	10.3	9.5	9.5	□0.1	38.1	□0.5	Negligible
R9	11.1	10.1	10.2	□0.1	40.7	□0.5	Negligible
R10	14.2	13.1	13.3	0.2	53.2	□0.5	Negligible
R11	11.0	10.1	10.1	□0.1	40.5	□0.5	Negligible
R12	13.4	12.4	12.5	□0.1	49.8	□0.5	Negligible
R13	9.0	8.2	8.3	0.1	33.0	□0.5	Negligible
R14	12.3	11.3	11.4	□0.1	45.6	□0.5	Negligible
R15	10.2	9.4	9.5	□0.1	37.8	□0.5	Negligible
R16	9.1	8.3	8.3	□0.1	33.2	□0.5	Negligible
R17	9.2	8.4	8.4	□0.1	33.7	□0.5	Negligible
R18	9.0	8.2	8.2	□0.1	32.7	□0.5	Negligible
R19	9.4	8.5	8.5	□0.1	34.1	□0.5	Negligible
R20	8.9	8.2	8.2	□0.1	32.7	□0.5	Negligible
R21	9.0	8.2	8.2	□0.1	32.8	□0.5	Negligible
R22	9.1	8.3	8.3	□0.1	33.2	□0.5	Negligible
R23	9.8	8.8	8.8	□0.1	35.4	□0.5	Negligible

Receptor	2019 Base (µg/m^3)	2026 DM (µg/m^3)	2026 DS (µg/m^3)	Change (µg/m^3)	% of AQAL	% OF AQO	Significance
R24	9.1	8.2	8.3	0.1	33.0	□0.5	Negligible
R25	9.2	8.4	8.4	□0.1	33.7	□0.5	Negligible
R26	9.7	8.8	8.8	□0.1	35.3	□0.5	Negligible
R27	9.7	8.8	8.9	□0.1	35.5	□0.5	Negligible
Proposed Receptors							
PR1	-	-	11.0	-	43.9	-	Negligible
PR2	-	-	11.1	-	44.3	-	Negligible
PR3	-	-	10.8	-	43.0	-	Negligible

Note: AQAL □ Air Quality Assessment Level. AQO □ Air Quality Objective.

Future Year: 2041

Table 8.5-4 – Predicted Annual Mean NO_2 Concentrations – 2041

Receptor	2019 Base (µg/m^3)	2041 DM (µg/m^3)	2041 DS (µg/m^3)	Change (µg/m^3)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	22.8	12.6	12.8	22.8	31.9	0.3	Negligible
R2	22.6	12.4	12.6	22.6	31.5	0.4	Negligible
R3	23.1	11.7	11.7	23.1	29.2	□0.5	Negligible
R4	28.6	13.5	13.5	28.6	33.8	□0.5	Negligible
R5	28.0	13.1	13.3	28.0	33.2	0.3	Negligible
R6	24.0	11.7	11.7	24.0	29.3	0.1	Negligible
R7	27.0	12.6	12.6	27.0	31.5	□0.5	Negligible
R8	31.4	19.0	18.9	31.4	47.3	□0.5	Negligible
R9	38.0	20.8	20.7	38.0	51.9	□0.5	Negligible
R10	51.1	18.3	18.5	51.1	46.2	0.4	Negligible
R11	31.5	14.7	14.9	31.5	37.3	0.6	Negligible
R12	51.8	24.7	25.3	51.8	63.1	1.4	Negligible
R13	14.5	8.7	8.8	14.5	21.9	□0.5	Negligible
R14	37.9	18.1	18.2	37.9	45.4	0.2	Negligible
R15	24.7	12.8	12.9	24.7	32.3	0.3	Negligible
R16	17.0	10.4	10.5	17.0	26.2	0.1	Negligible
R17	18.1	10.9	10.9	18.1	27.3	□0.5	Negligible
R18	17.3	11.1	11.1	17.3	27.6	□0.5	Negligible
R19	21.6	12.5	12.4	21.6	31.0	□0.5	Negligible

Receptor	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
R20	15.5	9.9	9.9	15.5	24.9	□0.5	Negligible
R21	17.0	10.3	10.2	17.0	25.6	□0.5	Negligible
R22	16.9	11.5	11.5	16.9	28.7	□0.5	Negligible
R23	21.9	13.0	13.0	21.9	32.5	□0.5	Negligible
R24	16.2	11.2	11.2	16.2	28.1	□0.5	Negligible
R25	17.4	11.6	11.7	17.4	29.2	0.1	Negligible
R26	22.5	11.2	11.2	22.5	28.0	0.1	Negligible
R27	20.5	10.3	10.4	20.5	25.9	0.2	Negligible
Proposed Receptors							
PR1	-	-	16.0	-	39.9	-	Negligible
PR2	-	-	17.5	-	43.8	-	Negligible
PR3	-	-	17.4	-	43.4	-	Negligible

Note: AQAL □Air Quality Assessment Level. AQO □Air Quality Objective.

Table 8.5-5 – Predicted Annual Mean PM_{10} Concentrations – 2041

Receptor	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	17.3	16.5	16.6	0.1	41.5	□0.5	Negligible
R2	17.5	16.7	16.8	□0.1	42.1	□0.5	Negligible
R3	17.4	17.1	17.1	□0.1	42.7	□0.5	Negligible
R4	18.6	18.6	18.6	□0.1	46.5	□0.5	Negligible
R5	16.4	15.7	15.8	□0.1	39.4	□0.5	Negligible
R6	15.4	14.2	14.2	□0.1	35.6	□0.5	Negligible
R7	15.9	14.7	14.7	□0.1	36.7	□0.5	Negligible
R8	16.2	16.5	16.5	□0.1	41.2	□0.5	Negligible
R9	17.4	17.4	17.4	□0.1	43.4	□0.5	Negligible
R10	22.9	20.0	20.0	□0.1	50.1	□0.5	Negligible
R11	17.3	16.7	16.8	□0.1	41.9	□0.5	Negligible
R12	21.5	21.4	21.5	0.2	53.8	□0.5	Negligible
R13	14.0	13.1	13.2	□0.1	32.9	□0.5	Negligible
R14	19.9	19.6	19.8	0.1	49.5	□0.5	Negligible
R15	16.3	15.6	15.7	□0.1	39.3	□0.5	Negligible
R16	14.1	13.1	13.1	□0.1	32.9	□0.5	Negligible

Receptor	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
R17	14.3	13.4	13.4	□0.1	33.6	□0.5	Negligible
R18	13.6	12.7	12.7	□0.1	31.8	□0.5	Negligible
R19	14.3	13.4	13.4	□0.1	33.4	□0.5	Negligible
R20	13.8	12.9	12.9	□0.1	32.2	□0.5	Negligible
R21	13.8	12.9	12.9	□0.1	32.2	□0.5	Negligible
R22	13.9	12.9	12.9	□0.1	32.3	□0.5	Negligible
R23	15.0	14.0	14.0	□0.1	35.0	□0.5	Negligible
R24	13.8	12.8	12.8	□0.1	32.0	□0.5	Negligible
R25	14.1	13.1	13.1	□0.1	32.8	□0.5	Negligible
R26	14.8	14.0	14.1	□0.1	35.2	□0.5	Negligible
R27	14.9	14.1	14.1	□0.1	35.4	□0.5	Negligible
Proposed Receptors							
PR1	-	-	19.2	-	48.1	-	Negligible
PR2	-	-	19.2	-	48.1	-	Negligible
PR3	-	-	17.9	-	44.7	-	Negligible

Note: AQAL □ Air Quality Assessment Level. AQO □ Air Quality Objective.

Table 8.5-6 – Predicted Annual Mean $PM_{2.5}$ Concentrations – 2041

Receptor	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
Human Receptors							
R1	10.9	10.3	10.3	□0.1	41.2	□0.5	Negligible
R2	10.9	10.2	10.2	□0.1	40.9	□0.5	Negligible
R3	10.5	10.0	10.0	□0.1	40.1	□0.5	Negligible
R4	11.2	10.9	10.8	□0.1	43.4	□0.5	Negligible
R5	10.4	9.7	9.7	□0.1	38.8	□0.5	Negligible
R6	9.9	8.9	8.9	□0.1	35.5	□0.5	Negligible
R7	10.2	9.1	9.1	□0.1	36.5	□0.5	Negligible
R8	10.3	10.1	10.1	□0.1	40.5	□0.5	Negligible
R9	11.1	10.6	10.6	□0.1	42.4	□0.5	Negligible
R10	14.2	12.0	12.0	□0.1	48.1	□0.5	Negligible
R11	11.0	10.2	10.3	0.1	41.0	□0.5	Negligible
R12	13.4	12.8	12.9	□0.1	51.6	□0.5	Negligible
R13	9.0	8.3	8.3	□0.1	33.1	□0.5	Negligible

Receptor	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)	% of AQAL	% OF AQO	Significance
R14	12.3	11.6	11.7	□0.1	46.8	□0.5	Negligible
R15	10.2	9.5	9.6	□0.1	38.2	□0.5	Negligible
R16	9.1	8.3	8.3	□0.1	33.2	□0.5	Negligible
R17	9.2	8.4	8.4	□0.1	33.8	□0.5	Negligible
R18	9.0	8.2	8.2	□0.1	32.7	□0.5	Negligible
R19	9.4	8.5	8.5	□0.1	34.2	□0.5	Negligible
R20	8.9	8.1	8.2	□0.1	32.6	□0.5	Negligible
R21	9.0	8.2	8.2	□0.1	32.8	□0.5	Negligible
R22	9.1	8.3	8.3	□0.1	33.2	□0.5	Negligible
R23	9.8	8.9	8.9	□0.1	35.5	□0.5	Negligible
R24	9.1	8.2	8.2	□0.1	33.0	□0.5	Negligible
R25	9.2	8.4	8.4	□0.1	33.7	□0.5	Negligible
R26	9.7	8.6	8.7	□0.1	34.6	□0.5	Negligible
R27	9.7	8.7	8.7	□0.1	34.8	□0.5	Negligible
Proposed Receptors							
PR1	-	-	11.2	-	44.7	-	Negligible
PR2	-	-	11.2	-	45.0	-	Negligible
PR3	-	-	10.9	-	43.6	-	Negligible

Note: AQAL □Air Quality Assessment Level. AQO □Air Quality Objective.

DESIGNATED HABITATS ASSESSMENT

Opening Year: 2026

Table 8.5-7 – Predicted Annual Mean NO_x Concentrations – 2026

Receptor	Name	Distance from Edge (m)	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)
AT1	Veteran Tree	0	22.0	14.7	15.1	0.3
SSSI1□0	Alvecote Pools	0	34.1	20.3	20.4	0.1
SSSI1□1	Alvecote Pools	10	32.2	19.4	19.4	0.0
SSSI1□2	Alvecote Pools	20	30.5	18.6	18.6	0.0
SSSI1□3	Alvecote Pools	30	29.1	17.9	17.9	0.0
SSSI1□4	Alvecote Pools	40	27.8	17.3	17.3	0.0
SSSI1□5	Alvecote Pools	50	26.8	16.8	16.8	0.0
SSSI1□6	Alvecote Pools	60	25.8	16.3	16.3	0.0
SSSI1□7	Alvecote Pools	70	25.0	15.9	15.9	0.0

Receptor	Name	Distance from Edge (m)	2019 Base ($\mu g/m^3$)	2026 DM ($\mu g/m^3$)	2026 DS ($\mu g/m^3$)	Change ($\mu g/m^3$)
SSSI1□8	Alvecote Pools	80	24.2	15.5	15.6	0.0
SSSI1□9	Alvecote Pools	90	23.5	15.2	15.2	0.0
SSSI1□10	Alvecote Pools	100	24.4	16.2	16.2	0.0
SSSI1□11	Alvecote Pools	110	23.8	15.9	16.0	0.0
SSSI1□12	Alvecote Pools	120	22.7	15.1	15.1	0.0
SSSI1□13	Alvecote Pools	130	22.2	14.9	14.9	0.0
SSSI1□14	Alvecote Pools	140	21.8	14.7	14.7	0.0
SSSI1□15	Alvecote Pools	150	21.4	14.5	14.5	0.0
SSSI1□16	Alvecote Pools	160	21.0	14.3	14.3	0.0
SSSI1□17	Alvecote Pools	170	20.7	14.2	14.2	0.0
SSSI1□18	Alvecote Pools	180	20.4	14.0	14.0	0.0
SSSI1□19	Alvecote Pools	190	20.1	13.9	13.9	0.0
SSSI1□20	Alvecote Pools	200	19.9	13.7	13.8	0.0
AW1□0	Grendon Wood	0	27.7	16.7	16.9	0.2
AW1□1	Grendon Wood	10	25.6	15.8	15.9	0.2
AW1□2	Grendon Wood	20	24.0	15.0	15.2	0.1
AW1□3	Grendon Wood	30	22.8	14.5	14.6	0.1
AW1□4	Grendon Wood	40	21.8	14.0	14.1	0.1
AW1□5	Grendon Wood	50	21.0	13.6	13.7	0.1
AW1□6	Grendon Wood	60	20.4	13.3	13.4	0.1
AW1□7	Grendon Wood	70	19.8	13.0	13.1	0.1
AW1□8	Grendon Wood	80	19.3	12.8	12.9	0.1
AW1□9	Grendon Wood	90	18.8	12.6	12.7	0.1
AW1□10	Grendon Wood	100	18.5	12.4	12.5	0.1
AW1□11	Grendon Wood	110	18.1	12.3	12.3	0.1
AW1□12	Grendon Wood	120	17.8	12.1	12.2	0.1
AW1□13	Grendon Wood	130	17.5	12.0	12.1	0.1
AW1□14	Grendon Wood	140	17.3	11.9	11.9	0.1
AW1□15	Grendon Wood	150	17.0	11.7	11.8	0.1
AW1□16	Grendon Wood	160	16.8	11.6	11.7	0.1
AW1□17	Grendon Wood	170	16.6	11.5	11.6	0.1
AW1□18	Grendon Wood	180	16.4	11.4	11.5	0.1
AW1□19	Grendon Wood	190	16.2	11.4	11.4	0.1
AW1□20	Grendon Wood	200	16.0	11.3	11.3	0.1
AW2□0	Unnamed-1410853	0	20.0	13.5	13.5	0.1

Receptor	Name	Distance from Edge (m)	2019 Base (µg/m³)	2026 DM (µg/m³)	2026 DS (µg/m³)	Change (µg/m³)
AW2□1	Unnamed-1410853	10	19.5	13.2	13.3	0.1
AW2□2	Unnamed-1410853	20	19.1	13.1	13.1	0.1
AW2□3	Unnamed-1410853	30	18.7	12.9	12.9	0.1
AW2□4	Unnamed-1410853	40	18.4	12.7	12.8	0.1
AW2□5	Unnamed-1410853	50	18.1	12.6	12.6	0.1
AW2□6	Unnamed-1410853	60	17.8	12.5	12.5	0.1
AW2□7	Unnamed-1410853	70	17.5	12.3	12.4	0.1
AW2□8	Unnamed-1410853	80	17.3	12.2	12.3	0.1
AW2□9	Unnamed-1410853	90	17.1	12.1	12.2	0.1
AW2□10	Unnamed-1410853	100	16.9	12.0	12.1	0.0
AW2□11	Unnamed-1410853	110	16.7	11.9	12.0	0.0
AW2□12	Unnamed-1410853	120	16.5	11.9	11.9	0.0
AW2□13	Unnamed-1410853	130	16.3	11.8	11.8	0.0
AW2□14	Unnamed-1410853	140	16.2	11.7	11.8	0.0
AW2□15	Unnamed-1410853	150	16.0	11.7	11.7	0.0
AW2□16	Unnamed-1410853	160	15.9	11.6	11.6	0.0
AW2□17	Unnamed-1410853	170	15.8	11.5	11.6	0.0
AW2□18	Unnamed-1410853	180	15.7	11.5	11.5	0.0
AW2□19	Unnamed-1410853	190	15.6	11.4	11.5	0.0
AW2□20	Unnamed-1410853	200	15.5	11.4	11.4	0.0

Table 8.5-8 – Nitrogen Deposition Critical Load Information – 2026

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2026 DM (kgN/ha/yr)	2026 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
AT1	Veteran Tree	0	38.3	37.4	37.5	0.1	0.6
SSSI1□0	Alvecote Pools	0	40.2	38.4	38.4	0.0	0.0
SSSI1□1	Alvecote Pools	10	39.9	38.2	38.2	0.0	0.0
SSSI1□2	Alvecote Pools	20	39.7	38.1	38.1	0.0	0.0
SSSI1□3	Alvecote Pools	30	39.5	38.0	38.0	0.0	0.0
SSSI1□4	Alvecote Pools	40	39.3	37.9	37.9	0.0	0.0
SSSI1□5	Alvecote Pools	50	39.1	37.8	37.8	0.0	0.0
SSSI1□6	Alvecote Pools	60	39.0	37.7	37.7	0.0	0.0
SSSI1□7	Alvecote Pools	70	38.8	37.6	37.7	0.0	0.0
SSSI1□8	Alvecote Pools	80	38.7	37.6	37.6	0.0	0.0

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2026 DM (kgN/ha/yr)	2026 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
SSSI1□9	Alvecote Pools	90	38.6	37.5	37.5	0.0	0.0
SSSI1□10	Alvecote Pools	100	38.5	37.5	37.5	0.0	0.0
SSSI1□11	Alvecote Pools	110	38.4	37.4	37.5	0.0	0.1
SSSI1□12	Alvecote Pools	120	38.3	37.4	37.4	0.0	0.0
SSSI1□13	Alvecote Pools	130	38.3	37.4	37.4	0.0	0.0
SSSI1□14	Alvecote Pools	140	38.2	37.3	37.3	0.0	0.1
SSSI1□15	Alvecote Pools	150	38.1	37.3	37.3	0.0	0.0
SSSI1□16	Alvecote Pools	160	38.1	37.3	37.3	0.0	0.0
SSSI1□17	Alvecote Pools	170	38.0	37.3	37.3	0.0	0.0
SSSI1□18	Alvecote Pools	180	38.0	37.2	37.2	0.0	0.0
SSSI1□19	Alvecote Pools	190	37.9	37.2	37.2	0.0	0.0
SSSI1□20	Alvecote Pools	200	37.9	37.2	37.2	0.0	0.0
AW1□0	Grendon Wood	0	38.6	37.1	37.2	0.0	0.1
AW1□1	Grendon Wood	10	38.3	37.0	37.0	0.0	0.3
AW1□2	Grendon Wood	20	38.0	36.9	36.9	0.0	0.2
AW1□3	Grendon Wood	30	37.8	36.8	36.8	0.0	0.2
AW1□4	Grendon Wood	40	37.7	36.7	36.7	0.0	0.2
AW1□5	Grendon Wood	50	37.6	36.6	36.7	0.0	0.2
AW1□6	Grendon Wood	60	37.5	36.6	36.6	0.0	0.2
AW1□7	Grendon Wood	70	37.4	36.6	36.6	0.0	0.2
AW1□8	Grendon Wood	80	37.3	36.5	36.5	0.0	0.2
AW1□9	Grendon Wood	90	37.2	36.5	36.5	0.0	0.1
AW1□10	Grendon Wood	100	37.2	36.5	36.5	0.0	0.1
AW1□11	Grendon Wood	110	37.1	36.4	36.4	0.0	0.2
AW1□12	Grendon Wood	120	37.0	36.4	36.4	0.0	0.1
AW1□13	Grendon Wood	130	37.0	36.4	36.4	0.0	0.1
AW1□14	Grendon Wood	140	37.0	36.4	36.4	0.0	0.1
AW1□15	Grendon Wood	150	36.9	36.3	36.4	0.0	0.1
AW1□16	Grendon Wood	160	36.9	36.3	36.3	0.0	0.1
AW1□17	Grendon Wood	170	36.8	36.3	36.3	0.0	0.1
AW1□18	Grendon Wood	180	36.8	36.3	36.3	0.0	0.1
AW1□19	Grendon Wood	190	36.8	36.3	36.3	0.0	0.1
AW1□20	Grendon Wood	200	36.8	36.3	36.3	0.0	0.1
AW2□0	Unnamed-1410853	0	37.3	36.5	36.5	0.0	0.1

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2026 DM (kgN/ha/yr)	2026 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
AW2□1	Unnamed-1410853	10	37.2	36.5	36.5	0.0	0.1
AW2□2	Unnamed-1410853	20	37.1	36.4	36.4	0.0	0.1
AW2□3	Unnamed-1410853	30	37.1	36.4	36.4	0.0	0.1
AW2□4	Unnamed-1410853	40	37.0	36.4	36.4	0.0	0.1
AW2□5	Unnamed-1410853	50	37.0	36.4	36.4	0.0	0.1
AW2□6	Unnamed-1410853	60	36.9	36.3	36.3	0.0	0.1
AW2□7	Unnamed-1410853	70	36.9	36.3	36.3	0.0	0.1
AW2□8	Unnamed-1410853	80	36.8	36.3	36.3	0.0	0.1
AW2□9	Unnamed-1410853	90	36.8	36.3	36.3	0.0	0.1
AW2□10	Unnamed-1410853	100	36.8	36.3	36.3	0.0	0.1
AW2□11	Unnamed-1410853	110	36.7	36.3	36.3	0.0	0.1
AW2□12	Unnamed-1410853	120	36.7	36.2	36.2	0.0	0.0
AW2□13	Unnamed-1410853	130	36.7	36.2	36.2	0.0	0.0
AW2□14	Unnamed-1410853	140	36.7	36.2	36.2	0.0	0.1
AW2□15	Unnamed-1410853	150	36.6	36.2	36.2	0.0	0.1
AW2□16	Unnamed-1410853	160	36.6	36.2	36.2	0.0	0.1
AW2□17	Unnamed-1410853	170	36.6	36.2	36.2	0.0	0.1
AW2□18	Unnamed-1410853	180	36.6	36.2	36.2	0.0	0.1
AW2□19	Unnamed-1410853	190	36.5	36.2	36.2	0.0	0.0
AW2□20	Unnamed-1410853	200	36.5	36.2	36.2	0.0	0.1

Future Year: 2041

Table 8.5-9 – Predicted Annual Mean NO_x Concentrations – 2041

Receptor	Name	Distance from Edge (m)	2019 Base (µg/m³)	2041 DM (µg/m³)	2041 DS (µg/m³)	Change (µg/m³)
AT1	Veteran Tree	0	22.0	12.6	12.8	0.2
SSSI1-0	Alvecote Pools	0	34.1	16.7	16.8	0.1
SSSI1-1	Alvecote Pools	10	32.2	16.0	16.1	0.1
SSSI1-2	Alvecote Pools	20	30.5	15.4	15.5	0.1
SSSI1-3	Alvecote Pools	30	29.1	15.0	15.0	0.1
SSSI1-4	Alvecote Pools	40	27.8	14.5	14.6	0.0
SSSI1-5	Alvecote Pools	50	26.8	14.2	14.2	0.0
SSSI1-6	Alvecote Pools	60	25.8	13.8	13.9	0.0
SSSI1-7	Alvecote Pools	70	25.0	13.5	13.6	0.0
SSSI1-8	Alvecote Pools	80	24.2	13.3	13.3	0.0
SSSI1-9	Alvecote Pools	90	23.5	13.0	13.1	0.0
SSSI1-10	Alvecote Pools	100	24.4	14.1	14.1	0.0
SSSI1-11	Alvecote Pools	110	23.8	13.9	13.9	0.0
SSSI1-12	Alvecote Pools	120	22.7	13.2	13.2	0.0
SSSI1-13	Alvecote Pools	130	22.2	13.0	13.0	0.0
SSSI1-14	Alvecote Pools	140	21.8	12.8	12.9	0.0
SSSI1-15	Alvecote Pools	150	21.4	12.7	12.7	0.0
SSSI1-16	Alvecote Pools	160	21.0	12.6	12.6	0.0
SSSI1-17	Alvecote Pools	170	20.7	12.5	12.5	0.0
SSSI1-18	Alvecote Pools	180	20.4	12.4	12.4	0.0
SSSI1-19	Alvecote Pools	190	20.1	12.3	12.3	0.0
SSSI1-20	Alvecote Pools	200	19.9	12.2	12.2	0.0
AW1-0	Grendon Wood	0	27.7	14.5	14.7	0.2
AW1-1	Grendon Wood	10	25.6	13.7	13.9	0.2
AW1-2	Grendon Wood	20	24.0	13.2	13.3	0.1
AW1-3	Grendon Wood	30	22.8	12.7	12.8	0.1
AW1-4	Grendon Wood	40	21.8	12.3	12.4	0.1
AW1-5	Grendon Wood	50	21.0	12.0	12.1	0.1
AW1-6	Grendon Wood	60	20.4	11.8	11.8	0.1
AW1-7	Grendon Wood	70	19.8	11.5	11.6	0.1
AW1-8	Grendon Wood	80	19.3	11.4	11.4	0.1
AW1-9	Grendon Wood	90	18.8	11.2	11.3	0.1
AW1-10	Grendon Wood	100	18.5	11.0	11.1	0.1

Receptor	Name	Distance from Edge (m)	2019 Base (µg/m^3)	2041 DM (µg/m^3)	2041 DS (µg/m^3)	Change (µg/m^3)
AW1□11	Grendon Wood	110	18.1	10.9	11.0	0.1
AW1□12	Grendon Wood	120	17.8	10.8	10.8	0.1
AW1□13	Grendon Wood	130	17.5	10.7	10.7	0.0
AW1□14	Grendon Wood	140	17.3	10.6	10.6	0.0
AW1□15	Grendon Wood	150	17.0	10.5	10.5	0.0
AW1□16	Grendon Wood	160	16.8	10.4	10.5	0.0
AW1□17	Grendon Wood	170	16.6	10.3	10.4	0.0
AW1□18	Grendon Wood	180	16.4	10.3	10.3	0.0
AW1□19	Grendon Wood	190	16.2	10.2	10.2	0.0
AW1□20	Grendon Wood	200	16.0	10.1	10.2	0.0
AW2□0	Unnamed-1410853	0	20.0	12.1	12.1	0.0
AW2□1	Unnamed-1410853	10	19.5	11.9	12.0	0.0
AW2□2	Unnamed-1410853	20	19.1	11.8	11.8	0.0
AW2□3	Unnamed-1410853	30	18.7	11.6	11.7	0.0
AW2□4	Unnamed-1410853	40	18.4	11.5	11.6	0.0
AW2□5	Unnamed-1410853	50	18.1	11.4	11.4	0.0
AW2□6	Unnamed-1410853	60	17.8	11.3	11.3	0.0
AW2□7	Unnamed-1410853	70	17.5	11.2	11.2	0.0
AW2□8	Unnamed-1410853	80	17.3	11.1	11.2	0.0
AW2□9	Unnamed-1410853	90	17.1	11.1	11.1	0.0
AW2□10	Unnamed-1410853	100	16.9	11.0	11.0	0.0
AW2□11	Unnamed-1410853	110	16.7	10.9	10.9	0.0
AW2□12	Unnamed-1410853	120	16.5	10.8	10.9	0.0
AW2□13	Unnamed-1410853	130	16.3	10.8	10.8	0.0
AW2□14	Unnamed-1410853	140	16.2	10.7	10.8	0.0
AW2□15	Unnamed-1410853	150	16.0	10.7	10.7	0.0
AW2□16	Unnamed-1410853	160	15.9	10.6	10.7	0.0
AW2□17	Unnamed-1410853	170	15.8	10.6	10.6	0.0
AW2□18	Unnamed-1410853	180	15.7	10.6	10.6	0.0
AW2□19	Unnamed-1410853	190	15.6	10.5	10.5	0.0
AW2□20	Unnamed-1410853	200	15.5	10.5	10.5	0.0

Table 8.5-10 – Nitrogen Deposition Critical Load Information – 2041

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2041 DM (kgN/ha/yr)	2041 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
AT1	Veteran Tree	0	38.3	37.1	37.2	0.0	0.3
SSSI1□0	Alvecote Pools	0	40.2	37.8	37.8	0.0	0.0
SSSI1□1	Alvecote Pools	10	39.9	37.7	37.7	0.0	0.0
SSSI1□2	Alvecote Pools	20	39.7	37.6	37.6	0.0	0.1
SSSI1□3	Alvecote Pools	30	39.5	37.6	37.6	0.0	0.1
SSSI1□4	Alvecote Pools	40	39.3	37.5	37.5	0.0	0.1
SSSI1□5	Alvecote Pools	50	39.1	37.4	37.4	0.0	0.0
SSSI1□6	Alvecote Pools	60	39.0	37.4	37.4	0.0	0.0
SSSI1□7	Alvecote Pools	70	38.8	37.3	37.3	0.0	0.0
SSSI1□8	Alvecote Pools	80	38.7	37.3	37.3	0.0	0.0
SSSI1□9	Alvecote Pools	90	38.6	37.2	37.3	0.0	0.0
SSSI1□10	Alvecote Pools	100	38.5	37.2	37.2	0.0	0.0
SSSI1□11	Alvecote Pools	110	38.4	37.2	37.2	0.0	0.0
SSSI1□12	Alvecote Pools	120	38.3	37.2	37.2	0.0	0.0
SSSI1□13	Alvecote Pools	130	38.3	37.1	37.1	0.0	0.1
SSSI1□14	Alvecote Pools	140	38.2	37.1	37.1	0.0	0.0
SSSI1□15	Alvecote Pools	150	38.1	37.1	37.1	0.0	0.0
SSSI1□16	Alvecote Pools	160	38.1	37.1	37.1	0.0	0.0
SSSI1□17	Alvecote Pools	170	38.0	37.0	37.0	0.0	0.0
SSSI1□18	Alvecote Pools	180	38.0	37.0	37.0	0.0	0.0
SSSI1□19	Alvecote Pools	190	37.9	37.0	37.0	0.0	0.0
SSSI1□20	Alvecote Pools	200	37.9	37.0	37.0	0.0	0.0
AW1□0	Grendon Wood	0	38.6	36.8	36.9	0.0	0.3
AW1□1	Grendon Wood	10	38.3	36.7	36.7	0.0	0.2
AW1□2	Grendon Wood	20	38.0	36.6	36.7	0.0	0.2
AW1□3	Grendon Wood	30	37.8	36.6	36.6	0.0	0.2
AW1□4	Grendon Wood	40	37.7	36.5	36.5	0.0	0.2
AW1□5	Grendon Wood	50	37.6	36.4	36.5	0.0	0.2
AW1□6	Grendon Wood	60	37.5	36.4	36.4	0.0	0.2
AW1□7	Grendon Wood	70	37.4	36.4	36.4	0.0	0.1
AW1□8	Grendon Wood	80	37.3	36.3	36.4	0.0	0.1
AW1□9	Grendon Wood	90	37.2	36.3	36.3	0.0	0.1
AW1□10	Grendon Wood	100	37.2	36.3	36.3	0.0	0.1
AW1□11	Grendon Wood	110	37.1	36.3	36.3	0.0	0.0

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2041 DM (kgN/ha/yr)	2041 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
AW1□12	Grendon Wood	120	37.0	36.3	36.3	0.0	0.1
AW1□13	Grendon Wood	130	37.0	36.2	36.2	0.0	0.1
AW1□14	Grendon Wood	140	37.0	36.2	36.2	0.0	0.1
AW1□15	Grendon Wood	150	36.9	36.2	36.2	0.0	0.1
AW1□16	Grendon Wood	160	36.9	36.2	36.2	0.0	0.0
AW1□17	Grendon Wood	170	36.8	36.2	36.2	0.0	0.1
AW1□18	Grendon Wood	180	36.8	36.2	36.2	0.0	0.1
AW1□19	Grendon Wood	190	36.8	36.2	36.2	0.0	0.1
AW1□20	Grendon Wood	200	36.8	36.1	36.2	0.0	0.1
AW2□0	Unnamed-1410853	0	37.3	36.3	36.3	0.0	0.1
AW2□1	Unnamed-1410853	10	37.2	36.3	36.3	0.0	0.0
AW2□2	Unnamed-1410853	20	37.1	36.3	36.3	0.0	0.1
AW2□3	Unnamed-1410853	30	37.1	36.3	36.3	0.0	0.1
AW2□4	Unnamed-1410853	40	37.0	36.2	36.3	0.0	0.1
AW2□5	Unnamed-1410853	50	37.0	36.2	36.2	0.0	0.0
AW2□6	Unnamed-1410853	60	36.9	36.2	36.2	0.0	0.0
AW2□7	Unnamed-1410853	70	36.9	36.2	36.2	0.0	0.1
AW2□8	Unnamed-1410853	80	36.8	36.2	36.2	0.0	0.1
AW2□9	Unnamed-1410853	90	36.8	36.2	36.2	0.0	0.0
AW2□10	Unnamed-1410853	100	36.8	36.2	36.2	0.0	0.0
AW2□11	Unnamed-1410853	110	36.7	36.1	36.2	0.0	0.1
AW2□12	Unnamed-1410853	120	36.7	36.1	36.1	0.0	0.1
AW2□13	Unnamed-1410853	130	36.7	36.1	36.1	0.0	0.1
AW2□14	Unnamed-1410853	140	36.7	36.1	36.1	0.0	0.0

Receptor	Name	Distance from Edge (m)	2019 Base (kgN/ha/yr)	2041 DM (kgN/ha/yr)	2041 DS (kgN/ha/yr)	Change (kgN/ha/yr)	Change (% LCL)
AW2□15	Unnamed-1410853	150	36.6	36.1	36.1	0.0	0.0
AW2□16	Unnamed-1410853	160	36.6	36.1	36.1	0.0	0.0
AW2□17	Unnamed-1410853	170	36.6	36.1	36.1	0.0	0.1
AW2□18	Unnamed-1410853	180	36.6	36.1	36.1	0.0	0.0
AW2□19	Unnamed-1410853	190	36.5	36.1	36.1	0.0	0.0
AW2□20	Unnamed-1410853	200	36.5	36.1	36.1	0.0	0.0