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LAND ADJACENT TO WINDHOVER ROUNDABOUT, BURSLEDON AIR QUALITY ASSESSMENT

LAND ADJACENT TO WINDHOVER ROUNDABOUT, BURSLEDON

Air Quality Assessment

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Prepared by **Callum Hayles**
Checked by **Graham Harker**
Approved by **Tom Smith**
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Ramboll
240 Blackfriars Road
London
SE1 8NW
United Kingdom

T +44 20 7808 1420
<https://uk.ramboll.com/environment-and-health>

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Assessment Methodology

Executive Summary

An Air Quality Assessment has been undertaken to support an outline planning application for the Proposed Development of Land adjacent to Windhover Roundabout, Bursledon for Wates Development Ltd.

Analysis of monitoring data collected by Eastleigh Borough Council (EBC), and dispersion modelling undertaken for this assessment, indicate that nitrogen dioxide and particulate matter concentrations are currently well below the long and short-term national air quality objectives in the study area. Defra background maps show that pollutant concentrations are likely to decrease over time at the Site and in the study area.

The assessment of potential impacts to air quality during the demolition and construction stage has identified that the activities, together with the location of nearby sensitive receptors, results in an overall medium risk for dust soiling and human health effects. Dust impacts would be effectively controlled through the implementation of suitable mitigation measures outlined in this report which should be implemented through a Construction Environmental Management Plan (CEMP) which is capable of being secured via a planning condition. With the mitigation in place, the construction stage dust effects in the study area would be temporary and not significant.

The Proposed Development is expected to lead to a maximum net increase in annual average daily traffic (AADT) of 904 (452 Heavy-Duty Vehicles (HDVs)) two-way vehicles per day on the Site access road when the development is operational. A detailed modelling assessment showed that vehicle emissions associated with the Proposed Development are expected to have a negligible impact on air quality at all modelled receptors, which demonstrates that the effect of the Proposed Development on local air quality will be not significant.

Measures proposed to mitigate against poor air quality during the completed development stage include a Travel Plan to promote active travel and public transport use and electric vehicle charging.

The energy strategy for the Proposed Development would be 'all electric'. An assessment of combustion plant emissions has therefore been scoped out.

Overall, it is concluded that there are no air quality constraints to the Proposed Development.

1. Introduction

1.1 Overview

Ramboll UK Limited ('Ramboll') has been commissioned by Wates Developments Ltd ('the Client') to undertake an Air Quality Assessment for a Site at the Land adjacent to Windhover Roundabout and between Bursledon Road (A3024) and West End Road (A27), Bursledon, Hants, SO31 8BN, hereafter referred to as the 'Proposed Development'.

1.1.1 Scope of Assessment

This report describes existing air quality within the study area and assesses the impact of the construction and operation of the development on air quality in the surrounding area. The main air pollutants of concern are dust and particulate matter with an aerodynamic diameter of less than 10 µm (PM₁₀), typically generated during demolition and construction activities and from industrial sources, and nitrogen dioxide (NO₂), PM₁₀ and particulate matter with an aerodynamic diameter of less than 2.5 µm (PM_{2.5}), typically generated by road traffic and combustion engine emissions.

Key air quality considerations include potential air quality impacts associated with the demolition and construction stage and completed development stage of the Proposed Development which are outlined below:

- Demolition and construction stage: Construction activities have the potential to generate fugitive dust emissions which may give rise to annoyance due to the soiling of surfaces, increase risk of health effects due to the increase in exposure to PM₁₀ concentrations, and result in damage to vegetation and ecosystems (where very high levels of soiling occur).
- Completed development stage: Emissions from vehicles associated with the operation of the Proposed Development may affect local air quality and mitigation may be necessary if air quality objectives are exceeded.

In summary, the assessment includes:

- Establishment of baseline air quality with the available monitoring data and information presented in the most recently available Eastleigh Borough Council (EBC) Air Quality Annual Status Report (ASR) for the baseline year¹;
- Qualitative assessment of construction dust impacts identifying appropriate construction mitigation measures based on the identified level of risk; and
- Quantitative assessment of road traffic impacts during the completed development stage through atmospheric dispersion modelling.

A number of elements were scoped out of this assessment as detailed in the following section.

Demolition and Construction Stage Traffic

At the time of writing, detailed information regarding the construction methodology for the development, specific activities and traffic movements is not available. Therefore, the peak demolition and construction stage vehicle movements cannot be determined; however, peak demolition and construction vehicle movements are unlikely to exceed the Environmental Protection UK (EPUK) / Institute of Air Quality Management (IAQM) Guidance thresholds for assessment. In addition, vehicle movements associated with construction are typically lower than the number of vehicle movements associated with the completed development activities, which

¹ Eastleigh Borough Council, 2023. 2023 Air Quality Annual Status Report (ASR).

have been considered in this assessment. Therefore, the construction traffic impacts on human health receptors in the area are considered to be not significant and have been scoped out of this assessment.

Further to this, a Construction Environmental Management Plan (CEMP) will outline measures to control and minimise the risk of adverse effects from construction activities. The CEMP would be submitted to Eastleigh Borough Council approval. The CEMP will consider HDVs and other construction traffic movements, including details of routing and times of day of movements. HDV access will be prevented or minimised, where possible, on traffic sensitive roads, residential streets, congested roads, or unsuitable junctions.

Combustion Plant Emissions

No centralised heat and energy plant are planned for the Proposed Development which would be 'all electric'. Therefore, an assessment of combustion plant emissions is not required.

Ecological Receptors

For designated nature conservation sites, the criteria for an assessment to be undertaken is a change in traffic of more than 1,000 vehicles per day or 200 HDVs on a road within 200 m of a designated habitat, alone or in combination with other developments^{2,3}.

The nearest ecological habitats where the change in traffic is greater than the criteria set out above are located adjacent to the M27; Solent Maritime Special Area of Conservation (SAC) and the Solent and Dorset Coast Special Protection Area (SPA) to the south east of Jn8 of the M27, and the River Itchen SAC to the north west of Jn7. The development is predicted to increase flows on the M27 south-east of Jn7 by 348 vehicles per day (226 HDVs) and M27 north-west of Jn7 by 454 vehicles per day (226 HDVs).

By 2030, flows along the M27 are predicted to be 94,654 vehicles per day (7,859 HDVs). Overall flows on the M27 will therefore increase by less than 0.5% and therefore development traffic will lead to an insignificant increase in emissions and therefore will not have a significant effect on ecological receptors as such, an assessment of ecological impacts has not been undertaken.

Suitability for use Assessment

Future Site users are not considered sensitive receptors as annual mean National Air Quality Objectives (NAQOs) do not apply at places of work. A suitability for use assessment in relation to air quality is therefore not required for the Site.

² Natural England, 2018. Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations. Version: June 2018. V1.4 Final.

³ Holman et al (2020). A guide to the assessment of air quality impacts on designated nature conservation sites – version 1.1, Institute of Air Quality Management, London.

2. Site Description

2.1 Site Location

The Site is circa 4.63 ha (11.4 acres) and comprises predominantly undeveloped agricultural pasture land, but with potential for some Made Ground to be present in limited areas of the Site. The Site takes the form of two connected grassland fields with a patch of tall ruderals and a wet flush along its eastern edge. The Site also includes a small collection of agricultural-type buildings sited on an area of hard standing within its south eastern part. Topographically the Site falls to its south-west towards Bursledon Road, and rises north-east towards West End Road.

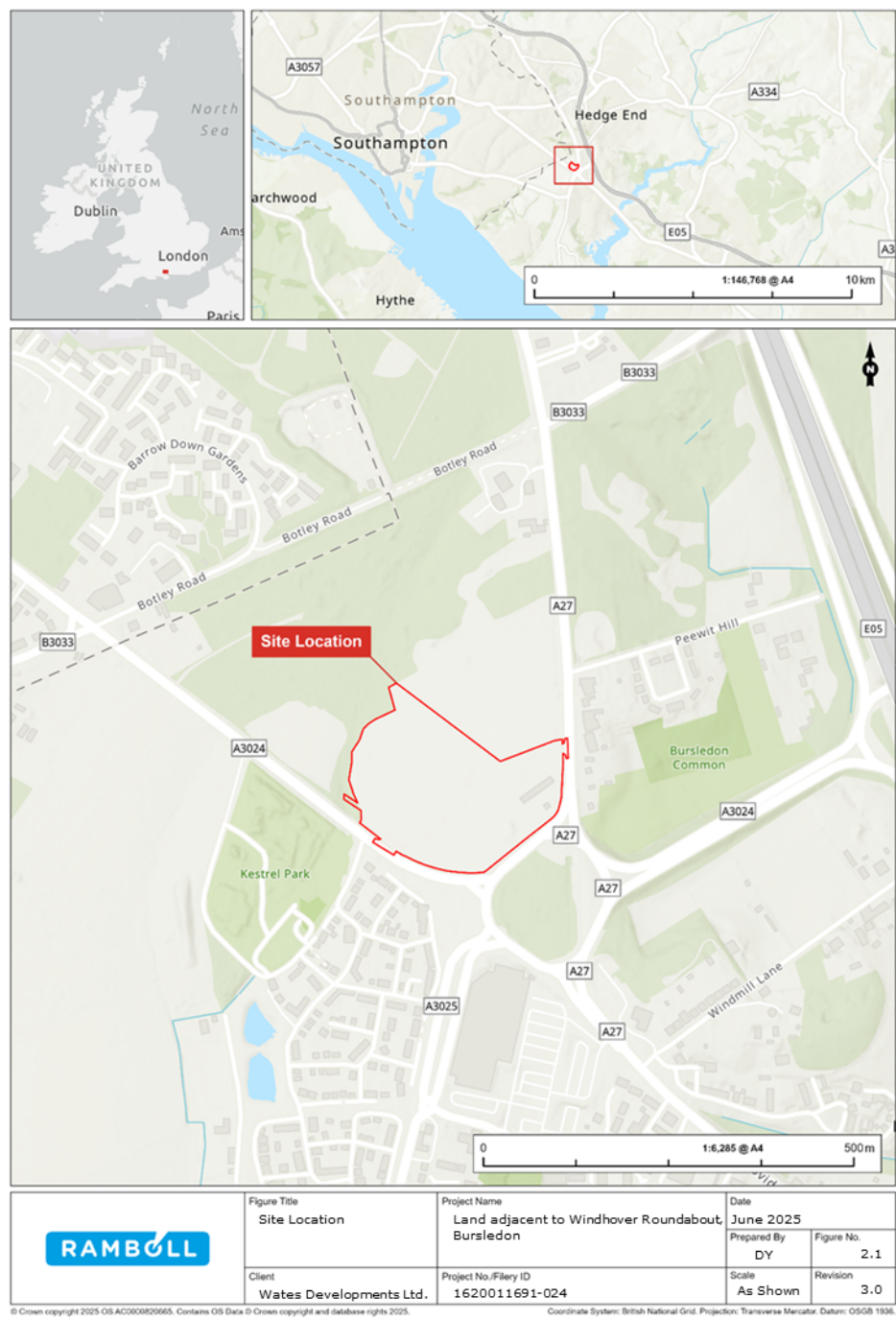


Figure 2.1: Site Location

3. Legislation and Policy

This section outlines the legislation, policies, and published guidance which have informed the assessment.

3.1 International Legislation and Policy

EU Directive 2008/50/EC⁵ on ambient air quality and Cleaner Air For Europe (the CAFE Directive) sets out the ambient air quality standards for NO₂ and PM₁₀ to be achieved by 1 January 2010 and 2005 respectively. The Air Quality Standards Regulations 2010⁶ implements the requirements of the Directive into UK legislation.

The Department for Environment, Food and Rural Affairs (Defra) published a new Clean Air Strategy 2019⁷ in January 2019, setting out how the UK will significantly reduce harmful air pollutant emissions by 2020 and 2030. The Clean Air Strategy contains an intention of working towards the World Health Organisation guideline value for PM_{2.5} of 10 µg/m₃.

The Environment Act⁸ requires the government to set a target for annual mean PM_{2.5} concentrations as well as a long-term target for air quality. The targets are:

- An annual mean concentration target of 10 µg/m³ to be met across England by 2040; and
- A Population Exposure Reduction target of a 35 % reduction in population exposure by 2040 compared to a base year of 2018⁹.

3.2 Local Air Quality Management

Part IV of the Environment Act 1995¹⁰, requires the UK Government to publish an Air Quality Strategy and local authorities to review, assess and manage air quality within their areas. This is known as Local Air Quality Management (LAQM).

The 2007 Air Quality Strategy¹¹ establishes the policy for ambient air quality in the UK. It includes the NAQOs for the protection of human health and vegetation for 11 pollutants. Those NAQOs included as part of LAQM are prescribed in the Air Quality (England) Regulations 2000¹², the Air Quality (Amendment) (England) Regulations 2002¹³ and the Air Quality Standards (Amendment) Regulations 2016¹⁴. Table 3.1 presents the NAQOs for NO₂ and PM₁₀, the two pollutants of most concern in urban areas.

⁵ 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.

⁶ Statutory Instrument 2010 No. 1001, Air Quality Standards Regulations 2010.

⁷ Defra, 2019. Clean Air Strategy.

⁸ Secretary of State, 2021. The Environment Act Chapter 30.

⁹ Statutory Instruments No. 96 (2023) The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023. The Stationary Office Limited. London

¹⁰ Secretary of State, 1995. The Environment Act Part IV Air Quality.

¹¹ Defra, 2007. Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

¹² Statutory Instrument 2000, No 921. The Air Quality (England) Regulations 2000.

¹³ Statutory Instrument 2002, No 3034. The Air Quality (England) (Amendment) Regulations 2002.

¹⁴ Statutory Instrument 2016, No 1184. The Air Quality Standards (Amendment) Regulations 2016.

Table 3.1: Objectives included in air quality regulations (England) 2000 for purpose of local air quality management

Pollutant	Concentration	Measured As	Date to be Achieved By
NO ₂	200 micrograms per metre cubed (µg/m ³) not to be exceeded more than 18 times per year	1 hour	31 December 2005
	40 µg/m ³	Annual mean	
PM ₁₀	50 µg/m ³ not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 µg/m ³	Annual mean	

Analysis of long-term monitoring data suggests that if the annual mean NO₂ concentration is less than 60 µg/m³ then the 1-hour mean NO₂ objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment 60 µg/m³ has been used to screen whether the 1-hour mean objective is likely to be achieved¹⁵. Similar to NO₂, a PM₁₀ annual mean below 32 µg/m³ is used to screen whether the 24-hour PM₁₀ mean NAQO is likely to be achieved¹⁵.

The 2007 Air Quality Strategy also introduced a new policy framework for tackling PM_{2.5} which included an exposure reduction target and a 'backstop' annual mean NAQO. The exposure reduction target is focussed on reducing average concentrations across the most polluted urban areas and is therefore not applicable to individual schemes, whilst the annual mean NAQO can be considered a concentration cap to ensure environmental compliance. The UK NAQO for PM_{2.5} are provided in Table 3.2.

Table 3.2: UK Objectives for PM_{2.5}

Pollutant	Objective	Target Date
Annual mean	20 µg/m ³	2020
3 year running annual mean	15 % reduction in concentrations measured at urban background sites	Between 2010 and 2020

The NAQOs apply to external air where there is relevant exposure to the public over the associated averaging periods within each NAQO. Guidance is provided within LAQM.TG(22) issued by Defra for local authorities on where the NAQOs apply, as detailed in Table 3.1. The NAQOs do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e., centre of roadways).

¹⁵ Defra, 2022. Local Air Quality Management Technical Guidance (TG22).

Table 3.3: Locations where National Air Quality Objectives apply

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

Local authorities are not required to achieve them but have to demonstrate effort of working towards their achievement. In addition, the Limit Values apply in all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations; and
- On the carriageway/central reservation of roads except where there is normally pedestrian access.

Where a local authority's review and assessment of its air quality identifies that air quality is likely to exceed the NAQOs, it must designate these areas as AQMAs and draw up an Air Quality Action Plan (AQAP) setting out measures to reduce pollutant concentrations with the aim of meeting the NAQOs.

3.3 Planning Policy

The National Planning Policy Framework (NPPF)¹⁶ sets out the Government's planning policies for England and how they are expected to be applied. In relation to achieving sustainable development, paragraph 8 states that:

¹⁶ Ministry of Housing, Communities and Local Government, 2024. National Planning Policy Framework.

"Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):...

c) an environmental objective – to 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."

So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development. Paragraph 11 states that plans and decisions should apply a presumption in favour of sustainable development, which for decision-taking means:

"... d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless: ...

ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole."

Paragraph 56 on planning conditions and obligations states:

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

Paragraph 109 on promoting sustainable transport states:

"Transport issues should be considered from the earliest stages of plan-making and development proposals, using a vision-led approach to identify transport solutions that deliver well-designed, sustainable and popular places. This should involve: ...

f) identifying, assessing and taking into account the environmental impacts of traffic and transport infrastructure – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; ..."

Paragraph 187 on conserving and enhancing the natural environment states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by: ...

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans, and..."

Paragraph 198 within ground conditions and pollution states:

"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, as well as the potential sensitivity of the Site or the wider area to impacts that could arise from the development.”

Paragraph 199 states that:

“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.”

Paragraph 200 states that:

“Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent of change’) should be required to provide suitable mitigation before the development has been completed”.

3.4 Local Policy

3.4.1 Eastleigh Borough Local Plan 2016-2036

The Eastleigh Borough Local Plan Local Plan 2016-2036¹⁷ was adopted in April 2022. The local plan outlines EBC objectives and strategy for development until 2036.

Policy ENV1: Mitigating the impacts of development on International Nature Conservation sites states:

“4. The approved mitigation measures for residential developments currently include:

v. Additionally for all residential developments, a financial contribution towards monitoring and, if necessary (based on future monitoring outcomes) managing or mitigating air quality effects within the New Forest SPA, SAC and Ramsar site.”

Policy CCC1: Safe and healthy communities states:

“i. Development should not result in pollution or hazards which prejudice the health and safety of communities and their environments, including air quality and the water environment. Where necessary to enable development to take place, appropriate measures will be required to prevent, control, mitigate or offset the impacts or risks of development on community health and safety.

ii. When the opportunity arises, particularly through development or redevelopment, remedial measures will be taken to address existing pollution or hazards which prejudice the health and safety of communities and their environments.”

¹⁷ New Forest District Council, 2020. New Forest District Local Plan 2016-2036.

Policy STR1: Achieving sustainable development states:

"All new development will be expected to make a positive social, economic and environmental contribution to community and business life in the Plan Area by:

Meeting most development needs within settlement boundaries, in a manner that is appropriate for and proportionate to the nature and size of the settlement, and where there is or will be sufficient supporting infrastructure and services; ...

v. Ensuring communities and workers are safe and feel safe, and the risks to people, places and to the environment from potential hazards including pollution, flooding and climate change effects are minimised;"

3.5 Additional Guidance

3.5.1 Air Quality Planning Practice Guidance, 2019

The Air Quality Planning Practice Guidance (PPG)¹⁸ provides guidance on how planning can take account of the impact of new development on air quality.

3.5.2 Defra's Local Air Quality Management Technical Guidance 2022 (LAQM.TG(22))

LAQM.TG(22)¹⁵ provides advice as to where the NAQOs apply and support to local authorities in carrying out their duties under the Environment Act 19957 and subsequent regulations.

3.5.3 IAQM Guidance on the assessment of dust from demolition and construction, 2024

The IAQM produced guidance¹⁹ to assist in the assessment of air quality impacts from demolition and construction activities. This guidance provides a consistent methodology for assessing the risks of dust impacts from demolition and construction activities and for identifying the correct level of mitigation which should be applied to avoid significant air quality effects.

3.5.4 EPUK/IAQM land-Use Planning & Development Control: Planning for Air quality, 2017

EPUK, together with the IAQM, produced updated guidance in 2017²⁰ on how air quality impacts should be assessed within the land-use planning and development control process. This guidance provides clear criteria to determine when a detailed air quality assessment is required and a methodology for assessing the significance of air quality effects.

3.5.5 IAQM A guide to the assessment of air quality impacts on designated nature conservation sites, 2020

IAQM produced guidance²¹ on the assessment of development impacts on nature conservation sites. The guidance is applicable to ecological sites covered by the Habitats Regulations as well as Sites of Special Scientific Interest (SSSIs), National Nature Reserves (NNR), Local Nature Reserves (LNR), Local Wildlife Sites (LWS) and Ancient Woodland (AW).

¹⁸ Department for levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019. Guidance, Air Quality. Available: <https://www.gov.uk/guidance/air-quality--3> (accessed 12 June 2024).

¹⁹ Stoaling et al., 2024. Guidance on the assessment of dust from demolition and construction, v2.2. Institute of Air Quality Management.

²⁰ Moorcroft and Barrowcliffe, 2017. Land-use Planning & Development Control: Planning for Air Quality. Institute of Air Quality Management.

²¹ Holman et al., 2020. A guide to the assessment of air quality impacts on designated nature conservation sites. Institute of Air Quality Management.

4. Methodology

4.1 Baseline Assessment

To establish the existing baseline air quality in the vicinity of the Site, relevant data was reviewed and assessed. Data was obtained from the following sources:

- EBC diffusion tube monitoring data¹; and
- Defra air quality background maps²²

The study area for the baseline assessment is extended to include appropriate local monitoring sites, which are shown in Figure 5.1.

Sufficient local authority monitoring information is available to allow the assessment to be completed and therefore a site-specific air quality monitoring survey has not been undertaken.

Analysis of long-term monitoring data suggests that if the annual mean NO₂ concentration is less than 60 µg/m³ then the 1-hour mean NO₂ objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment 60 µg/m³ has been used to screen whether the 1-hour mean objective is likely to be achieved¹⁵. Similarly, a PM₁₀ annual mean below 32 µg/m³ is used to screen whether the 24-hour PM₁₀ mean objective is likely to be achieved¹⁵.

4.2 Demolition and Construction Stage Assessment

Likely effects associated with demolition and construction stage dust emissions, unlike other airborne pollutants, cannot be accurately predicted, and quantified because they are highly dependent on local weather conditions and mitigation measures implemented at source.

The assessment of potential construction impacts follow IAQM Guidance on the assessment of the impacts of construction on air quality. The IAQM assessment methodology considers three separate dust effects and defines their significance according to the sensitivity of the surrounding area, as follows:

- Annoyance due to dust soiling;
- The risk of health effects due to a significant increase in exposure to PM₁₀; and
- Harm to ecological receptors.

Potential air quality impacts during the construction phase were considered in line with the IAQM Guidance at sensitive receptor locations up to 250 m from the Site boundary or within 50 m of the routes used by construction vehicles on a public highway, up to 250 m from the Site entrance. Figure 4.1 shows the study area for the demolition and construction stage assessment.

²² Defra. Background Mapping data for local authorities. Available: <https://uk-air.defra.gov.uk/data/iaqm-background-home> (accessed 12 June 2024).

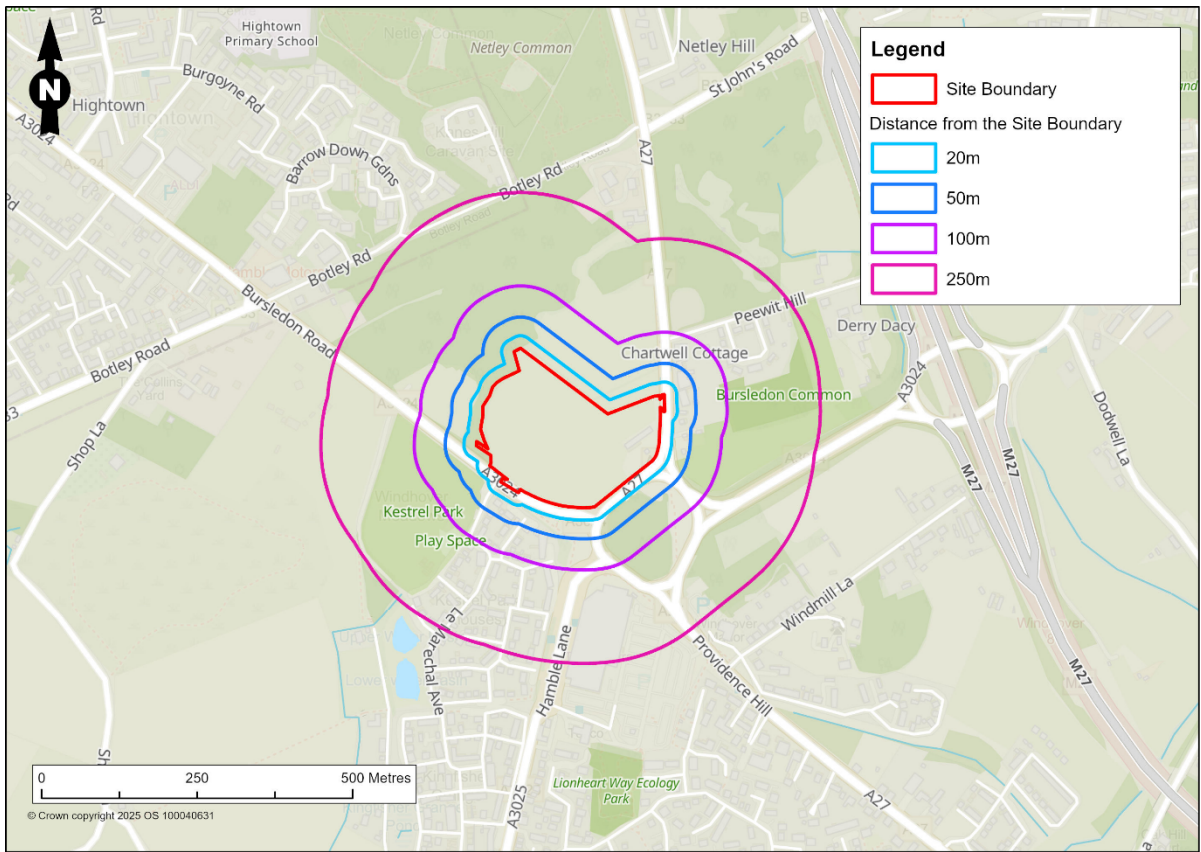


Figure 4.1: Dust Risk Assessment Study Area for the Construction and Demolition Stage

The IAQM Guidance recommends that no assessment of the significance of dust effects is made without mitigation in place, as mitigation is assumed to be secured by industry best practice, planning conditions, legal requirements or required by regulations. On the assumption that the identified mitigation measures are applied and are commensurate with the risk of potential dust impacts, the guidance indicates that the potential for dust effects to arise during the demolition and construction stage would be insignificant and would be temporary in nature.

With appropriate mitigation in place, the effect of demolition and construction stage effects on air quality is assessed as not significant. The purpose of the construction dust assessment is therefore to identify the appropriate level of mitigation to employ.

Full details of the dust risk assessment methodology, including assessment criteria, are provided in Appendix 2.

4.3 Completed Development Stage Assessment

The changes to air quality due to traffic emissions have been predicted using the Air Dispersion Modelling System (ADMS) Roads²³ dispersion model. This model has been extensively validated against both field and laboratory datasets and against monitoring data in cities throughout the UK.

The model requires the user to provide various input data, including meteorological data, AADT flows, the proportion of HDVs, road characteristics and vehicle speed. Full details of the detailed air dispersion model setup are provided in Appendix 2.

²³ CERC, 2024. ADMS-Roads. Available: <https://www.cerc.co.uk/environmental-software/ADMS-Roads-model.html> (accessed 22 May 2025).

The model was run using appropriate and representative meteorological data from Southampton Airport meteorological station. Traffic emissions were calculated using the Emission Factors Toolkit (EFT) v13.1²⁴, which utilises nitrogen oxides (NO_x), PM₁₀ and PM_{2.5} emission factors from the European Environment Agency COPERT 6 emission tool. The traffic data was entered into the ADMS-roads model, along with speed data to provide combined emission rates for each of the modelled road links. The predicted concentrations of roadside NO_x were converted to roadside NO₂ using the LAQM conversion calculator²⁵.

Traffic data used in this assessment been provided by the transport consultants for the project, Motion.

4.3.1 Impacts on Human Health

An assessment of traffic has been undertaken by comparing the change in AADT associated with the completed development stage of the Proposed Development with thresholds set out in the EPUK/IAQM Guidance. The thresholds for a significant change in flows are:

- A change of Light Duty Vehicles (LDVs) flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere.
- A change of Heavy-Duty Vehicles (HDVs) flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere.

For the assessment of road traffic emissions during the completed development stage, the study area for human health receptors has been defined as roads within 250 m of those roads which would experience a significant increase in development traffic that may lead to adverse effects on local air quality, in accordance with EPUK/IAQM Guidance.

Figure 4.2 shows the study area for the completed development stage assessment of human health receptors. In total, eleven receptors within the study area have been chosen to assess the impact of development traffic on the local air quality and are described in Table 4.1.

²⁴ Defra, 2025. EFT v13.1. Available: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/> (accessed 22nd of May 2025).

²⁵ Defra, 2025. NO_x to NO₂ calculator v9.1. Available: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/> (accessed 22nd of May 2025).

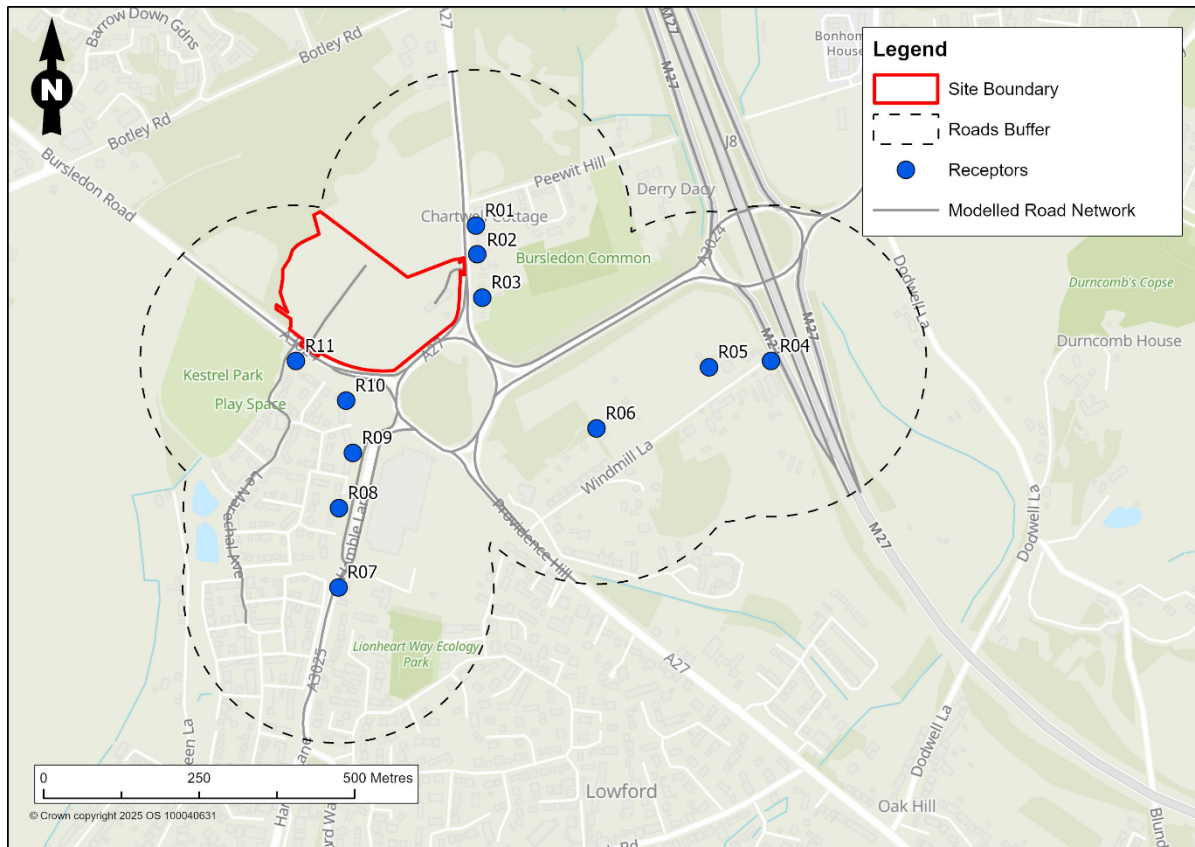


Figure 4.2: Road Traffic Assessment Study Area for the Completed Development stage

The above criteria are for when an assessment may be required for human health impacts. If traffic from a development exceeds these levels, then it does not necessarily mean that a modelling assessment is required, only that air quality impacts of traffic require more detailed consideration.

Changes in LDV and HDV flows associated with the operational stage of the Proposed Development are predicted to exceed the EPUK/IAQM indicative criteria outlined above and result in potentially significant increases in traffic on the local road network. Therefore, a detailed assessment of operational stage vehicle emissions was undertaken.

4.3.2 Assessment Scenarios

Predictions of NO₂, PM₁₀ and PM_{2.5} concentrations at receptors were made for the following scenarios:

- Scenario 1 Baseline: existing baseline and model verification (2023);
- Scenario 2 Do Minimum: future baseline without the Proposed Development (2030); and
- Scenario 3 Do Something: future baseline and fully operational Proposed Development (2030).

Traffic flows provided for 2030 represent those expected when the Proposed Development is fully completed. Emission rates and background values used for the assessment are for 2030.

The air quality at background and roadside locations is expected to improve in future years due to the gradual renewal of the vehicle fleet with less polluting and more efficient vehicle models. The

EFT is widely accepted and used, meaning sensitivity tests were not considered necessary in this assessment.

4.3.3 Modelled Receptors

4.3.3.1 Existing Human Health Receptors

Human health receptors have been assessed adjacent to those roads which would experience a significant increase in development traffic that may lead to adverse effects on local air quality, in accordance with EPUK/IAQM Guidance.

Relevant sensitive receptor locations are places where members of the public might be expected to be regularly present over the averaging period of the NAQOs. For the long- and short-term mean NAQOs that are the focus of this assessment, sensitive receptors would generally be residential properties where the development traffic criteria were exceeded.

Sensitive receptors were chosen to reflect locations where members of the public would receive relevant exposure to annual mean, daily and hourly pollutant concentrations from road traffic. As concentrations fall-off rapidly on moving away from an emissions source, such as a main road, concentrations are expected to be higher adjacent to the road network resulting in the highest exposure to pollutants. When identifying sensitive receptors, particular attention has been paid to those receptors closest to the road network combined with proximity to junctions, where traffic may become congested, and where there is a combined effect of several road links. Consequently, pollutant concentrations were predicted at a number of residential facades representative of worst-case exposure locations.

For this development affected roads predicted to observe a significant increase in vehicle movements as a result of the Proposed Development are the A3024 (Bert Betts Way), The A27 (West End Road) south of the eastern site access, the A3024 (Bursledon Road) immediately east of the southern site access and Hamble Lane. The largest increase is predicted to be along the A3024, facilitation traffic accessing the M27. Although development traffic will travel on a wide network of roads within the study area, receptors have been chosen around the affected road network in accordance with EPUK/IAQM guidance.

Eleven receptors within the study area have been chosen to assess the impact of development traffic on the local air quality and are described in Table 4.1 and shown in Figure 4.2. Receptors were modelled at a height of 1.5 m representing human exposure at ground floor level. There are limited properties in proximity to Bert Betts Way, as such the majority of the receptor locations were identified along Bursledon Road, and West End Road, close to the Site access/egress points and near Windhover roundabout, where traffic emissions are likely to be the largest.

Table 4.1: Summary of Existing Sensitive Receptors

Receptor ID	Location	Type	X (m)	Y (m)	Height (m)
R1	Stoney Croft, West End Road	Residential	448012	111251	1.5
R2	The Stennings, West End Road	Residential	448015	111204	1.5
R3	Lorna Doone, West End Road	Residential	448023	111135	1.5
R4	3 Oakdene, Windmill Lane	Residential	448486	111033	1.5
R5	The Stables, Gables Farm, Windmill Lane.	Residential	448387	111023	1.5

Receptor ID	Location	Type	X (m)	Y (m)	Height (m)
R6	Bursel Dene, Windmill Lane	Residential	448206	110925	1.5
R7	Beafort House, Hamble Lane	Residential	447791	110670	1.5
R8	11 Jacobs Close	Residential	447792	110797	1.5
R9	11 Langtry Crescent	Residential	447815	110886	1.5
R10	16 Newman Road	Residential	447804	110969	1.5
R11	150 Le Marechal Avenue	Residential	447723	111033	1.5

4.3.4 Model Verification

Model verification refers to checks that are carried out on model performance in relation to road modelling at a local level. Modelled concentrations are compared with the results of local monitoring and, where there is a disparity between modelled and monitored concentrations, an adjustment may be applied to the final model output. Details of model verification undertaken for this project are provided in Appendix 2.

4.4 Significance Criteria

4.4.1 Demolition and Construction Stage

IAQM Guidance recommends that no assessment of the significance of dust effects is made without mitigation in place, as mitigation is assumed to be secured by industry best practice, planning conditions, legal requirements or required by regulations.

With appropriate mitigation in place, the effect of demolition and construction stage dust emission impacts on air quality is always assessed as not significant. The purpose of the demolition and construction stage dust assessment has therefore been to identify the appropriate level of mitigation to employ outlined in Section 8.1.

4.4.2 Completed Development Stage

4.4.2.1 Existing Human Health Receptors

The relevant objectives for human health are set out in Table 3.1 and Table 3.2. The assessment of the Proposed Development impacts on local air quality has used the approach developed in IAQM Guidance, which considers the change in air quality associated with a Proposed Development on existing receptors. The guidance has produced a matrix which can be used to calculate the impacts at individual receptor locations as shown in Table 4.2.

EPUK/IAQM Guidance considers both the magnitude of change at each receptor and the resulting overall concentration. The absolute concentration at the receptor is also taken into consideration, i.e., if the receptor is close to or above the NAQO, marginal changes in magnitude may be determined to be a moderate impact; however, if the receptor is less than 75 % of the NAQO, marginal changes in magnitude may be determined to be negligible.

Table 4.2: Impact Descriptors for Changes to Annual Mean NO₂, PM₁₀ and PM_{2.5} Concentrations

Long-term Average Concentration at Receptor with Development	Percentage Change in Concentration Relative to Annual Mean NAQOs			
	<1	2 - 5	6 - 10	>10
75 % or less of NAQO	Negligible	Negligible	Slight	Moderate
76–94 % of NAQO	Negligible	Slight	Moderate	Moderate
95–102 % of NAQO	Slight	Moderate	Moderate	Substantial
103–109 % of NAQO	Moderate	Moderate	Substantial	Substantial
110 % or more of NAQO	Moderate	Substantial	Substantial	Substantial
Notes: Where concentrations increase the impact is adverse, where concentrations decrease the impact is beneficial. % Change rounded to nearest whole number. Where the % change is less than 0.5 % the impact would be Negligible. Impacts considered to have a significant effect highlighted in bold.				

IAQM Guidance states that the overall significance of effects should be based on professional judgement and needs to take account of factors such as:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

In this assessment, in accordance with IAQM Guidance, widespread moderate or substantial impacts are considered a significant overall effect, whereas a negligible or slight impact is considered not significant. Where localised moderate or substantial impacts are predicted, this does not necessarily constitute a significant effect overall; however, appropriate mitigation should be considered at these locations.

4.5 Assumptions and Limitations

There are many components that contribute to the uncertainty in predicted concentrations. Although the ADMS-Roads model has been extensively validated against field datasets and their use has gained wide acceptance throughout the UK, no computer-based model is able to fully replicate actual conditions as the model simplifies real-world conditions into a series of algorithms. The model used in this assessment is also dependent upon several sources of data which will have inherent uncertainties associated with them.

The assessment has relied on data provided by EBC and Defra to characterise baseline conditions. It has been assumed that these data have been reported correctly and the instruments used have been calibrated.

The Proposed Development traffic impacts have been assessed using predicted traffic flows provided by the Transport Consultant, Motion Traffic flows were initially provided for 2024, the opening year for the development is 2030. Tempro growth factors have been applied to the 2024 traffic data.

The model was verified against 2023 background data, monitoring data, meteorological data, and traffic data as 2023 was the latest year with full monitoring results available.

The terrain within 250 m of the modelled network is relatively flat with slopes less than 10 %, and therefore terrain effects have not been included within the modelling.

Gradients have been modelled on roads deemed necessary, these are shown in Appendix A2.

The assessment has assumed air quality at background and roadside locations is expected to improve in future years due to the gradual renewal of the vehicle fleet with less polluting and more efficient models. Air Quality Consultants published a study looking at trends in nitrogen oxides in the UK between 2016 to 2022²⁶. The study concluded that there is an overall decreasing trend in NO_x and NO₂ concentrations from 2016 with concentrations remaining well below pre-pandemic levels in 2022, likely due to longer-term changes in emissions and vehicle fleet turnover.

²⁶ Air Quality Consultants, 2022. Trends in UK NO_x and NO₂ Concentrations through the COVID-19 Pandemic. Available: <https://www.aqconsultants.co.uk/resources>

5. Baseline Assessment

5.1 Local Air Quality Management

EBC has investigated air quality within its jurisdiction as part of its responsibilities under the LAQM regime.

EBC operates both continuous automatic monitoring and passive diffusion tube monitoring of air quality at a number of locations within its jurisdiction. A summary of the closest and most representative monitoring locations in the vicinity of the Site are shown in Figure 5.1.

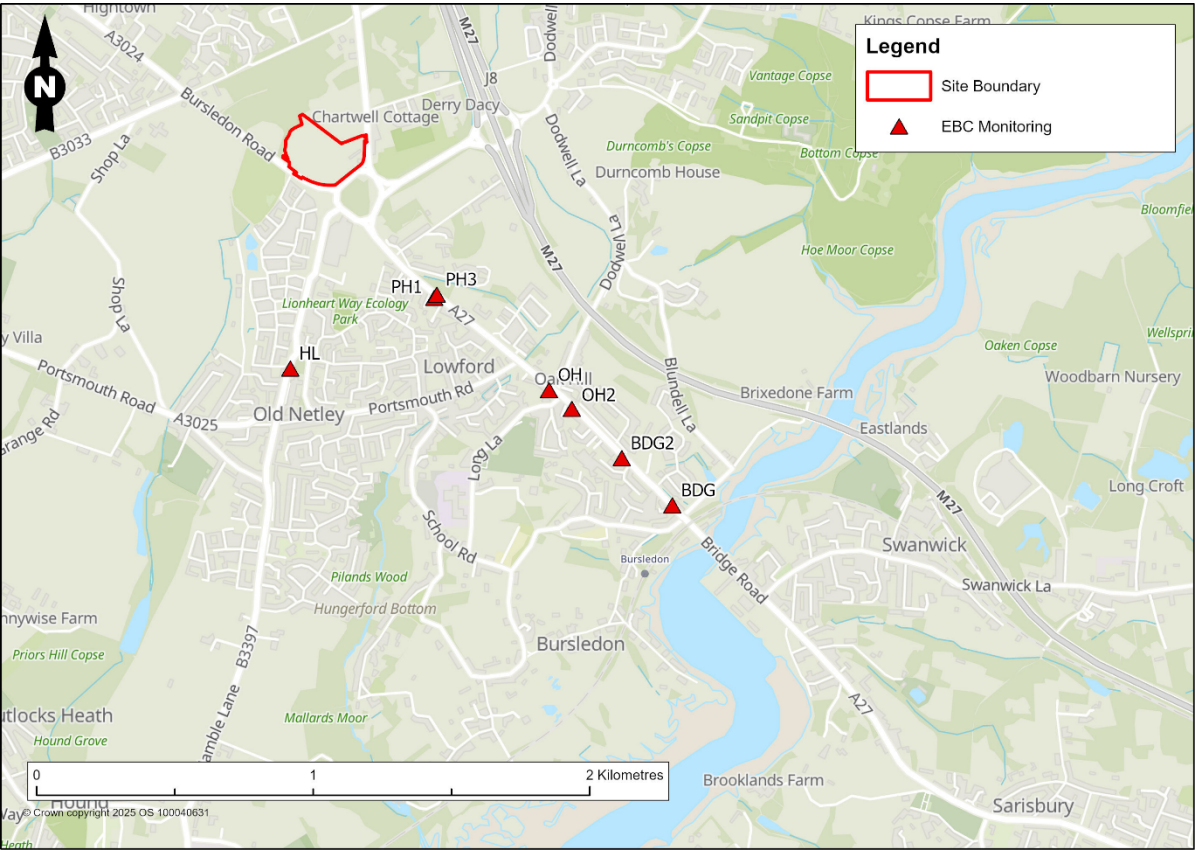


Figure 5.1: Monitoring Locations in the Vicinity of the Site

5.1.1 Nitrogen Dioxide Monitoring

A summary of the closest and most representative NO₂ monitoring locations in the vicinity of the Site are shown in Table 5.1.

Table 5.1: Measured NO₂ Concentrations in the Study Area

Site ID	Site Type	Annual Mean (µg/m³)				
		2019	2020	2021	2022	2023
Diffusion Tubes						
BDG	Roadside	26.4	21.1	22.4	21.0	20.1
BDG2	Roadside	54.1	36.3	34.9	35.5	29.8
HL	Roadside	29.9	25.8	25.0	24.5	23.8

Site ID	Site Type	Annual Mean (µg/m³)				
		2019	2020	2021	2022	2023
OH	Roadside	38.3	29.4	30.8	30.6	27.1
OH2	Roadside	48.4	39.7	41.5	38.6	33.7
PH1	Roadside	38.8	25.0	26.6	26.9	23.9
PH3	Roadside	29.6	23.1	22.2	23.3	20.6
Objective		40				
Notes: Bold indicates exceedance of the NAQO						

Table 5.1 shows measured NO_2 concentrations have generally decreased between 2019 and 2023 and that the annual mean NO_2 NAQO has only been exceeded at two locations. However, it should be noted that NO_2 concentrations during 2020 and 2021 will have reduced relative to 2019 due to restrictions on human activity during the Covid-19 pandemic.

Current monitoring indicated that annual mean NO_2 concentrations were well below the NAQO. Annual mean NO_2 concentrations across the Site are likely to be lower than those presented in Table 5.1 as concentrations drop off rapidly moving away from emission sources on the road network.

The monitoring data outlined in Table 5.1 also indicates the 1-hour mean NO_2 NAQO is unlikely to have been exceeded in the study area between 2019 to 2023 as annual mean NO_2 concentrations were below $60 \mu\text{g}/\text{m}^3$.

5.1.2 Particulate Matter Monitoring

There is no particulate matter (PM) monitoring in close proximity of the Proposed Development, the nearest PM monitoring location is approximately 7 km north located along Southampton Road, Eastleigh; 2023 annual mean PM_{10} and $\text{PM}_{2.5}$ concentrations were reported at $13.7 \mu\text{g}/\text{m}^3$ and $6.4 \mu\text{g}/\text{m}^3$ respectively, well below their relevant air quality objectives.

5.2 Defra Background Maps

In addition to measured concentrations, estimated background concentrations from the national maps provided by Defra were obtained for the existing baseline (2023), and the year the Proposed Development is expected to become operational (2030) and are provided in Table 5.2.

In order to reflect background concentrations more accurately across the study area, Defra's mapped background concentrations have been compared against concentrations measured at CM1 Southampton Centre Automatic Urban and Rural Network and Portsmouth (AURN) urban background station²⁷ in 2023 to produce a calibration factor. The factor was 1.07, and was not applied. Full details of the background adjustment process are presented in Appendix 2.

²⁷ Southampton City Council, 2023. 2023 Air Quality status Report (ASR).

Table 5.2: Estimated Annual Mean Background Concentrations (Adjusted)

Year	Location	Annual Mean (µg/m³)		
		NO ₂	PM ₁₀	PM _{2.5}
2023	Site 447500,111500	12.0	11.6	7.4
2030		9.3	11.1	6.9
Objective		40	40	20

Table 5.2 shows that the estimated background concentrations across the Site are all well below the relevant NAQO and are expected to decrease over time.

5.3 Predicted Baseline Concentrations

The predicted polluted concentrations at each existing human health receptor for the 2023 baseline are presented in Table 5.3.

Table 5.3: Predicted Baseline Concentrations (2023)

Receptor ID	X (m)	Y (m)	NO ₂	PM ₁₀	PM _{2.5}
R1	448012	111251	22.7	15.2	8.6
R2	448015	111204	23.3	15.3	8.7
R3	448023	111135	24.7	15.7	8.9
R4	448486	111033	30.9	16.0	9.2
R5	448387	111023	22.1	14.4	8.3
R6	448206	110925	18.8	13.8	8.1
R7	447791	110670	33.6	18.4	10.6
R8	447792	110797	18.3	13.9	8.2
R9	447815	110885	19.2	14.1	8.3
R10	447804	110969	18.4	13.9	8.2
R11	447723	111033	19.7	13.3	8.3
Objective			40	40	20

The predicted concentrations indicate the annual mean NO₂, PM₁₀ and PM_{2.5} NAQOs were met at all modelled sensitive receptors in 2023.

The predicted baseline concentrations also indicate the short-term NO₂ and PM₁₀ objective is likely to have been met at existing receptors in 2023 as annual mean concentrations do not exceed 60 µg/m³ and 32 µg/m³ respectively.

5.4 Assessment of Baseline Data

Monitoring results show an overall decrease in annual mean NO₂ concentrations between 2019 and 2023 at monitoring sites in the study area. During this period NO₂ concentrations will have been affected by changes to traffic flows associated with Covid-19 lockdowns and measures introduced during the pandemic (particularly during 2020 and 2021).

The available monitoring data and predicted baseline concentrations indicate that existing long- and short-term NAQOs for NO₂, PM₁₀ and PM_{2.5} are likely to be met in the study area.

Pollutant concentrations at background and roadside locations are predicted to decrease in future years due to the gradual improvement in vehicle emissions.

6. Demolition and Construction Stage Assessment

6.1 Dust and Amenity

There are numerous existing receptors (such as residential properties, schools, and designated ecological sites) within 250 m of the Site boundary and within 50 m of the routes proposed to be used by demolition and construction traffic; therefore, a detailed assessment of demolition and construction stage dust impacts is required in accordance with IAQM Guidance.

6.1.1 Assessment of Impacts

Using the evaluation criteria within the IAQM Guidance, the potential dust emission magnitude has been identified for each stage of the Proposed Development as shown in Table 6.1 for the demolition, earthworks, construction and trackout activities associated with the Proposed Development.

Table 6.1: Dust emissions magnitude for each construction activity

Activity	Dust Emission Magnitude	Justification
Demolition	Small	There are some existing agriculture structures on site which are to be demolished, it is expected to be less than 12,000 m ³ material.
Earthworks	Medium	Total site area is between 18,000m ² - 110,000 m ² .
Construction	Large	Total building volume to be constructed during is expected to be more than 75,000 m ³ .
Trackout	Medium	Up to 20 - 50 outward HDV movements expected in in any one day.

The next stage of the process is to define the sensitivity of the assessment area to dust soiling and human health impacts. This process combines the sensitivity of the receptor with distance from the source to determine the overall sensitivity as summarised in Table 6.2.

Table 6.2: Sensitivity of area to dust impacts

Sensitivity to Dust Soiling	Sensitivity to Human Health Impacts	Sensitivity to Ecological Receptors
Medium – there are between 10-100 sensitivity receptors (residential properties along West End road, Knowlton Close and Le Marechal Avenue) within 50 m of the Site boundary.	Low – between 10-100 high sensitivity receptors (residential properties) within 50 m of the Site boundary, and 2023 PM ₁₀ concentrations of up to 11.6 µg/m ³ .	N/A – There are no identified ecological habitats within located within 20 m of the Site boundary. As such, there are no risks of dust impacts.

The dust emission magnitude determined in Table 6.1 has been combined with the sensitivity assessment in Table 6.2 to define the risk of impacts for each construction activity of the Proposed Development in the absence of mitigation, as shown in Table 6.3.

Table 6.3: Risk of dust impacts in absence of mitigation

Sensitivity of surrounding area to impacts	Dust Emission Magnitude			
	Demolition (Small)	Earthworks (Medium)	Construction (Large)	Trackout (Medium)
Dust soiling (Medium)	Low	Medium	Medium	Medium
Human health (Low)	Negligible	Low	Low	Low

Overall, there is a **Medium Risk** of dust impacts associated with the demolition and construction stage of the Proposed Development. The application of appropriate mitigation measures for a medium-risk site during the construction phase will avoid any significant dust effects.

6.1.2 Significance of Demolition and Construction Stage Emissions

IAQM Guidance recommends that no assessment of the significance of demolition and construction stage effects is made without mitigation in place. With effective implementation and monitoring of the mitigation measures detailed in Table 8.1, the construction dust and vehicle emissions effects in the area are temporary and not significant.

7. Completed Development Stage Assessment

7.1 Road Traffic Emissions

7.1.1 Existing Human Health Receptors

Predicted annual mean concentrations of NO₂, PM₁₀ and PM_{2.5} at existing human health receptors in 2030, both without and with the Proposed Development in place, are presented in Table 7.1, Table 7.2 and Table 7.3.

Table 7.1: Predicted Impact on annual mean NO₂ Concentrations in 2030 (µg/m³)

Receptor ID	Scenario 2 Do Minimum	Scenario 3 Do Something	Change	Impact Descriptor
R1	14.5	14.6	0.12	Negligible
R2	14.7	14.9	0.16	Negligible
R3	15.3	15.6	0.23	Negligible
R4	19.3	19.4	0.17	Negligible
R5	14.2	14.3	0.12	Negligible
R6	12.6	12.7	0.11	Negligible
R7	20.7	20.8	0.05	Negligible
R8	12.6	12.7	0.05	Negligible
R9	13.0	13.1	0.10	Negligible
R10	12.6	12.9	0.25	Negligible
R11	13.2	13.5	0.26	Negligible
Objective	40		-	-

Table 7.2: Predicted Impact on annual mean PM₁₀ Concentrations in 2030 (µg/m³)

Receptor ID	Scenario 2 Do Minimum	Scenario 3 Do Something	Change	Impact Descriptor
R1	14.5	14.5	0.04	Negligible
R2	14.6	14.7	0.06	Negligible
R3	15.0	15.0	0.08	Negligible
R4	15.3	15.3	0.05	Negligible
R5	13.7	13.7	0.03	Negligible
R6	13.1	13.1	0.03	Negligible
R7	17.8	17.8	0.03	Negligible
R8	13.2	13.2	0.02	Negligible
R9	13.4	13.4	0.03	Negligible
R10	13.2	13.2	0.07	Negligible
R11	12.7	12.7	0.07	Negligible
Objective	40		-	-

Table 7.3: Predicted Impact on annual mean PM_{2.5} Concentrations in 2030 (µg/m³)

Receptor ID	Scenario 2 Do Minimum	Scenario 3 Do Something	Change	Impact Descriptor
R1	8.0	8.0	0.02	Negligible
R2	8.1	8.1	0.03	Negligible
R3	8.3	8.3	0.04	Negligible
R4	8.5	8.5	0.03	Negligible
R5	7.6	7.6	0.02	Negligible
R6	7.5	7.5	0.02	Negligible
R7	10.0	10.0	0.02	Negligible
R8	7.6	7.6	0.01	Negligible
R9	7.7	7.7	0.02	Negligible
R10	7.6	7.6	0.04	Negligible
R11	7.7	7.8	0.04	Negligible
Objective	20		-	-

The predicted annual mean NO₂, PM₁₀ and PM_{2.5} concentrations in 2030 without and with the Proposed Development in place are well below the relevant NAQOs at all existing receptor locations.

Results indicate the short-term NO₂ and PM₁₀ NAQO is likely to be met at existing receptors when the Site becomes operational as annual mean concentrations do not exceed 60 µg/m³ and 32 µg/m³ respectively.

The largest change in pollutant concentrations relative to the annual mean NAQOs are 0.6 % for NO₂ and 0.2 % for PM₁₀ and PM_{2.5}.

Using the criteria set out in Table 4.2 the impact on annual mean NO₂, PM₁₀ and PM_{2.5} concentrations is described as negligible at all assessed receptors.

The PM_{2.5} results indicate that the long term 2040 target of 10 µg/m³ will likely be met at all modelled receptor locations.

8. Mitigation Measures

8.1 Demolition and Construction Stage

Under best-practice guidance, the Proposed Development will constitute a Medium dust risk for demolition, construction, earthworks and trackout activities. Therefore, for this site, the general mitigation measures applicable to a high-risk site should be applied. These have been outlined in Table 8.1.

The control of dust emissions from construction sites relies upon good site management and mitigation techniques to reduce emissions of dust and limit dispersion. A summary of the mitigation measures recommended in the IAQM Guidance to reduce impacts from Medium-risk sites is provided in Table 8.1. This considers the nature of the development and its location. It is recommended that these measures are included within a CEMP which would be secured through an appropriately worded planning condition. The proposed mitigation measures provided below are tried and tested and are standard measures included in CEMPs on a regular basis.

Table 8.1: Desirable and Highly Recommended Dust Mitigation for Medium-Risk Site Activities

Stage	Mitigation Measure
Communications	Develop and implement a stakeholder communications plan. Display the name and contact details of the responsible person for dust issues on site boundary in addition to head/regional office contact information.
Dust Management Plan	Develop and implement a Dust Management Plan (DMP) which would be included as part of the CEMP, to be approved by EBC.
Site Management	Record all complaints and incidents in a site log. Take appropriate measures to reduce emissions in a timely manner, and record the measures taken within the log. Make the complaints log available to the Local Planning Authority if requested. Record any exceptional dust incidents on- or off-site. Hold regular liaison meetings with other high risk construction sites within 250 m of the Site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised.
Monitoring	Undertake daily on- and off-site visual inspections where there are nearby receptors. This should include regular dust soiling checks of surfaces such as street furniture, cars, and windowsills within 100 m of site boundary, with cleaning to be provided if necessary. Carry out regular inspections to ensure compliance with the DMP and record results in the Site logbook. Increase the frequency of inspections during activities with a high potential to create dust or in prolonged dry weather. Agree dust deposition, dust flux, or real-time PM ₁₀ continuous monitoring locations with EBC. Baseline monitoring should, if possible, commence at least three months before work on site commences.
Preparing and Maintaining Site	Plan site layout to locate dust generating activities as far as possible from receptors. Use solid screens around dusty activities and around stockpiles. Fully enclose the Site or specific operations where there is a high potential for dust production and the Site is active for an extensive period.

Stage	Mitigation Measure
	Avoid site runoff of water and mud. Keep site fencing barriers and scaffolding clean using wet methods. Remove dust generating materials from site as soon as possible. Minimise emissions from stockpiles by covering, seeding, fencing, or damping down.
Operating Vehicle/Machinery and Sustainable Travel	Ensure vehicles switch off engines when stationary. Avoid use of diesel or petrol generators where possible. Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas. Produce a Construction Logistics Plan (CLP) to manage the sustainable delivery of materials. Implement a Travel Plan that supports and encourages sustainable travel.
Operations	Only use cutting, grinding, or sawing equipment with suitable dust suppression equipment or techniques. Ensure adequate water supply for effective dust and particulate matter suppression. Use enclosed chutes, conveyors, and covered skips. Minimise drop heights of materials. Ensure suitable cleaning material is available at all times to clean up spills.
Waste Management	Avoid bonfires.
Measures Specific to Demolition	Soft strip buildings before demolition. Ensure effective water suppression during demolition. Avoid explosive blasting, using appropriate manual or mechanical alternatives. Bag and remove any biological debris or damp down such material before demolition.
Measures Specific to Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. Only remove the cover in small areas during work and not all at once.
Measures Specific to Construction	Avoid scabbing if possible. Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out. Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored silos with suitable emissions control systems. Smaller supplies of fine powder material to be in sealed containers and stored appropriately.
Measures Specific to Trackout	Use water assisted dust sweepers on the Site access and local roads. Avoid dry sweeping of large areas. Ensure vehicles entering and leaving the Site are covered to prevent escape of materials. Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. Record all inspections of haul routes and any subsequent action in a site logbook.

Stage	Mitigation Measure
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowzers and regularly cleaned. Implement a wheel wash system. Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the Site exit, wherever site size and layout permits. The Site access gate to be located at least 10 m from receptors where possible.

With effective implementation and monitoring of the above mitigation measures, the construction dust and vehicle emissions effects in the area would be temporary and not significant.

8.2 Completed Development Stage

Emissions associated with road traffic during the completed development stage of the Proposed Development are expected to have a negligible, non-significant effect on local air quality. However, to limit the impacts of traffic associated with the development during the Completed Development stage, the following mitigation measures are proposed:

- Travel Plan to promote active travel and use of public transport;
- Proposed sheltered and visitor cycle parking; and
- Electric vehicle charging provisions for up to 27 cars.

9. Conclusion

The air quality impacts associated with the Proposed Development at Land adjacent to Windhover Roundabout, Bursledon have been assessed.

Available baseline data indicates that concentrations of NO₂, PM₁₀ and PM_{2.5} are likely to meet the long- and short-term NAQOs at the Site and in the surrounding study area.

The dust risk assessment has identified that construction activities pose a medium risk, however with the implementation of appropriate mitigation measures, construction activities are not expected to result in significant effects on local sensitive receptors.

Atmospheric dispersion modelling was undertaken to determine the impacts of the traffic generated when the Proposed Development is operational. Analysis of modelling results show that the Proposed Development is expected to have a negligible impact on air quality at human health receptors and that NO₂, PM₁₀ and PM_{2.5} concentrations are expected to meet long- and short-term NAQOs in 2030 at the assessed existing sensitive receptors.

Measures proposed to improve air quality during the completed development stage include a Travel Plan to promote active travel and public transport use and electric vehicle charging.

Overall, it is concluded the Proposed Development would not have a significant effect on air quality and there are no air quality constraints to the Proposed Development.

Appendix 1

Glossary

Abbreviations	Meaning
AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network
CEMP	Construction Environmental Management Plan
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DT	Diffusion Tube, a passive sampler used for collecting NO ₂ in the air
EBC	Eastleigh Borough Council
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes. Includes Heavy Goods Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen oxides, generally considered to be nitric oxide and NO ₂
NPPF	National Planning Policy Framework
PM ₁₀ /PM _{2.5}	Small airborne particles less than 10/2.5 microns in aerodynamic diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Appendix 2

Assessment Methodology

A2.1 Dust Risk Assessment

The assessment of potential demolition and construction dust impacts has followed the IAQM Guidance.

A2.1.1 Dust Emission Magnitude

The criteria used to determine the dust emission magnitude for each demolition and construction stage activity are described in Table A2.1.

Table A2.1: Determining Dust Emission Magnitude

Large	Medium	Small
Demolition		
- Total building volume >75,000 m³ - Potentially dusty construction material (e.g. concrete) - On-site crushing and screening - Demolition activities >12 m above ground level	- Total building volume 12,000 m³ - 75,000 m³ - Potentially dusty construction - Demolition activities 6 m - 12 m above ground level	- Total building volume <12,000 m³ - Construction material with low potential for dust release (e.g. metal cladding or timber) - Demolition activities <6 m above ground during wetter months
Earthworks		
- Total site area >110,000 m² - Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) >10 Heavy earth moving vehicles active at any one time - Formation of bunds >6 m in height	- Total site area 18,000 m² - 110,000 m² - Moderately dusty soil type (e.g. silt) 5-10 heavy earth moving vehicles active at any one time - Formation of bunds 3 m - 6 m in height	- Total site area <18,000 m² - Soil type with large grain size (e.g. sand) <5 heavy earth moving vehicles active at any one time - Formation of bunds <3 m in height
Construction		
- Total building volume >75,000 m³ - On-site concrete batching - Sandblasting	- Total building volume 12,000 m³ - 75,000 m³ - Potentially dusty construction material (e.g. concrete) - On-site concrete batching	- Total building volume <12,000 m³ - Construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout		
>50 HDV (>3.5 t) movements in any one day - Potentially dusty surface material (e.g. high clay content)	20-50 HDV (>3.5 t) movements in any one day - Moderately dusty surface material (e.g. high clay content)	<20 HDV (>3.5 t) movements in any one day - Surface material with low potential for dust release

Large	Medium	Small
Unpaved road length >100 m	Unpaved road length 50 m - 100 m	Unpaved road length <50 m

A2.1.2 Receptor Sensitivity

The criteria used to determine receptor sensitivity to demolition and construction stage activities are described in Table A2.2.

Table A2.2: Determining Dust Emission Magnitude

High	Medium	Low
Sensitivities of People to Dust Soiling Effects		
- Users can reasonably expect a enjoyment of a high level of amenity; or - The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. - Indicative examples include dwellings, museums and other culturally important collections, medium- and long-term car parks and car showrooms.	- Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or - The appearance, aesthetics or value of their property could be diminished by soiling; or - The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. - Indicative examples include parks and places of work.	- The enjoyment of amenity would not reasonably be expected; or - Property would not reasonably be expected to be - Diminished in appearance, aesthetics or value by soiling; or - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. - Indicative examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short-term car parks and roads.
Sensitivities of People to the Health Effects of PM₁₀		
- Locations where members of the public are exposed over a time period relevant to the air quality objective for PM₁₀ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). - Indicative examples include residential properties, Hospitals, schools and residential	- Locations where the people exposed are workers, and - Exposure is over a time period relevant to the air quality - Objective for PM₁₀ (in the case of the 24-hour objectives, - A relevant location would be one where individuals may be exposed for eight hours or more in a day). - Indicative examples include office and shop	- Locations where human exposure is transient. - Indicative examples include public footpaths, playing fields, parks and shopping streets.

High	Medium	Low
care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	workers, but will generally not include workers occupationally exposed to PM ₁₀ , as protection is covered by Health and Safety at Work legislation.	
Sensitivities of Receptors to Ecological Effects		
- Locations with an international or national designation and the designated features may be affected by dust soiling; or - Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. - Indicative examples include a SAC designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	- Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or - Locations with a national designation where the features may be affected by dust deposition. - Indicative example is a SSSI with dust sensitive features.	- Locations with a local designation where the features may be affected by dust deposition. - Indicative example is a Local Nature Reserve with dust sensitive features.

A2.1.3 Area Sensitivity

The criteria used to determine the sensitivity of the demolition and construction dust risk assessment study area to dust soiling are described in Table A2.3.

Table A2.3: Determining Dust Emission Magnitude

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<250
High	>100	High	High	Low	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

The criteria used to determine the sensitivity of the demolition and construction dust risk assessment study area to human health impacts are described in Table A2.4.

Table A2.4: Determining Dust Emission Magnitude

Receptor Sensitivity	Annual Mean PM ₁₀ Concentration (µg/m ³)	Number of Receptors	Distance from the Source (m)			
			<20	<50	<100	<250
High	>32	>100	High	High	High	Medium
		10-100	High	High	Medium	Low
		1-10	High	Medium	Low	Low
	28-32	>100	High	High	Medium	Low
		10-100	High	Medium	Low	Low
		1-10	High	Medium	Low	Low
	24-28	>100	High	Medium	Low	Low
		10-100	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	<24	>100	Medium	Low	Low	Low
		10-100	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Medium	>32	>10	High	Medium	Low	Low
		1-10	Medium	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low
		1-10	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low
		1-10	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

The criteria used to determine the sensitivity of the demolition and construction dust risk assessment study area to ecological impacts are described in table A2.5.

Table A2.5: Determining Dust Emission Magnitude

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

A2.1.4 Risk of Dust Impact

The criteria used to determine the risk of demolition dust impacts are described in Table A2.6.

Table A2.6: Risk of Demolition Dust Impacts

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

The criteria used to determine the risk of earthworks dust impacts are described in Table A2.7.

Table A2.7: Risk of Earthworks Dust Impacts

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

The criteria used to determine the risk of construction dust impacts are described in Table A2.8.

Table A2.8: Risk of Construction Dust Impacts

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

The criteria used to determine the risk of trackout dust impacts are described in Table A2.9.

Table A2.9: Risk of Construction Dust Impacts

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

A2.2 Assessment of Road Traffic Emissions

A2.2.1 ADMS-Roads Model Setup

A detailed dispersion modelling assessment was undertaken using the ADMS-Roads dispersion model. The model requires the user to provide various input data, including AADT flows, the proportion of HDVs, road characteristics (such as road width), and the vehicle speed. A summary of the model setup used for this assessment is provided in Table A2.10.

Table A2.10: ADMS-Roads Setup and Processing

Data	Description
ADMS-Roads	Version 5.0.1.3

Data	Description
Time Varying Emission Factors	Based on Department for Transport statistics. Table TRA0307. Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2023.
Meteorological Data	2023 hourly meteorological data from Southampton Airport.
Latitude	50.9°
Surface Roughness	A value of 0.5 for Park land/Open suburbia areas was used to represent the dispersion site and the meteorological measurement site.
Minimum Monin-Obukhov Length	A value of 10 for Small towns was used to represent the dispersion site and to represent the meteorological measurement site.
Traffic Data	Traffic data for verification and assessment traffic data provided by the Applicant's transport consultant, Motion. Traffic data outlined in Table A2.11 to Table A2.12.
Terrain	N/A. The terrain in the study area does not have slopes of more than 10 %, and therefore terrain effects were not included within the model.
Emission Factor Toolkit (EFT)	Version 13.1. Road type: England (Urban).
NO _x to NO ₂ Conversion	NO _x to NO ₂ calculator version 9.1 ²⁸ . Traffic Mix: All UK traffic. Local Authority: Eastleigh Borough Council.
Background Maps	2021 reference year background maps.

A2.2.1.1 Traffic Data

The traffic data (two-way where applicable) modelled in each scenario of the assessment is summarised in Table A2.11 to Table A2.12.

Table A2.11: Model Verification 2023 Traffic Data

Road ID	Gradient (%)	AADT	HDV (%)
Bursledon_Rd_01	1.8	7847	1.0
Bursledon_Rd_02	0.9	5957	0.8
Bursledon_Rd_03	3.5	13804	0.9
Bursledon_Rd_04	2.2	13804	0.9
Bursledon_Rd_05	2.2	13804	0.9
Bursledon_Rd_06	2.2	13804	0.9
Bursledon_Rd_07	3.0	13804	0.9
Bursledon_Rd_08	3.0	13804	0.9

²⁸ Defra, 2020. NO_x to NO₂ calculator v8.1. Available: <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/nox-to-no2-calculator/> (accessed 18 June 2024).

Road ID	Gradient (%)	AADT	HDV (%)
Bursledon_Rd_09	1.4	13804	0.9
Bursledon_Rd_10	5.0	13804	0.9
Bursledon_Rd_11	4.0	13804	0.9
Bursledon_Rd_12	1.4	13804	0.9
Bursledon_Rd_13	3.0	13804	0.9
Bursledon_Rd_14	0.0	13804	0.9
Bursledon_Rd_15	0.0	13804	0.9
Bursledon_Rd_16	0.4	13804	0.9
Dodwell_Ln_01	0.0	16827	0.7
Dodwell_Ln_02	0.0	16827	0.7
Hamble_Lane_01	0.2	27160	0.8
Hamble_Lane_02	0.2	27160	0.8
Hamble_Lane_03	0.9	27160	0.8
Hamble_Lane_04	0.9	27160	0.8
Hamble_Lane_05	1.8	27160	0.8
Hamble_Lane_06	1.8	27160	0.8
Hamble_Lane_07	1.8	27160	0.8

Table A2.12: Modelled Road Links and Future Traffic Flows

Road ID	Gradient (%)	Scenario 1 Baseline		Scenario 2 Do Minimum		Scenario 3 Do Something	
		AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
BertBettsEast_01	4.5	15991	1.3	17131	1.3	17562	2.6
BertBettsEast_02	4.5	15991	1.3	17131	1.3	17562	2.6
BertBettsEast_03	4.5	15991	1.3	17131	1.3	17562	2.6
BertBettsWest_04	4.5	19405	1.4	20788	1.4	21231	2.4
BertBettsWest_01	4.2	19405	1.4	20788	1.4	21231	2.4
BertBettsWest_02	4.2	19405	1.4	20788	1.4	21231	2.4
BertBettsWest_03	4.2	19405	1.4	20788	1.4	21231	2.4
BursledonRd_01	2.3	12156	1.7	13022	1.7	13467	3.3
BursledonRd_02	2.3	12156	1.7	13022	1.7	13467	3.3
BursledonRd_03	0.5	11590	1.1	12416	1.1	12875	2.8
BursledonRd_04	0.0	23746	1.4	25438	1.4	26342	3.1
BursledonRd_05	0.0	22560	1.5	24168	1.5	24265	1.5
BursledonRd_06	0.0	22560	1.5	24168	1.5	24265	1.5
BursledonRd_07	0.0	22560	1.5	24168	1.5	24265	1.5

Road ID	Gradient (%)	Scenario 1 Baseline		Scenario 2 Do Minimum		Scenario 3 Do Something	
		AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
Dodwell_Ln01	1.7	10034	0.6	10749	0.6	10788	0.6
Dodwell_Ln02	0.4	6793	0.9	7277	0.9	7312	0.9
Dodwell_Ln03	0.4	6793	0.9	7277	0.9	7312	0.9
Dodwell_Ln03x	0.4	6793	0.9	7277	0.9	7312	0.9
Dodwell_Ln04	1.7	10034	0.6	10749	0.6	10788	0.6
Dodwell_Ln05	0.7	16827	0.7	18026	0.7	18100	0.7
Hamble_Lane_01	2.4	14338	0.8	15360	0.8	15421	0.8
Hamble_Lane_02	2.4	14338	0.8	15360	0.8	15421	0.8
Hamble_Lane_03	2.4	14338	0.8	15360	0.8	15421	0.8
Hamble_Lane_04	2.4	12822	0.9	13736	0.9	13790	0.9
Hamble_Lane_05	2.4	12822	0.9	13736	0.9	13790	0.9
Hamble_Lane_06	2.4	12822	0.9	13736	0.9	13790	0.9
Hamble_Lane_07	0.2	27160	0.8	29095	0.8	29210	0.8
Hamble_Lane_07x	0.2	27160	0.8	29095	0.8	29210	0.8
Hamble_Lane_08	0.2	27160	0.8	29095	0.8	29210	0.8
Hamble_Lane_09	0.2	27160	0.8	29095	0.8	29210	0.8
Hamble_Lane_10	0.2	27160	0.8	29095	0.8	29210	0.8
Hamble_Lane_11	0.9	27160	0.8	29095	0.8	29210	0.8
M27NW_Off	3.1	11622	1.2	12450	1.2	12681	2.0
M27NW_On	3.5	9732	1.8	10425	1.8	10648	2.9
M27SE_OFF_01	0.9	9641	0.9	12450	0.7	12681	1.6
M27SE_OFF_02	0.9	9641	0.9	12450	0.7	12681	1.6
M27SE_ON_01	0.6	11932	1.0	12782	1.0	12956	1.9
M27SE_ON_02	0.6	11932	1.0	12782	1.0	12956	1.9
MarechalAve_01	0.6	2506	0.4	2685	0.4	2685	0.4
MarechalAve_02	0.6	2506	0.4	2685	0.4	2685	0.4
MarechalAve_03	0.6	2506	0.4	2685	0.4	2685	0.4
MarechalAve_04	0.6	2506	0.4	2685	0.4	2685	0.4
MarechalAve_05	0.6	2506	0.4	2685	0.4	2685	0.4
ProvHill_01	1.8	5957	0.8	6381	0.8	6416	0.8
ProvHill_01x	1.8	5957	0.8	6381	0.8	6416	0.8
ProvHill_02	0.9	7847	1.0	8406	1.0	8444	1.0
ProvHill_03	0.9	7847	1.0	8406	1.0	8444	1.0
ProvHill_04	3.5	13804	0.9	14788	0.9	14861	0.9

Road ID	Gradient (%)	Scenario 1 Baseline		Scenario 2 Do Minimum		Scenario 3 Do Something	
		AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
M27_South	2.3	43972	7.7	47105	7.7	47105	7.7
M27_N_01	2.4	37908	10.2	35099	11.8	34868	11.6
M27_N_02	0.0	37908	10.2	47549	8.7	47549	8.9
Site_East	0.0	0	0.0	0	0.0	471	0.0
Site_South	0.0	0	0.0	0	0.0	1001	45.2
West_End_Rd_01	3.4	6697	0.4	7174	0.4	7354	0.4
West_End_Rd_01x	3.4	6697	0.4	7174	0.4	7354	0.4
West_End_Rd_02	4.2	9919	0.5	10626	0.5	10793	0.5
West_End_Rd_02x	4.2	9919	0.5	10626	0.5	10793	0.5
West_End_Rd_03	4.2	9919	0.5	10626	0.5	10793	0.5
West_End_Rd_04	0.5	16616	0.5	17800	0.5	18147	0.5
West_End_Rd_05	0.5	16616	0.5	17800	0.5	17924	0.5
WindH_InChg_01	0.2	26271	1.2	28144	1.2	28673	2.2
WindH_InChg_02	0.2	25286	1.2	27088	1.2	27586	2.1
WindH_InChg_03	0.2	24304	1.2	26036	1.2	26504	2.1
WindH_InChg_04	0.2	23450	1.2	25121	1.2	25535	2.0
WindH_InChg_05	0.2	22418	1.2	24015	1.2	24395	2.0
WindH_InChg_06	0.2	21388	1.1	22912	1.1	23258	1.9
WindH_Rbt_01	0.2	28956	1.0	31020	1.0	31592	1.7
WindH_Rbt_02	0.2	27893	1.0	29881	1.0	30425	1.7
WindH_Rbt_03	0.2	30393	1.1	32558	1.1	33205	1.9
WindH_Rbt_04	0.2	29289	1.1	31376	1.1	31996	1.8
WindH_Rbt_05	0.2	29415	1.0	31511	1.0	32039	1.7

Figure A2.1 to Figure A2.2 show the road network and speeds modelled as part of the assessment.

Figure A2.1: Modelled Road Network and Road Link Speed for Verification

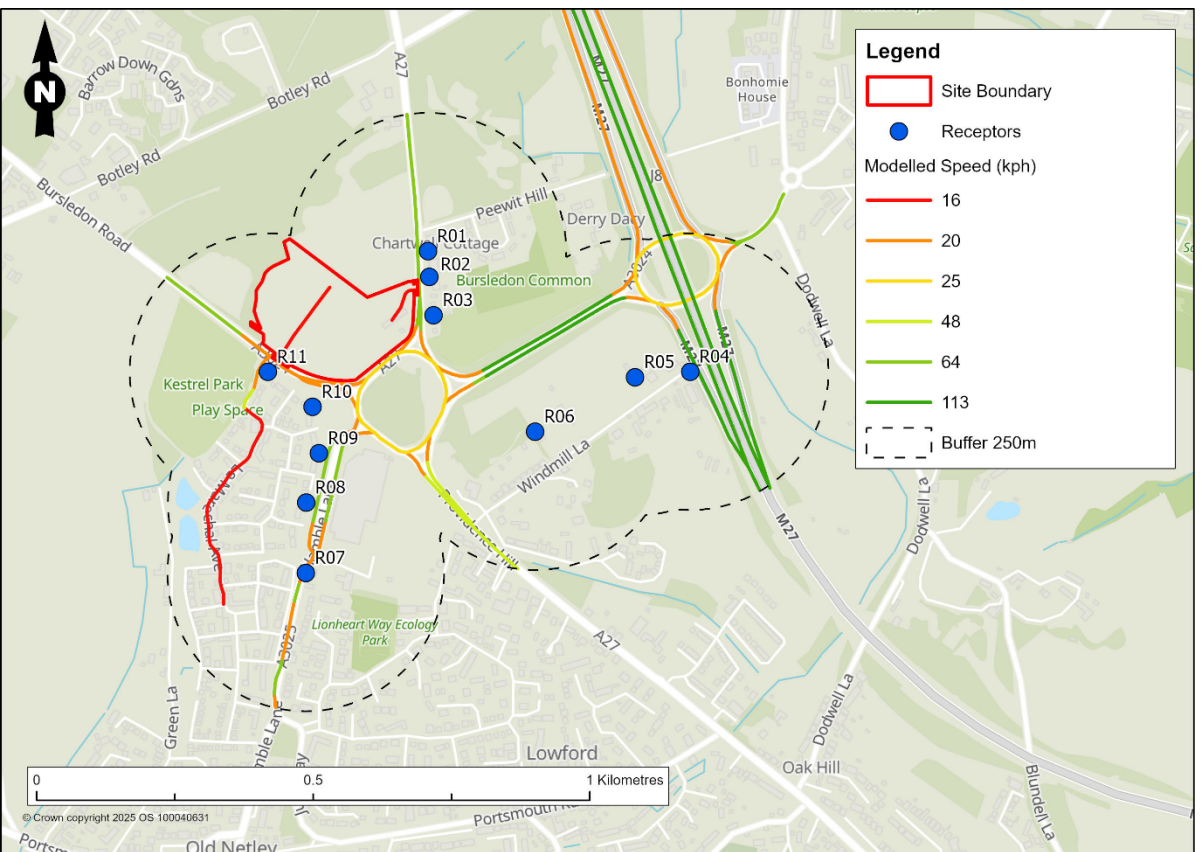
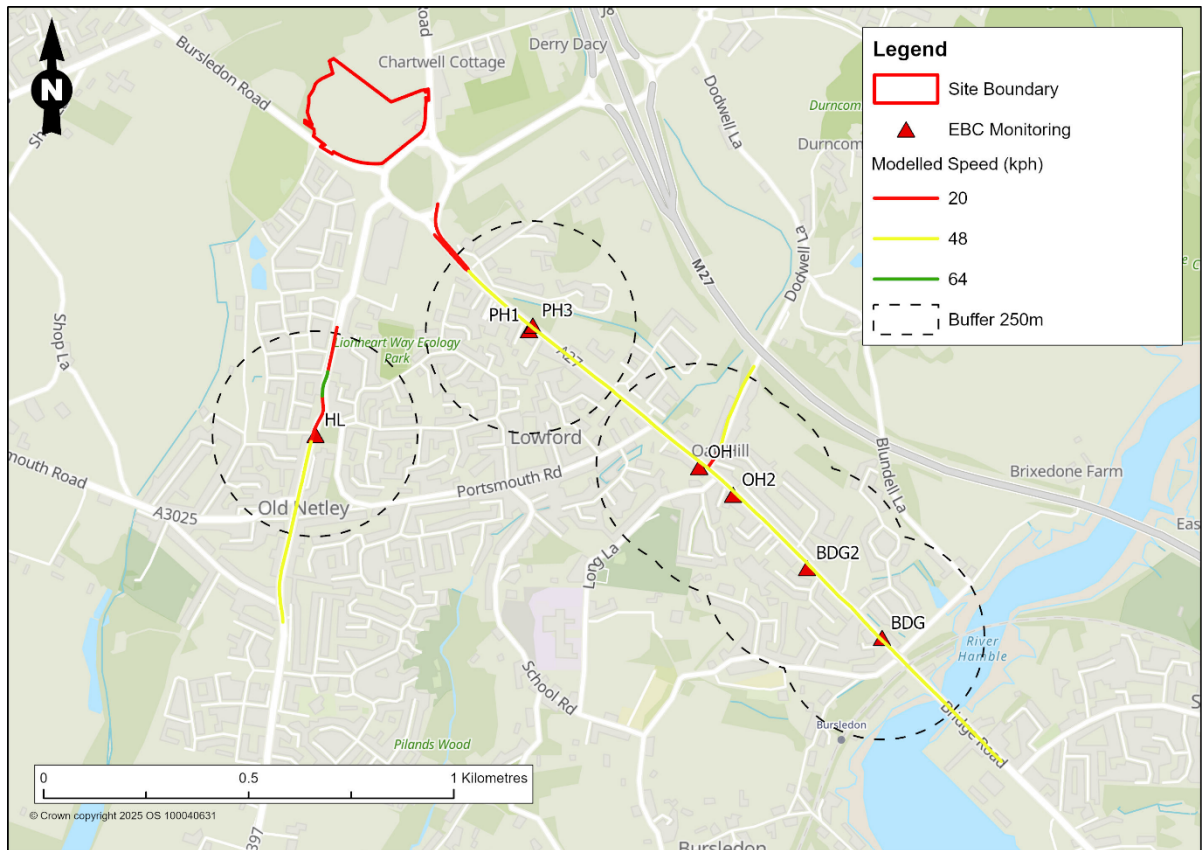


Figure A2.2: Modelled Road Network and Road Link Speed for Baseline/Do Minimum and DS

A2.2.2 Model Verification

A2.2.2.1 Nitrogen Dioxide

Model verification was undertaken using monitoring sites within the air quality study area. In total Seven diffusion tubes were identified as shown in Table A2.13 with four being used for final verification (Figure A2.3 and Table A2.14)

Table A2.13: Measured and Modelled Road NO_x

Monitoring ID	X (m)	Y (m)	Included in Verification?
BDG	449099	109864	Yes
BDG2	448917	110035	No – Kerbside location.
HL	447718	110359	Yes
OH	448654	110281	No – diffusion tube is near a bus stop and junction
OH2	448736	110213	No – The diffusion tube is within a potential canyon area.
PH1	448239	110614	Yes
PH3	448248	110625	Yes

Only those representative of modelled sensitive receptor locations and with sufficient data capture were considered suitable for the purposes of model. Four diffusion tubes were included in model verification are sited in line with LAQM.TG(22). Diffusion tubes BDG2, OH and OH2 were omitted from the final verification process.

Most NO₂ is produced in the atmosphere by the reaction of nitrogen oxide (NO) with ozone (O₃). It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NO_x = NO + NO₂). The model output of road-NO_x has been compared with the 'measured' road-NO_x for the baseline year (2023), which was calculated from the measured NO₂ concentrations and the Defra background NO₂ concentrations within the NO_x from NO₂ calculator.

Table A2.13: Measured and Modelled Road NO_x

Monitoring ID	Measured NO ₂ (µg/m ³)	Measured road-NO _x (µg/m ³)	Modelled road-NO _x (µg/m ³)	Ratio Measured NO _x /Modelled Road NO _x
BDG	20.1	18.1	9.2	1.976
HL	23.8	27.8	26.8	1.037
PH1	23.9	25.1	5.6	4.518
PH3	20.6	17.1	9.9	1.727

The primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A2.3). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total NO₂ concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO₂ concentration within the NO_x from NO₂ calculator.

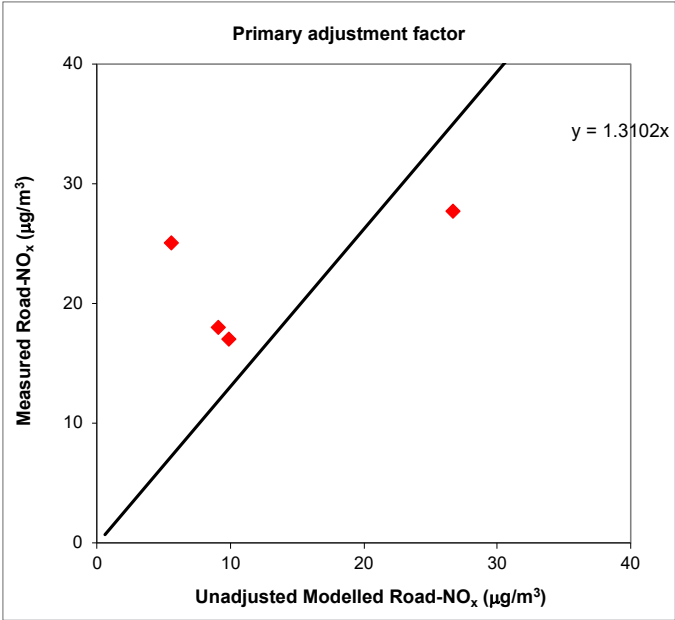


Figure A2.3: Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x Concentrations

A secondary adjustment factor was calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure A2.4).

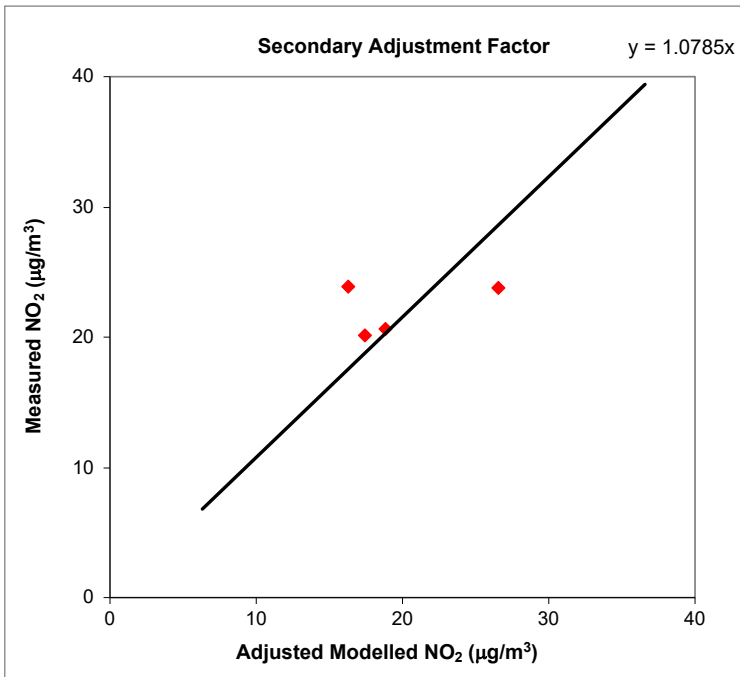


Figure A2.4: Comparison of Measured Road-NO₂ with primary Adjusted Modelled NO₂ Concentration

The primary and secondary adjustment factors in Table A2.14 were applied to all modelled NO₂ data. The results imply that overall, the model was underpredicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO₂ adjustment is minor.

Table A2.14: Verification Factors

Adjustment Factor	Value
Primary adjustment factor	1.3102
Secondary adjustment factor	1.0785

Table A2.15 shows the adjustment of model output following comparison of model output to measured NO₂ concentrations.

Table A2.15: Measured and Adjusted Modelled NO₂ Comparison

Monitoring ID	Total NO ₂ after secondary adjustment (µg/m ³)	Difference in NO ₂ after adjustment (%)
BDG	18.8	-6%
HL	28.7	21%
PH1	17.6	-26%
PH3	20.3	-1%

Figure A2.5 compares final adjusted modelled total NO₂ at each of the monitoring sites, to measured total NO₂, and shows the 1:1 relationship, as well as ±10 % and ±25 % of the 1:1 line. The final NO₂ adjustment is minor (Figure A2.5).

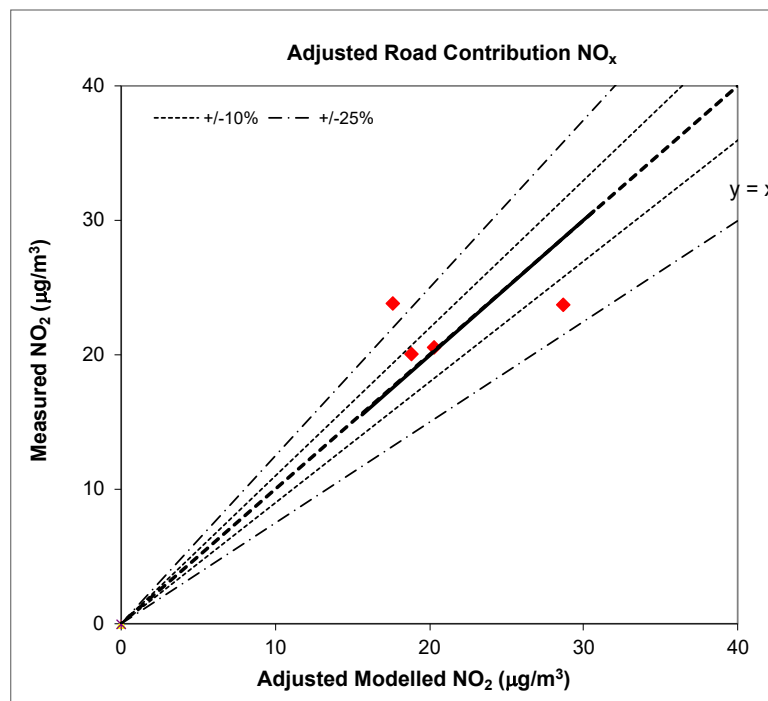


Figure A2.5: Comparison of Measured NO₂ with Fully Adjusted Modelled NO₂ Concentrations

A2.2.2.2 Particulate Matter

The adjustment factor calculated for NO₂ concentrations has been applied to PM₁₀ and PM_{2.5} results as described above as there was not a suitable automatic site available that monitored PM for the verification process.

A2.2.2.3 Model Performance

An evaluation of model performance was undertaken to establish confidence in model results. LAQM.TG(22) identifies a number of statistical procedures that are appropriate to evaluate model performance and assess uncertainty. The statistical parameters used in this assessment are:

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

A brief for explanation of each statistic is provided in Table A2.16.

Table A2.16: Model Performance Statistics Description

Statistical parameter	Comments	Ideal Value
RMSE	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25 % of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO₂ objective of 40 µg/m³, if an RMSE of 10 µg/m³ or above 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 µg/m³ for the annual mean NO₂ objective.	0.01
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 underprediction.	0.00
CC	CC 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 large number of model and observed data points.	1.00

The parameters described in Table A2.16 estimate how the model results agree or diverge from the observations.

Calculations were carried out prior to, and after adjustment (Table A2.17) and provide information on the improvement of the model predictions as a result of the application of the verification adjustment factors.

Table A2.17: Model Performance Statistics

Statistical Parameter	No Adjustment	NO_x and NO₂ Road Contribution Adjusted	Comment
RMSE	10.1	4.04	RMSE decreased to value closer to ideal value of 0.01 following adjustment. RMSE within 10 % of the air quality objective after adjustment factors applied.
FB	0.18	0.03	FB exceeded ideal value of 0 before adjustment. FB had ideal value of 0 after adjustment factors applied.
CC	0.42	0.40	CC further from ideal value of 1.00 following adjustment, however, it should be noted that CC is not recommended as a measure of model uncertainty for smaller datasets ¹⁵ .

A2.2.3 Background Concentrations

Defra publish details of estimated background concentrations of pollutants for each 1 km grid square across the country. Concentrations at Two sites were selected for adjusting background values. Southampton City Council and Portsmouth.

Defra mapped background concentrations at the automatic monitoring site have been compared against concentrations measured at the monitoring site in 2023 to better reflect background concentrations more accurately across the study area. A calibration factor was of 1.07 was produced but not applied.