Chapter 10 – Air Quality Appendices

Contents.

Appendix 10.1 – Legislation, policy and guidance documents

European legislation

The European Union Directive on ambient air quality and cleaner air for Europe (2008/50/EC)[1] sets legally binding limits for pollutant concentrations. This directive was made law in England through the Air Quality Standards Regulations 2010[2] and The Air Quality Standards (Amendment) Regulations 2016[3].

The European Union Directive on the reduction of national emissions of certain atmospheric pollutants (2016/2284)[4] covers emission reduction commitments for anthropogenic atmospheric emissions, including nitrogen oxides (NO_x) and fine particulate matter ($PM_{2.5}$). It aims to contribute to achieving the air quality objectives set out in Directive 2008/50/EC[1].

Air Quality Strategy

The Environment Act 1995 (Part IV)[5] requires the Secretary of State to publish an air quality strategy and local authorities to review and assess the quality of air within their boundaries. The latter has become known as Local Air Quality Management (LAQM).

The Air Quality Strategy[6] provides the policy framework for local air quality management and assessment in the UK. It sets out air quality standards and objectives for key air pollutants. These standards and objectives are designed to protect human health and the environment. The Strategy also sets out how the different sectors of industry, transport and local government, can contribute to achieving these Air Quality Objectives (AQOs).

Local authorities are required to identify whether the AQOs have been, or will be, achieved at relevant locations. If the objectives are not achieved, the authority must declare an Air Quality Management Area (AQMA) and should prepare an Air Quality Action Plan (AQAP) within 12 months. An action plan must identify appropriate measures and policies that can be introduced in order to work towards achieving the AQO(s).

The AQOs set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The AQOs for use by local authorities are prescribed within the Air Quality (England) Regulations 2000[7], and the Air Quality (England) (Amendment) Regulations 2002[8].

The objectives for nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$) are set out in Table A10.1.The AQOs for NO_2, PM_{10} and $PM_{2.5}$ were to have been achieved by 2005, 2004 and 2020 respectively and continue to apply in all future years thereafter.

The Environment Act 2021[9] acts as the UK's new framework of environmental protection and came into force on 1st April 2022. With regard to air quality, the Environment Act establishes a legally binding duty on government to bring forward at least two new air quality targets in secondary legislation. This was implemented through the Environmental Improvement Plan[10] which outlines new $PM_{2.5}$ targets for future years. These are a long term target of 10 µg/m^3 by 2040 and an interim target of 12 µg/m^3 by 31st January 2028. These targets are expected to focus on reducing concentrations of, and exposure to, $PM_{2.5}$.

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[1] The European Parliament and the Council of the European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council
[2] The Stationery Office (2010) Statutory Instrument 2010, No 1001, The Air Quality Standards Regulations 2010, London
[3] The Stationery Office (2016) Statutory Instrument 2016, No 1184, The Air Quality Standards (Amendment) Regulations 2016, London
[4] The European Parliament and the Council of the European Union (2016) Directive 2016/2284 of the European Parliament and of the Council
[5] The Stationery Office (1995) The Environment Act 1995 (Part IV), London
[6] Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – [online] (Last accessed: 24/07/2024), Available at: www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1
[7] The Stationery Office (2000) Statutory Instrument 2000, No 928, The Air Quality (England) Regulations 2000, London
[8] The Stationery Office (2002) Statutory Instrument 2002, No 3043, The Air Quality (England) (Amendment) Regulations 2002, London
[9] The Stationary Office (2021) Statutory Instrument 2021, The Environment Act 2021, London
[10] Department for Environment, Food & Rural Affairs (2023) Environmental Improvement Plan 2023 –[online], (Last accessed: 24/07/2024), Available at: https://www.gov.uk/government/publications/environmental-improvement-plan

Additionally, a new Air Quality Strategy has been published in April 2023 which sets out a framework which should be followed by local authorities in support of Defra's long term air quality goals including new $PM_{2.5}$ targets[11].

Table A10.1: Air Quality Objectives (AQOs) for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO_2)	1-hour Mean	200 µg/m^3 Not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 Not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
Fine Particles ($PM_{2.5}$) *	Annual Mean	20 µg/m^3
Notes: Measured gravimetrically *The time period in LAQM.TG(22)[24] states "Work towards reducing emissions/concentrations of fine particulate matter ($PM_{2.5}$)"		

The AQOs apply at locations where members of the public are likely to be regularly present and exposed over the averaging period of the AQO. Examples of where the annual mean AQOs should apply are provided in the Local Air Quality Management Technical Guidance (LAQM.TG(22))[24], and include: building façades of residential properties, schools, hospitals. The annual mean AQOs are not relevant for the building façades of offices or other places of work where members of the public do not have regular access, kerbsides or gardens.

The 24-hour mean AQO for PM_{10} is considered to apply at the same locations as the annual mean AQO, as well as in gardens of residential properties and at hotels.

The 1-hour mean AQO for NO_2 also applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations, pavements of busy shopping streets, carparks and bus stations which are not fully enclosed. The 1-hour mean AQO does not apply at kerbside sites where the public do not have regular access.

EU limit values

The European Union (EU) has also set limit values for NO_2, PM_{10} and $PM_{2.5}$; these are legally binding and have been implemented into English legislation by The Air Quality Standards Regulations 2010 and The Air Quality Standards (Amendment) Regulations 2016.

The limit values for NO_2, PM_{10} and $PM_{2.5}$ are the same as the English AQOs (given in Table A10.1), but applied from 2010 for NO_2, 2005 for PM_{10} and 2015 for $PM_{2.5}$. The limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway).

[11] Defra (2023) Air Quality Strategy: framework for local authority delivery [online] (Last accessed: 24/07/2024), – http://www.gov.uk/government/consultations/revised-national-air-quality-strategy

Environmental Targets (Fine Particulate Matter) (England) Regulations 2023

In 2023, the Environment Agency published The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[12] which outlined two targets for $PM_{2.5}$; an Annual Mean Concentration Target (AMCT) for $PM_{2.5}$ of 10 µg/m^3 to be met by 2040 and a Population Exposure Reduction Target (PERT) for $PM_{2.5}$ of at least 35% reduction in population exposure by 2040 compared with the average population exposure from 1st January 2016 to 31st December 2018.

Statutory Nuisance legislation

Part III of the Environmental Protection Act (EPA) 1990[13] (as amended) contains the main legislation on Statutory Nuisance and allows local authorities and individuals to take action to prevent a statutory nuisance. Section 79 of the EPA defines, amongst other things, smoke, fumes, dust and smells emitted from industrial, trade or business premises so as to be prejudicial to health or a nuisance, as a potential Statutory Nuisance.

Fractions of dust greater than 10 µm in diameter (i.e. greater than PM_{10}) typically relate to nuisance effects as opposed to potential health effects and therefore are not covered within the Air Quality Strategy. In legislation, there are currently no numerical limits in terms of what level of dust deposition constitutes a nuisance.

Clean Air Strategy

The Clean Air Strategy (CAS)[14], published in 2019, sets out the Government's proposals aimed at delivering cleaner air in England and indicates how devolved administrations intend to make emission reductions. It sets out the comprehensive action that is required across all parts of government and society to deliver clean air.

Building Regulations

The Building Regulations help to ensure that new buildings, conversions, renovations and extensions (domestic or commercial) are going to be safe, healthy and high performing. Detailed regulations cover specific topics including structural integrity, fire protection, accessibility, energy performance, acoustic performance, protection against falls, electrical and gas safety. Part F of the Building Regulations (2021)[15] provides guidance on indoor air quality and the pollutant concentrations that must not be exceeded in buildings for use as either dwellings or non-dwellings.

National planning policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF)[16] sets out planning policy for England and was updated on 12th of December 2024. It includes advice on when air quality should be a material consideration in development control decisions. Relevant sections are set out below:

> Paragraph 8: *"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 protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy. […]"*

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[12] Environmental Protection (2023) The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 – [online], (Last accessed: 16/12/2024), Available at: The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023

13 The Stationery Office (1990) Environmental Protection Act 1990, London

14 Defra (2019) The Clean Air Strategy 2019, London

[15] HMSO (2021). The Building Regulations 2021. Approved Document Part F: Ventilation

[16] Department for Levelling Up, Housing and Communities, (2024) National Planning Policy Framework, Department for Levelling Up, Housing and Communities, London. Available: National Planning Policy Framework

Paragraph 56: *"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 110: "*The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making."*

Paragraph 187*: "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 instability. 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. […] "

Paragraph 198: *"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: *"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 201: *"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

The NPPF is supported by Planning Practice Guidance (PPG)[17].

The PPG states that:

Paragraph 001 (Reference ID: 32-001-20191101): *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance relevant Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit or where the need for emissions reductions has been identified."*

Paragraph 002 (Reference ID: 32-002-20191101): *"Plans may need to consider ways in which the development could be made appropriate in locations where air quality is or is likely to be a concern, and not give rise to unacceptable risks from pollution. This could, for example entail identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

[17] Ministry of Housing, Communities & Local Government (2024) Planning practice guidance - GOV.UK

Paragraph 005 (Reference ID: 32-005-20191101): *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and / or breach legal obligations (including those relating to the conversation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."*

The PPG also sets out the information that may be required in an air quality assessment, stating that:

Paragraph 007 (Reference ID: 32-007-20191101): *"Assessments need to be proportional to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific. The scope and content of supporting information is best discussed and agreed between the local planning authority and applicant before it is commissioned."*

It also provides guidance on options for mitigating air quality impacts, and makes clear that:

Paragraph 008 (Reference ID: 32-008-20191101): *"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact."*

Local planning policy

Broxtowe Borough Council (BBC) Local Plan

The BBC Local Plan provides a guide for development and growth within the BBC area of administration, sets out key issues faced by the BBC up until 2028 and co-ordinates policies, priorities and programmes with public resources for delivery. The BBC Local Plan has been split into two separate documents: The Part 1 Local Plan: Core Strategy[18] and Part 2 Local Plan[19]. The BBC Local Plan replaces the previous Broxtowe Local Plan 2004[20]

The Part 1 Local Plan: Core Strategy[18] was adopted in 2014 and contains no policies regarding air quality.

The Part 2 Local Plan[19] was adopted in 2019 and contains two policies regarding air quality as shown below:

- Policy 20: Air Quality
  "1. For any development proposals, all reasonable steps will be required to be taken to provide effective alternatives for users of the development to utilise modes of transport other than the private car.
  2. Permission will not be granted for development which would directly result in a significant deterioration in air quality either through poor design or as a consequence of site selection.
  3. Electric Vehicle charging points will be required in all housing developments of 10 or more houses and commercial developments of 1,000 square metres or more of floorspace."
- Policy 19: Pollution, Hazardous Substances and Ground Conditions
  "1. Permission will not be granted for development which would result in:
  […]
  a) An unacceptable level of pollution, or is likely to result in unacceptable exposure to sources of pollution or risks to safety;
  […]"

[18] Broxtowe Borough Council (2014) Aligned Core Strategies Part 1 Local Plan – [online], (Last accessed: 02/12/2024), Available at: https://www.broxtowe.gov.uk/media/2160/broxtowe-aligned-core-strategy.pdf.
[19] Broxtowe Borough Council (2019) Part 2 Local Plan 2018-2028 – [online], (Last accessed: 02/12/2024), Available at: https://www.broxtowe.gov.uk/media/7088/part-2-local-plan-adopted-october-2019.pdf
[20] Broxtowe Borough Council (2004) Broxtowe Local Plan 2004 – [online], (Last accessed: 02/12/2024), Available at: https://www.broxtowe.gov.uk/media/2877/local-plan-main-document-2004.pdf

Air Quality Strategy for Nottingham and Nottinghamshire

BBC do not have their own Air Quality Strategy for the borough, as such the Air Quality Strategy for Nottingham and Nottinghamshire 2020 – 2030[21] is followed to prevent and reduce activities that may cause air pollution within the BBC area of administration. The two aims of the Air Quality Strategy for Nottingham and Nottinghamshire 2020 - 2030[21] are shown below:

> *"1. To reduce average concentrations of nitrogen dioxide and fine particulate matter in Nottinghamshire (which will ultimately lead to a reduction in Air Quality Management Areas in Nottinghamshire).*
>
> *2. To reduce the estimated proportion of disease and deaths attributable to air pollution (encompassing fine particulate matter, nitrogen dioxide and other air pollutants)."*
>
> *The Air Quality Strategy for Nottingham and Nottinghamshire 2020 – 2030 aspires to deliver these aims under the following strategic objectives:*
>
> *1. Place Making and Development for Good Air Quality.*
>
> *2. Enable the Shift to Zero and Low Emissions Transport to Reduce Emissions.*
>
> *3. Reduce, Minimise and Prevent Emissions from Industrial, Commercial, Agricultural and Domestic Sources and Activity.*
>
> *4. Engagement and Communication for Behaviour Change.*

Toton and Chetwynd Barracks Strategic Masterplan Supplementary Planning Document (SPD)

BBC published the Toton and Chetwynd Barracks Strategic Masterplan Supplementary Planning Document (SPD)[22] in February 2023 to support the development of next generation communities in the Toton and Chetwynd Barracks areas. The Proposed Development alongside the two cumulative schemes 'Land at Toton East' and 'Land at Toton North' are located within the key character areas of "Toton East" and "Toton South" in the masterplan SPD of potential areas for residential development within Toton. The SPD aligns strongly with the policies outlined in the BBC Local Plan Part 2[19], to ensure for sustainable development in these character areas.

Local air quality management in Broxtowe

According to the latest 2024 Broxtowe Borough Council's (BBC) Annual Status Report (ASR)[23], there are currently no Air Quality Management Areas (AQMAs) declared within the BBC area of administration, with the single AQMA "AQMA Trowell" revoked since the 16th of January 2024 (declared in 2006 for exceedances of the NO_2 annual mean AQO). However, it should be noted that the Site is 3.1 km southwest from the Nottingham City Council (NCC) "AQMA No. 2" declared for exceedances of the NO_2 annual mean AQO only in 2002.

Importantly, BBC undertook automatic monitoring at one site in 2023 through a Zephyr sensor (MCERTs certified), installed in 2022 to monitor PM_{10}, $PM_{2.5}$ and NO_2 concentrations, located within the previous "Trowell" AQMA, located 3.3 km northwest of the Application Site.

Additionally, BBC operated seven passive diffusion tube monitoring locations in 2023 to measure NO_2 concentrations in the vicinity of the Site.

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[21] Nottingham City Council (2020) Air Quality Strategy for Nottingham and Nottinghamshire 2020 – 2030 – [online], (Last accessed: 13/11/2024), Available at: https://committee.nottinghamcity.gov.uk/documents/s107973/Notts%20AQ%20Strategy%202020%20FINALv1.0.pdf

[22] Broxtowe Borough Council (2023) Toton and Chetwynd Barracks Strategic Masterplan Supplementary Planning Document – [online], (Last accessed: 02/12/2024), Available at: Toton and Chetwynd SPD February 2023

[23] Broxtowe Borough Council (2024) 2024 Broxtowe Borough Council Air Quality Annual Status Report

A review of the BBC ASR 2024[23] has indicated that in 2023, no exceedances of the NO_2 annual mean AQO were recorded at the automatic monitoring sensor or any passive diffusion tube monitoring locations within the BBC area of administration. In addition, no exceedances of the 60 µg/m^3 threshold were recorded in 2023, making it unlikely that the NO_2 1-hour mean AQO was exceeded within the BBC area of administration.

Compliance with the annual mean AQOs for PM_{10} and $PM_{2.5}$ alongside the 24-hour mean PM_{10} AQO was observed at the single automatic monitoring site operated by BBC in 2023.

Assessment guidance

The primary guidance documents consulted in undertaking this assessment are detailed below.

Defra Local Air Quality Management Technical Guidance

The Defra Local Air Quality Management Technical Guidance (LAQM.TG(22))[24] was published for use by local authorities in their LAQM review and assessment work. The document provides key guidance in aspects of air quality assessment, including screening, use of monitoring data, and use of background data that are applicable to all air quality modelling assessments.

Defra's $PM_{2.5}$ Targets: Interim Planning Guidance

Defra published their $PM_{2.5}$ Targets Interim Planning Guidance[25] in November 2024 which sets out how developments can appropriately consider the $PM_{2.5}$ Environmental Targets (Fine Particulate Matter) (England) Regulations 2023[12] in their respective planning applications. This Interim Planning Guidance asks applicants to consider $PM_{2.5}$ exposure when selecting a development site alongside considering mitigation within the development design for minimising potential $PM_{2.5}$ emissions and the exposure of future occupants/building users.

EPUK-IAQM 'Air Quality Guidance for Planning'

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance[26] to help ensure that air quality is properly accounted for in the development control process. It clarifies when an air quality assessment should be undertaken, what it should contain, and how impacts should be described and assessed including guidelines for assessing the significance of impacts.

IAQM 'Construction and Demolition Dust Guidance'

Guidance on the assessment of dust from demolition and construction has been published by the IAQM[27]. The guidance provides a methodology to determine the dust emission magnitude and provides a series of matrices to determine the risk magnitude of potential dust sources associated with construction activities. This allows for the identification of appropriate mitigation measures that are defined within further IAQM guidance.

Design Manual for Roads and Bridges

The Design Manual for Roads and Bridges[28] (DMRB) (LA 105) considers any receptor within 200 m of a road source to be potentially affected by that operation. Receptors, including ecological designations within 200 m of a road source require further assessment of potential impacts.

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[24] Defra (2022) Local Air Quality Management Technical Guidance (TG22) – [online] (Last accessed: 24/07/2024), Available at: https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf
[25] Defra (2024) PM2.5 Targets: Interim Planning Guidance – [online], (Last accessed: 10/12/2024), Available at: PM_{2.5} Targets: Interim Planning Guidance - Defra, UK
[26] Environmental Protection UK and Institute of Air Quality Management (2017), Land-Use Planning & Development Control: Planning For Air Quality v1.2 – [online] (Last accessed: 24/07/2024), Available at: iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[27] Institute of Air Quality Management (2024) Guidance on the assessment of dust from demolition and construction v2.2 – [online], (Last accessed: 24/07/2024), Available at: iaqm.co.uk/wp-content/uploads/2013/02/Construction-Dust-Guidance-Jan-2024.pdf
[28] Standards for Highways (2019) Design Manual for Roads and Bridges LA 105 Air Quality (Last accessed: 24/07/2024), Available at: https://www.standardsforhighways.co.uk/tses/attachments/10191621-07df-44a3-892e-c1d5c7a28d90?inline=true

IAQM 'A Guide to The Assessment Of Air Quality Impacts On Designated Nature Conservation Sites'

The IAQM has published 'A guide to the assessment of air quality impacts on designated nature conservation sites'[29] which assists in understanding air quality impacts on European, national and local designated sites. It should be noted that this guidance should be utilised to determine whether there will be a likely 'significant effect' on a habitat; however, an appropriately qualified and experienced ecologist should assess the significance of the potential effects on the habitat.

[29] Institute of Air Quality Management (2020) A guide to the assessment of air quality impacts on designated nature conservation sites – [online], (Last accessed: 24/07/2024), Available at: iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2020.pdf

Appendix 10.2 - Environmental health officer consultation

From: [redacted]
Sent: 07 February 2025 15:11
To: [redacted]
Subject: RE: Toton West - Air Quality Assessment Methodology

Follow Up Flag: Follow up
Flag Status: Completed

⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠

Hello [redacted]

I can confirm my acceptance of the proposed methodology provided.

Kind regards
[redacted]

[redacted]
Environmental Health Officer
Public Protection
Broxotwe Borough Council

From: [redacted]
Sent: 27 January 2025 11:55
To: [redacted]
Cc: [redacted]
Subject: Toton West - Air Quality Assessment Methodology

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi [redacted]

Hoare Lea have been instructed to undertake an Air Quality Assessment to support the outline planning application for a residential development named 'Toton West' located South of the A52, Broxtowe, Nottinghamshire.

I have set out our proposed assessment approach below and would invite any comments or local air quality considerations you may have. The site is located at the below location (red outline):

The Proposed Development comprises a residential development of up to 420 homes and associated open space and infrastructure.

Hoare Lea propose to undertake the assessment using the following methodology:

- A baseline assessment of air quality will be undertaken using Broxtowe Borough Council's (BBC's) data, taken from the most recently available Annual Status Report/s.
- Monitoring data for 2020 and 2021 will not be included as part of our assessment, owing to the effects of the COVID-19 pandemic. Monitoring data from 2023 will be used to establish the baseline.
- A review of the BBC Part 1 Local Plan: Core Strategy and Local Plan Part 2 will be carried out.
- A review of relevant supplementary planning guidance including the Toton and Chetwynd Barracks Strategic Masterplan Supplementary Planning Document (February 2023).
- DEFRA's background pollution maps (2021 reference year) will be used to establish background concentrations in the area.
- An assessment of the construction impacts on air quality and dust using the IAQM methodology, in compliance with 'The Control of Dust and Emissions During Construction and Demolition'.
- Any construction or operational phase mitigation will be recommended as necessary in line with IAQM guidance.
- The energy strategy for the primary supply to the Proposed Development is yet to be determined. If combustion sources are proposed during normal operation and within the primary energy strategy, local air quality impacts may be anticipated and a detailed assessment of impacts of combustion emissions from the energy plant will be conducted.
- Initial road traffic data associated with the Proposed Development has been provided by ADC Infrastructure Ltd, the appointed Transport Consultants for the project. The annual average daily traffic (AADT) increase associated with the Proposed Development falls above the EPUK and IAQM criteria, indicating potential for air quality impacts and therefore a detailed assessment will be required to assess the impacts of additional road traffic on existing sensitive receptors. As such, the impacts of road traffic emissions associated with the operation of the Proposed Development on sensitive existing receptors will be modelled using ADMS-Roads.

- Additionally, the Proposed Development operational traffic flows will be utilised in an 'In Combination' scenario to consider the potential air quality impacts arising from a combination of the Proposed Development operational traffic flows alongside operational traffic flows of surrounding development sites (also residential), since exceedances of the EPUK and IAQM criteria have been observed in this combination scenario, utilising traffic data provided by ADC Infrastructure Ltd. Therefore, a detailed assessment will also be required to assess the in combination impacts of additional road traffic on existing sensitive receptors from both the Proposed Development and surrounding sites. As such, the impacts of road traffic emissions for this 'In Combination' scenario will be modelled using ADMS-Roads.
- Concentrations of NO_2, PM_{10} and $PM_{2.5}$ will be predicted at existing receptors in the vicinity of the Site.
- We are proposing to verify the dispersion model using data from existing monitoring locations in BBC. The following passive diffusion tube monitoring locations have been identified as potential sites to be used for verification purposes using 2023 data, if possible:
  - DT 11
  - DT 12
  - DT 13
  - DT 15
  - DT 16
- The source of the emission factors used will be EFT V12.1.
- We are proposing to use 2023 meteorological data from the Nottingham/Watnall meteorological station.
- An assessment of Site Suitability will be undertaken qualitatively with a desk-based review of the existing baseline air quality undertaken to inform the exposure of future users of the development. Local air quality monitoring and DEFRA's background pollution maps will be used to understand concentrations at the Application Site.

I would also be grateful if you could please confirm your acceptance of the proposed methodology and provide me with any comments you may have. However, if you would like to discuss further, please do not hesitate to contact me.

Please let me know if there are any additional guidance documents that aren't publicly available that you would like us to consider.

Many thanks,

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A TETRA TECH COMPANY

Appendix 10.3 – Construction dust assessment

Methodology

The assessment of construction dust impacts has been undertaken in line with the methodology outlined in the IAQM construction guidance[27]. The Site is currently unoccupied, as such, no demolition works are included as part of the proposals and an assessment of dust impacts from demolition is not required. Therefore, activities on the proposed construction site have been divided into three types to reflect their different potential impacts. These are:

- Earthworks
- Construction; and
- Trackout

The risk of dust emissions was assessed for each activity with respect to:

- Potential loss of amenity due to dust soiling;
- The risk of health effects due to a significant increase in exposure to PM_{10}; and
- The risk of ecological impacts due to a significant increase in exposure to PM_{10}.

The first stage of the assessment involves screening to determine whether there are any sensitive receptors within the threshold distances defined by the IAQM construction guidance[27]. A detailed assessment of the impact of dust from construction sites will be required where:

- A 'human receptor' is located within 250 m of the boundary of the Site or within 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance;
- An 'ecological receptor' is located within 50 m of the boundary of the Site or within 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance.

The magnitude of dust emission for each activity is determined on the basis of the guidance, indicative thresholds, information available relating to the project and expert judgement. The risk of dust impacts arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of dust impacts is then used to determine the mitigation requirements. Following the implementation of the appropriate mitigation, residual effects are considered to be not significant.

Table A10.2: Sensitivity of the area to dust soiling effects on people and property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20	<50	<100	<250
High	>100	High	High	Medium	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

Table A10.3: Sensitivity of the area to human health effects

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

Table A10.4 to Table A10.6 illustrate how the dust emission magnitude should be combined with the sensitivity of the area to determine the risk of impacts with no mitigation measures applied.

Table A10.4: Risk of dust impacts – earthworks

Sensitivity of Area	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

Table A10.5: Risk of dust impacts – construction

Sensitivity of Area	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

Table A10.6: Risk of dust impacts – trackout

Sensitivity of Area	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 risk of dust impacts is based on the potential dust emissions magnitude and the sensitivity of the area. These two factors are then combined to determine the risk of dust impacts with no mitigation applied. In the absence of any site-specific information, a higher risk category has been applied to represent a worst-case scenario.

Assessment screening

There are 'human receptors' within 250 m of the Site but no designated habitat sites within 50 m of the Site boundary or within 50 m of the route(s) used by construction vehicles on the public highway, up to 250 m from the Site entrance.

The closest statutory designated ecological receptor to the Site is Toton Fields, classed as a Local Nature Reserve (LNR) which is located within 20 m south of the Site, and is therefore within the distance of the IAQM criteria[27] where it is considered that there is the potential of a risk of dust impact from on-site activities

(earthworks and construction). However, since the Toton Fields LNR is set back approximately 0.5 km of the B6003 (Stapleford Lane), an anticipated construction vehicle route, at the closest point, and as such does not fall within the IAQM guidance 50 m threshold for the risk of trackout activities.

Additionally, the locally designated Toton Sidings Local Wildlife Site (LWS) is located within 20 m west of the Site and is therefore within the distance of the IAQM criteria[27], where it is considered that there is the potential of a risk of dust impact from on-site activities (earthworks and construction). As the Toton Sidings LWS is set back approximately 700 m of the B6003 (Stapleford Lane) to the east and approximately 300 m from the A52 at the north, which are both anticipated construction vehicle routes to the Site, the LWS also does not fall within the IAQM guidance 50 m threshold for the risk of trackout activities.

Therefore, an assessment of construction dust on ecological receptors from on-site activity has been screened into the assessment, with an assessment of construction dust on ecological receptors from trackout screened out. An assessment of construction dust at human receptors is also required.

Potential dust emission magnitude

The potential magnitude of dust emissions from demolition, construction, earthworks and trackout has been assessed, as identified in Table A10.7.

Table A10.7: Predicted magnitude of dust emissions

Activity	Magnitude	Justification
Earthworks	Large	Extensive landscaping will be required as part of the proposals and earthworks across the entirety of the Site will be required. The total Site area is greater than 110,000 m^2. The soil type at the Site has been classed as "loamy and clayey" which is a potentially dusty soil type using the application Soilscape[30]. Therefore, in line with the IAQM construction guidance[27], the magnitude of dust emissions from earthworks is anticipated to be large.
Construction	Large	As the proposals consist of 420 dwellings, the total construction volume is anticipated to exceed 75,000 m^3. Therefore, in line with IAQM construction guidance[27], the magnitude of dust emissions from construction is anticipated to be large.
Trackout	Large	The unpaved road length will be greater than 100 m after analysis of the Site using QGIS and Google Maps. The soil type at the Site has been previously classed as "loamy and clayey" using the application Soilscape[30] which is a potentially dusty soil type. Therefore, in line with IAQM construction guidance[27], the magnitude of dust emissions from construction is anticipated to be large as a worst case.

Sensitivity of the study area

The sensitivity of the area takes into account the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Site-specific factors, such as whether there are natural shelters, such as trees or other vegetation, to reduce the risk of wind-blown dust.

The sensitivity of the area and the factors considered are detailed in Table A10.8 with the demolition and construction distance band criteria illustrated in Figure A10.1 below.

[30] Cranfield Soil and Agrifood Institute Soilscapes map – [online], (Last accessed: 24/07/2024), Available at: http://www.landis.org.uk/soilscapes/

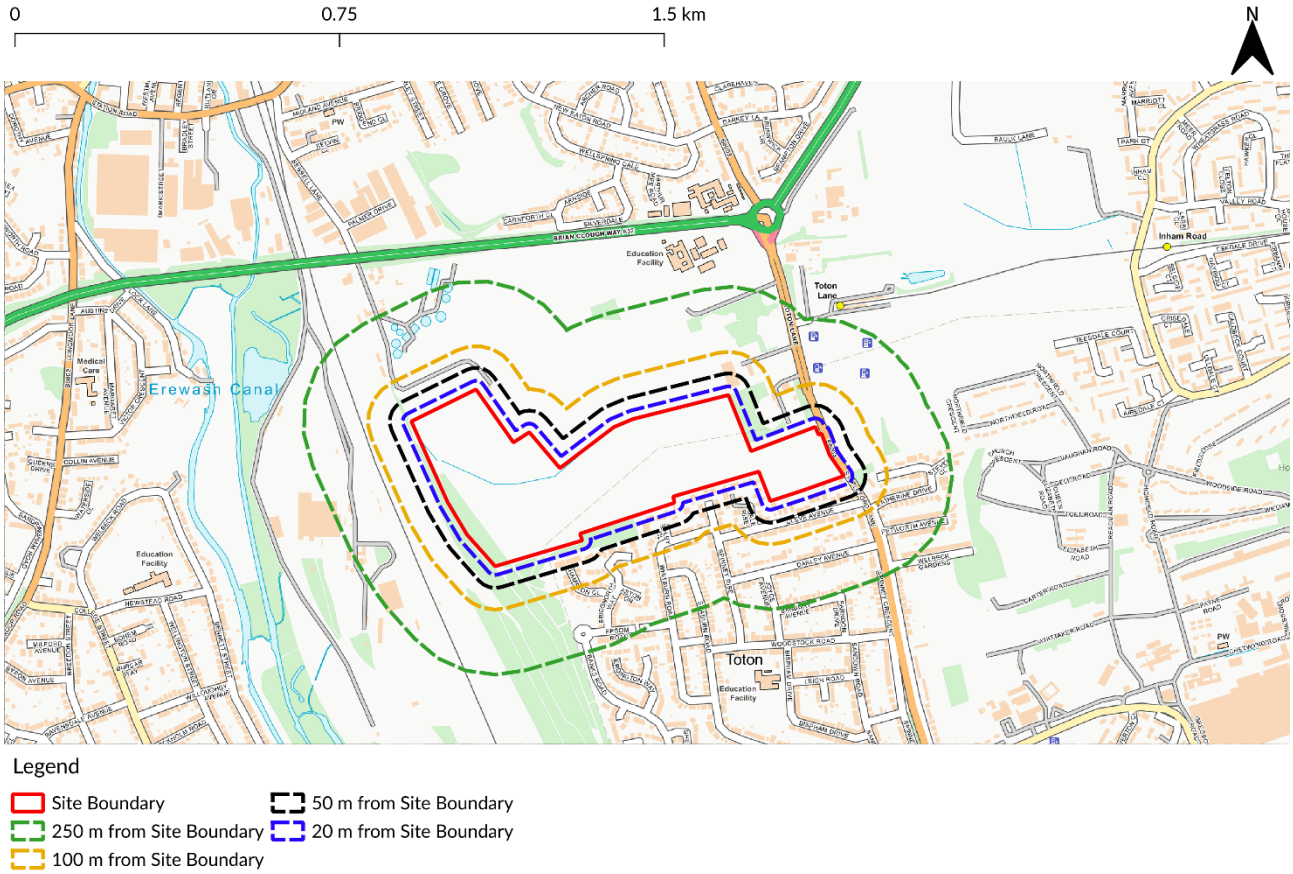

Figure A10.1: IAQM demolition and construction dust distance criteria from the Site boundary. Contains OS Data © Crown Copyright and Database rights 2024.

Table A10.8: Sensitivity of the area

Sensitivity Type	Factors	Sensitivity of Area	
		On – Site	Trackout
Dust Soiling	For construction activities, there are between 10 and 100 high sensitivity residential receptors within 20 m south of the Site, along Edale Rise, Spinney Rise, Selby Close and Bridgnorth Way. Additionally, there are greater than 100 high sensitivity residential receptors within 250 m of the Site at the south and southeast. Within 250 m northeast from the Site lies the medium sensitivity George Spencer Academy netball courts with associated medium sensitivity car parking spaces. Additionally, within 250 m northeast of the Site lies greater than 100 medium term parking spaces associated with Toton Lane Park & Ride, classed as medium sensitivity receptors to dust soiling. Therefore, the sensitivity of the area surrounding the Site has been classified as high sensitivity with regards to dust soiling for on-site activities. For trackout, the distances are measured within 50 m from the sides of the roads used by construction traffic up to 250 m from the exit of the Site. There are between 10-100 high sensitivity residential receptors within 50 m of the B6003, up to 250m south of the Site entrance/exit. Additionally, there are also between 10-100 medium sensitivity receptors (car parking spaces	High	Medium

Sensitivity Type	Factors	Sensitivity of Area	
		On – Site	Trackout
	at the Toton Lane Park & Ride) within 50 m of the B6003 road network routed north to the A52 up to 250 m from the Site entrance/exit. As such, the sensitivity of the area is classified as medium to dust soiling for trackout in line with IAQM Guidance.		
Human Health	As shown in Table 10.5.3, the Defra predicted background PM_{10} concentration for the worst-case grid square in which the Site is located, is 13.0 µg/m^3 in 2023 the most recent year with available monitoring data. For construction activities there are between 10 and 100 high sensitivity residential receptors within 20 m of the Site, along Edale Rise, Spinney Rise, Selby Close and Bridgnorth Way. For trackout, there are between 10-100 high sensitivity receptors (residential) within 50 m of the B6003 road network up to 250 m south from the Site entrance/exit Therefore, the sensitivity of the area surrounding the Site has been classified as low sensitivity with regards to human health impacts for on-site and trackout activities.	Low	Low
Ecological	The locally designated Toton Fields LNR ecological receptor is situated within 20 m south of the Site Boundary, which contains freshwater (The River Erewash and Bypass channel) and mixed woodland (plantation) habitats. Additionally, the Toton Sidings LWS, of local significance only, is also located within 20 m west of the Site Boundary. As confirmed by the Applicant's ecologist, the LNR and LWS designations are of local significance only, and so any assessment of effects should be weighted to that extent. Given the location of the LNR and LWS within a highly urbanised area, existing levels of pollution will limit the quality of habitats interest. Therefore, due to the local designation of the LNR and LWS, already located within a highly urbanised area, the sensitivity of the LNR and LWS to dust deposition as a result of on-site activities will be low, in line with the IAQM guidance, Therefore, the sensitivity of the area surrounding the Site has been classified as low sensitivity with regards to ecological impacts for on-site activities.	Low	-

Risk of dust impacts

The outcomes of the assessments of potential magnitude of dust emissions and the sensitivity of the area are combined to determine the risk of impact. This risk is then used to inform the selection of appropriate mitigation. Table A10.9 details the risk of dust impacts for demolition, earthworks, construction and trackout activities.

Table A10.9: Summary of unmitigated dust risks

Potential Impact	Sensitivity – Onsite Activity	Sensitivity - Trackout	Magnitude		
			Earthworks	Construction	Trackout
Magnitude			Large	Large	Large
Dust Soiling Impacts	High	Medium	High Risk	High Risk	Medium Risk
Human Health Impacts	Low	Low	Low Risk	Low Risk	Low Risk
Ecological Impacts	Low	-	Low Risk	Low Risk	Low Risk

To mitigate the potential impacts during the construction phase it is recommended that mitigation measures as detailed in the IAQM construction guidance[27] are implemented. These mitigation measures have been carefully selected for the Proposed Scheme and are based upon the worst-case high risk dust risk category outlined in Table A10.9. The mitigation measures are provided in Table A10.10 below.

Table A10.10: Mitigation measures for the construction phase

Issue	Mitigation measures
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
Dust Management Plan	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The DMP may include monitoring of dust deposition, dust flux, real-time PM10 continuous monitoring and/or visual inspections.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the Local Authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the log book.
	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. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Monitoring	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling check of surfaces such as street

Issue	Mitigation measures
	furniture, cars, window sills within 100 m of the site boundary, with cleaning to be provided if necessary.
	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
	Agree dust deposition, dust flux, or real-time PM10 continuous monitoring locations with the Local Authority. Where possible, commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences.
Preparing and maintaining the site	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
	Avoid site runoff of water or mud.
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used cover as described below.
	Cover, seed or fence stockpiles to prevent wind whipping.
Operating vehicles/machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.
	Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where applicable).
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing)
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered skips.
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste management	Avoid bonfires and burning of waste materials.

Issue	Mitigation measures
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.
Construction	Avoid scrabbling (roughening of concrete surfaces) if possible.
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being in continuous use.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	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 log book.
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
	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.
	Access gates to be located at least 10 m from receptors where possible.

Construction phase – Non-Road Mobile Machinery

Pollutants emitted by NRMM that may have the most significant potential effects on local air quality are particulate matter and NO_X/NO_2. Typically, NRMM is associated with construction sites and, therefore there is a potential for NRMM emissions to adversely affect local air quality as a result of the Proposed Scheme.

However, Defra's LAQM.TG(22) guidance[24] states that "Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed."

Appendix 10.4 – Road traffic modelling methodology

Model input parameters

Table A10.11: Model input parameters

Parameter	Description	Input Variable
Surface Roughness	Surface roughness of the modelling domain as a function of land use	A surface roughness length z_0 of 0.5 m was used for the dispersion site. This value considered appropriate for the surface roughness of the dispersion modelling assessment area. A roughness length z_0 of 0.3 m was used for the meteorological site. This value is considered appropriate for this assessment.
Road Source Emissions	Source of the emission factors used	EFT v.12.0.1
Emission Year	Modelling year used to factor the traffic emissions	2023 for the verification year and 2030 for all future year scenarios
NO_x to NO_2 Conversion	Conversion from NO_x concentrations to NO_2 concentrations	NO_x to NO_2 calculator v9.0. General inputs – 2023 for verification and 2030 for all future year scenarios, BBC, Nottingham City Council (NCC) and Erewash Borough Council, All other non-urban UK traffic.
Road Type	Road type within the EFT emission database	Rural (not London), Urban (not London) and Motorway (not London)
Elevation of Road	Height of the road link above ground level	All roads at 0 m – roads are at ground level
Road Width	Width of the road link	Road width obtained from Google Street View
Road Speed	Road speed in km/h	Signposted speed limits and surveyed speeds as provided by ADC Infrastructure Limited. Speeds have been reduced in line with LAQM.TG(22)[24] as described in 'Traffic Data' below.
Meteorology	Representative hourly sequential meteorological data	Nottingham/Watnall 2023
Background	Background pollutant concentration considered during the modelling	Defra 2021 reference year background maps (released in 2024) 1km x 1km grid squares for the year 2023 in the verification and 2030 at each existing receptor for NO_2, PM_{10} and $PM_{2.5}$ concentrations as set out in Table A10.14.

Parameter	Description	Input Variable
Output	Output as gridded or specified points	At specified points as detailed in Chapter 10: Air Quality.
Pollutant Output	Pollutants modelled and averaging time	NO_2, PM_{10} and $PM_{2.5}$ annual mean concentrations.

Traffic data

Traffic data (traffic flows, speeds and composition of fleet) have been provided by ADC Infrastructure Limited. Projections of future vehicle movements have been provided by ADC Infrastructure Limited and details of the projections are contained within the Transport Assessment. Average speeds for all roads have been reduced by up to 20 kph up to 50 m from junction of major roads, reduced by up to 10 kph up to 50 m from all other junctions and roundabouts, and reduced to 40 kph for all trunk slip roads in line with LAQM.TG(22)[24].

Figure A10.2 illustrates the roads and monitoring sites that were included in the verification assessment, with a summary of the traffic data utilised in the verification (2023) assessment provided in Table A10.12.

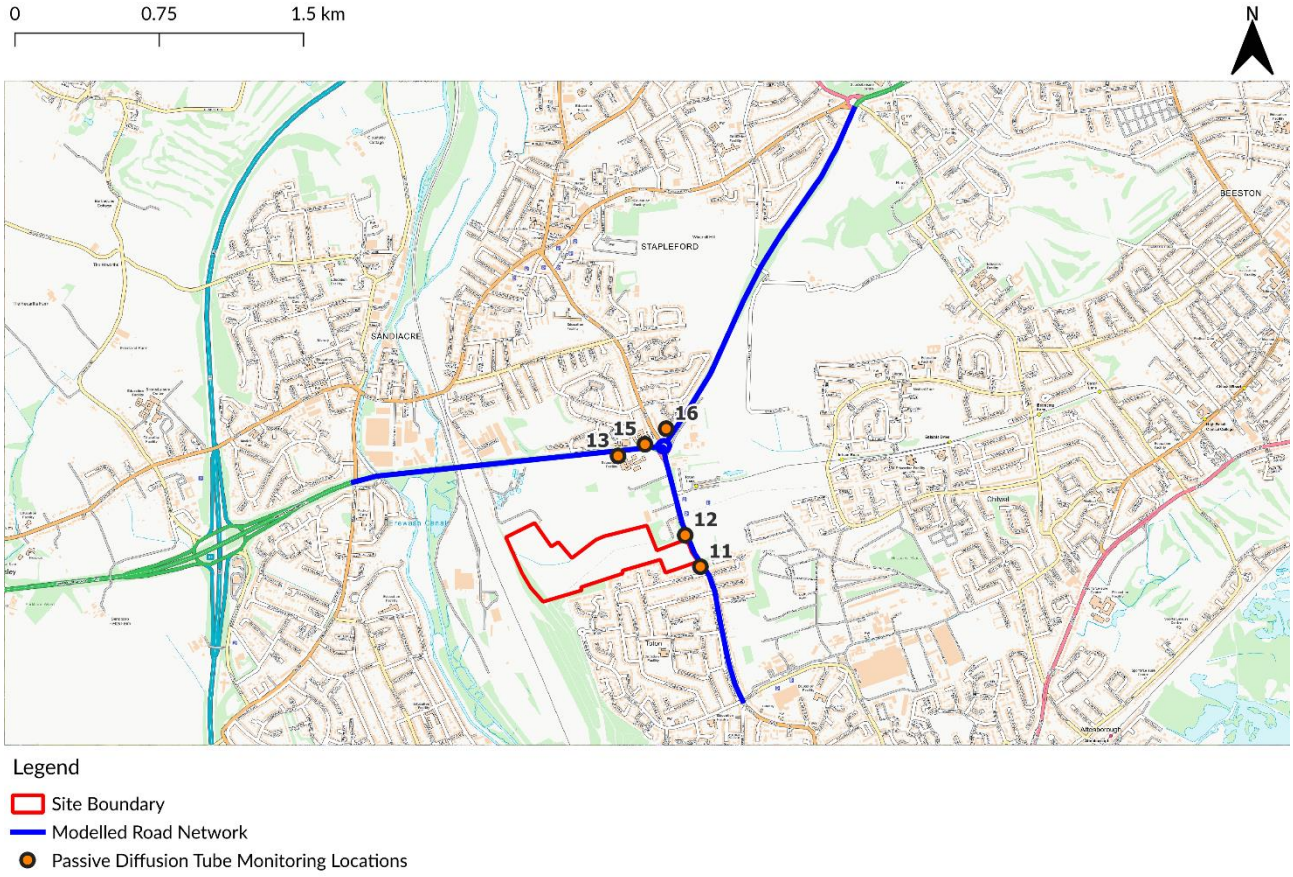

Figure A10.2: Roads and the monitoring sies included in the verification (2023) model. Contains OS Data © Crown Copyright and Database rights 2024.

Table A10.12: Summary of Traffic Data used in the Verification (2023) Assessment

Road Name	2023 LDV	2023 HDV	Speed (km/h)
A52 East	20137	623	64
A52 West	25171	826	64
B60003 North of Site	9685	104	48
B6003 South of Site	19370	208	48
Bardills roundabout	18642	200	48

The road network was extended from that used in the verification (2023) to cover links exceeding the EPUK/IAQM screening criteria in the future year of 2030. For the operational phase, the following scenarios have been modelled:

- 2023 Verification year;
- 2030 Do-Minimum (DM) (predicted traffic flows in 2030, without the Proposed Development);
- 2030 Do-Something (DS) (predicted traffic flows in 2030, with additional flows from the Proposed Development);
- 2030 In Combination Do-Something (IC-DS) (predicted traffic flows in 2030, which include development flows from the Proposed Development, alongside the additional development flows from the Committed Developments 'Land at Toton East' and 'Land at Toton North').

It should be noted that future year emission factors for the earliest Proposed Development opening year (2041) currently aren't available. The regression analysis in Figure A10.5 indicated that NO_2 concentrations recorded in the vicinity of the Site over the last five years of representative monitoring data have shown a reduction in concentrations, which identified a statistically significant trend. The future emissions year and background concentrations are therefore considered representative of future model scenarios.

Figure A10.3 demonstrates the roads included in the 2030 DM roads modelling assessment. Figure A10.4 illustrates the roads included in the 2030 DS and 2030 IC-DS scenarios (including the new junction on the A52 to connect to the new link road).

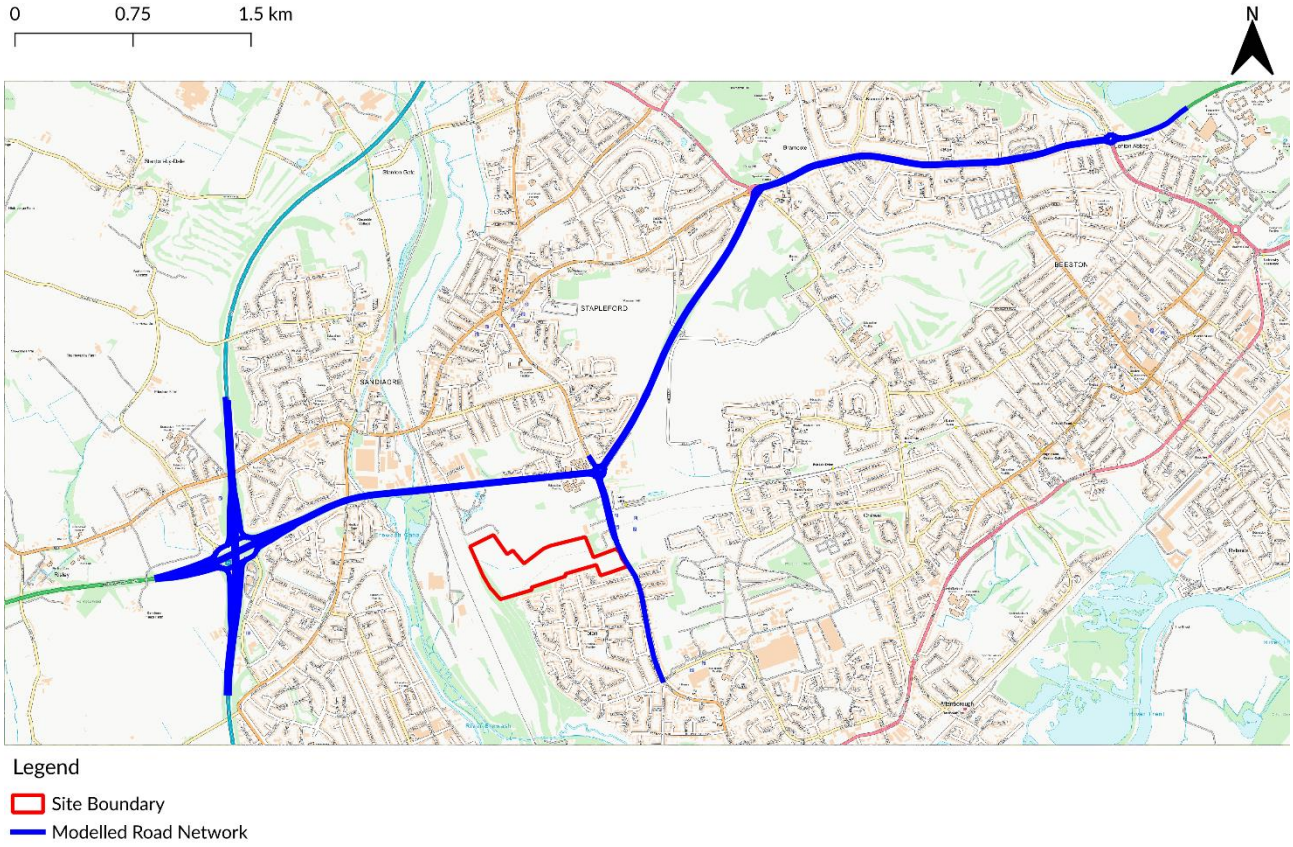

Figure A10.3: Roads included in the DM (2030) scenario. Contains OS Data © Crown Copyright and Database rights 2024.

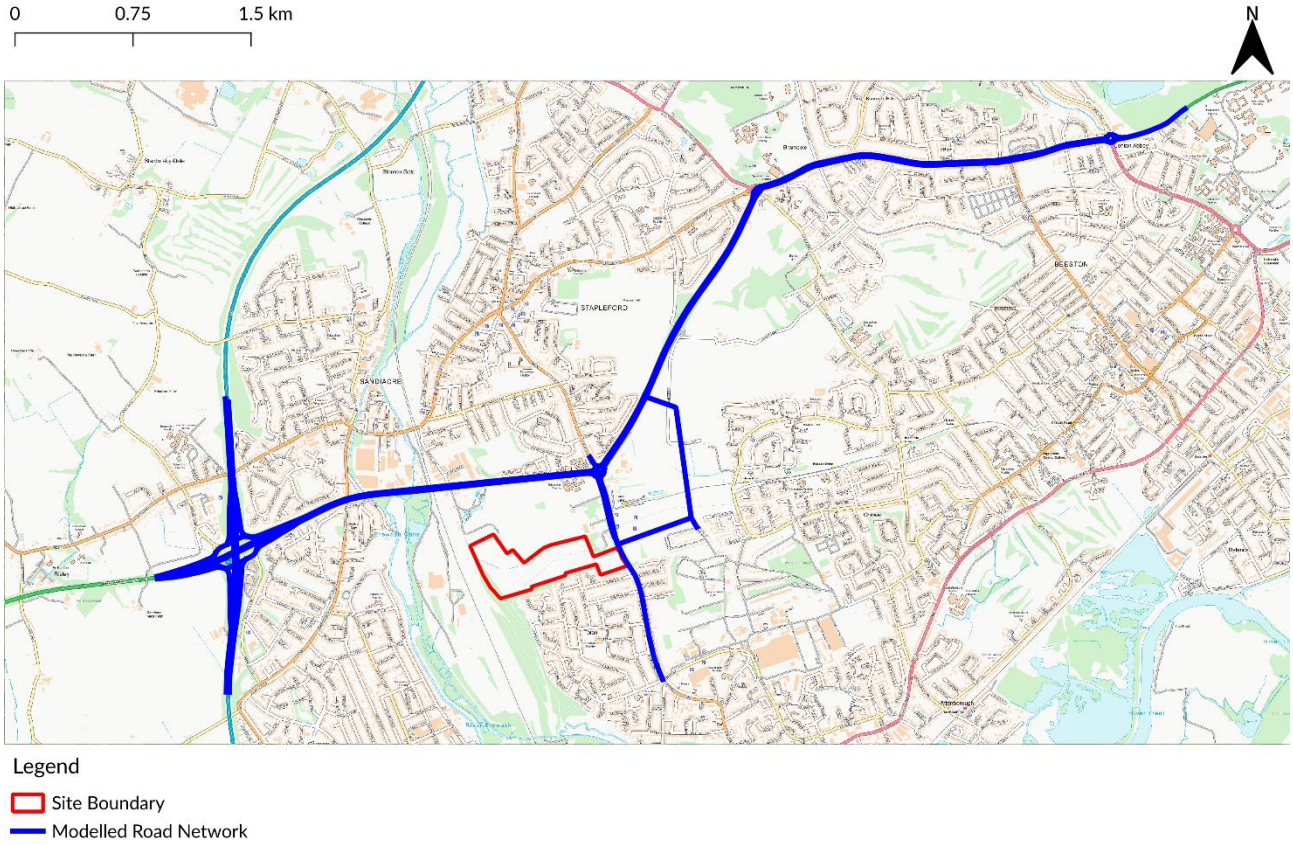

Figure A10.4: Roads included in the DS (2030) and IC-DS (2030) scenarios. Contains OS Data © Crown Copyright and Database rights 2024

As shown in Figure A10.4, a new junction is proposed to be introduced on the A52 to accommodate the new site entrance via the new link road, which altered the road layout between the DM and both the DS and IC-DS scenarios.

As such, for the DS and IC-DS scenarios, the road links were updated to reflect this change.

Table A10.13: Summary of traffic data used in the future year assessments.

Road Name	Road speed (km/h)	2030 Do Minimum (DM) (AADT)		2030 Do Something (DS) (AADT)		2030 In-Combination Do Something (IC-DS) (AADT)	
		LDVs	HDVs	LDVs	HDVs*	LDVs	HDVs*
A52 East before new link road junction	64	40521	1579	40908	1579	42932	1579
A52 East after new link road junction	64	39940	1556	40327	1556	41955	1556
A52 West	64	46271	3229	47044	3229	48957	3229
B6003 North of Site	48	23543	383	24896	383	25264	383
B6003 South of Site	48	21447	801	21833	801	22790	801

Road Name	Road speed (km/h)	2030 Do Minimum (DM) (AADT)		2030 Do Something (DS) (AADT)		2030 In-Combination Do Something (IC-DS) (AADT)	
		LDVs	HDVs	LDVs	HDVs*	LDVs	HDVs*
Bardills roundabout	48	13477	402	29029	402	14149	402
B6003 North of Bardills roundabout	32	44128	7088	13670	7088	44800	7088
Sandiacre Interchange	40	20004	597	29680	597	20844	597
M1 North of Sandiacre Interchange	112	46271	3229	44128	3229	48957	3229
M1N On slip	64	23543	383	9890	383	25264	383
M1S On slip	64	21447	801	16713	801	22790	801
M1 South of Sandiacre Interchange	112	28352	1842	56045	1842	30225	1842
Derby Road NB	64	39940	1556	20245	1556	41955	1556
Derby Road SB	64	46271	3229	20245	3229	48957	3229
Priory Roundabout	40	23543	383	19721	383	25264	383
A52 East of Priory Rdbt	45	28352	1842	23823	1842	30225	1842
New Road (new A52 junction for link road)	32	N/A**	N/A**	193	0	1003	0
Link road	32	N/A**	N/A**	193	0	4977	0

*Additional operational traffic flows for the Proposed Development (DS scenario) and IC-DS scenario are LDV only due to the residential nature of the Proposed Development and both cumulative schemes 'Land at Toton East' and 'Land at Toton North'.

**Link Road not in place for the DM scenario.

Emissions

Emissions were calculated using the most recent version of the Emissions Factor Toolkit (EFT) v12.0.1[31]. The traffic data was entered into the EFT in order to calculate a combined emission rate for each of the road links in the modelled network.

To understand whether air quality is improving in Broxtowe, a five-year regression analysis has been undertaken on average annual mean NO_2 concentrations recorded at all roadside passive diffusion tube

31 Defra (2023), Local Air Quality Management (LAQM) Support Emissions Factor Toolkit v12.0.1 - [online] (Last accessed: 24/07/2024), Available at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/

monitoring locations in BBC's administrative area between 2017 and 2023 (excluding 2020 and 2021), as shown in Figure A10.5 below.

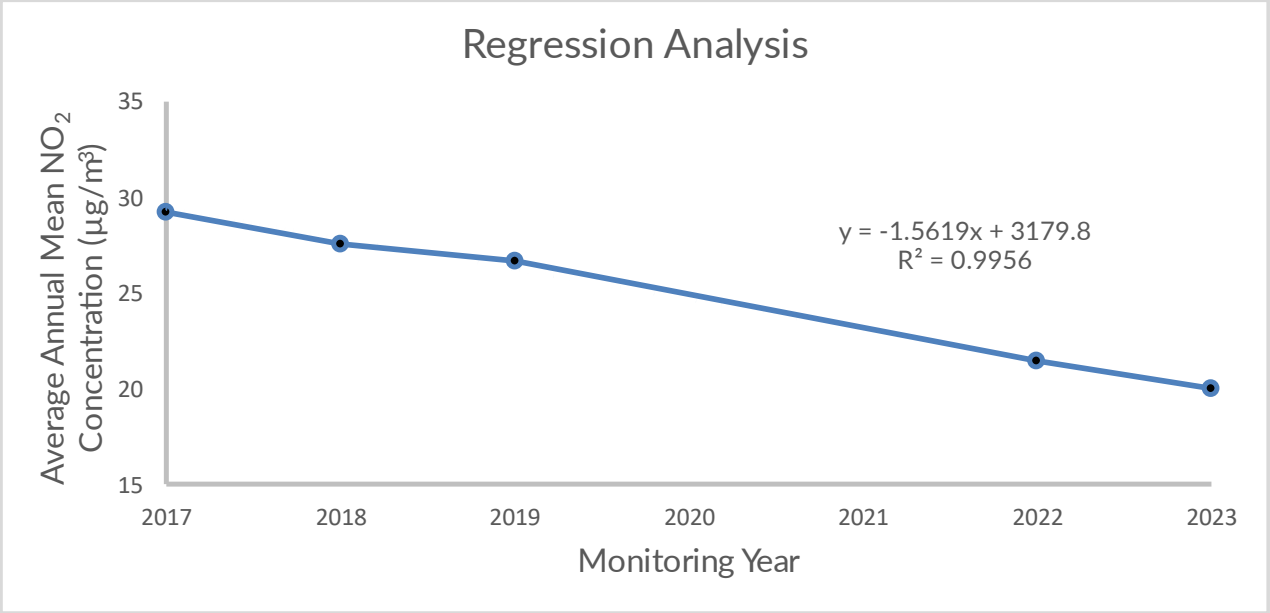

Figure A10.5: Five-year linear regression analysis for all roadside passive diffusion tube monitoring locations in BBC's administrative area.

The regression analysis indicates that NO_2 concentrations recorded at roadside monitoring locations in BBC's administrative area over the last five representative years have been reducing at an average rate of 1.6 µg/m^3 per year. This decreasing trend is statistically significant and suggests that an improvement in air quality has been recorded across Broxtowe in recent years.

However, emission factors for NO_x, PM_{10} and $PM_{2.5}$ have been held at 2030 for all future year scenarios as a worst-case scenario. Emissions are expected to reduce in the future but there are inherent uncertainties when predicting future emissions further into the future. To assume there will be no further improvement in transport emissions between 2030 and 2041, the anticipated opening year of the Proposed Development, is considered a worst-case scenario.

Meteorological data

The model has been run using the full year of meteorological data corresponding to the most recent set of representative NO_2 monitoring data (2023). The meteorological data has been taken from the meteorological station located at Nottingham/Watnall, an urban flat site located approximately 9 km north of the Site, which has 100% data capture and is considered suitable for the area surrounding the Site due to its proximity and location within an urban flat area. The 2023 wind rose is displayed below in Figure A10.6.

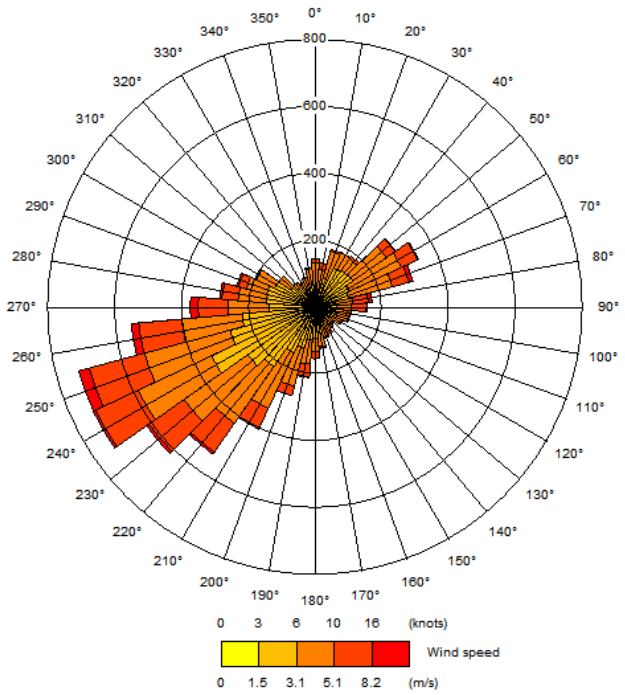

Figure A10.6: Windrose for Nottingham/Watnall 2023.

Background concentrations

Defra's 2030 background concentrations (predictions from the 2021 reference maps) have been used throughout this assessment (DM, DS and IC-DS scenarios), acting as a conservative assumption that background air quality will not improve between 2030, and the anticipated opening year of the Proposed Development in 2041.

Defra background maps have been used to determine the equivalent NO_2, PM_{10} and $PM_{2.5}$ background concentrations at each existing receptor, as shown in Table A10.14.

Table A10.14: Summary of Defra Background Data at Existing Sensitive Receptors

Receptor ID	Grid Square		2030 Background Concentration (µg/m³)		
	X	Y	NO_2	PM_{10}	$PM_{2.5}$
Existing Sensitive Receptors					
R1	449406	336137	9.1	13.6	7.2
R2	449329	336132	9.1	13.6	7.2

Receptor ID	Grid Square		2030 Background Concentration (µg/m³)		
	X	Y	NO_2	PM_{10}	$PM_{2.5}$
R3	449402	336078	9.1	13.6	7.2
R4	449243	336075	9.1	13.6	7.2
R5	449532	336208	9.1	13.6	7.2
R6	449545	336019	9.1	13.6	7.2
R7	449687	335526	8.8	12.8	7.1
R8	449746	335481	8.8	12.8	7.1
R9	449198	336121	9.1	13.6	7.2
R10	448900	336086	10.1	13.1	7.4
R11	447524	335816	10.0	14.5	7.6
R12	447405	335653	10.0	14.5	7.6
R13	447349	335771	10.0	14.5	7.6
R14	450560	337914	8.8	12.5	7.0
R15	450696	337957	8.8	12.5	7.0
R16	451101	338098	8.8	12.1	7.0
R17	451382	338127	8.8	12.1	7.0
R18	451778	338095	8.8	12.1	7.0
R19	451626	338051	8.8	12.1	7.0
R20	452145	338089	9.1	12.1	7.0
R21	452449	338166	9.1	12.1	7.0
R22	452703	338262	9.1	12.1	7.0
R23	452703	338262	9.1	12.1	7.0
R24	453094	338315	10.5	12.9	7.0
R25	450404	337730	8.8	12.5	7.0

Receptor ID	Grid Square		2030 Background Concentration (µg/m³)		
	X	Y	NO_2	PM_{10}	$PM_{2.5}$
R26	450954	338107	8.5	12.7	6.9
R27	452064	338118	9.1	12.1	7.0
R28	452524	338220	9.1	12.1	7.0
R29	452639	338197	9.1	12.1	7.0
R30	447627	335793	10.0	14.5	7.6
R31	449756	336585	9.1	13.6	7.2
R32	452795	338223	9.1	12.1	7.0

Model verification

The model verification process seeks to minimise uncertainties associated with the air quality model by comparing the model output with locally measured concentrations. The verification process has been undertaken in line with LAQM.TG(22) guidance[24] and helps to identify differences between modelled and measured concentrations, which can arise for a number of reasons including uncertainties associated with traffic data, background pollutant concentrations, meteorological data, emission rates, and model input parameters, such as roughness length. The verification methodology is described in subsequent sections.

Monitoring data

A total of five NO_2 passive diffusion tube monitoring sites from BBC's administrative area were used to verify the model, as shown in Figure A10.2.

The locations of the monitoring sites have been taken from the 2024 BBC ASR[23] and monitoring data for the year 2023, the latest comparable year of monitoring data, has been used for all monitoring sites during verification. 2023 traffic data was provided by ADC for use in the verification.

NO_2

Most NO_2 is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_X = NO + NO_2).

The verification method follows the process described in LAQM.TG(22)[24], comparing modelled and monitored road NO_X concentrations at selected monitoring sites. The gradient of the best-fit line between the 'measured' road-NO_X contribution and the model derived road-NO_X contribution, forced through zero, has been used to determine the adjustment factor, as shown in Figure A10.7. This factor has then been applied to the modelled road-NO_X concentrations for each receptor, to provide adjusted modelled road-NO_X concentrations. The NO_X to NO_2[32] calculator has then been used to determine total NO_2 concentrations from the adjusted modelled road-NO_X concentrations and the background NO_2 concentrations.

32 Defra, (2020), NO_x to NO_2 Calculator v8.1. –[online] (Last accessed: 24/07/2024), Available at: laqm.defra.gov.uk/review-and-assessment/tools/tools.html

The following adjustment factor has been applied to all modelled nitrogen dioxide data in the model area:

Verification factor = 2.14

These results imply that the model has under-predicted the road-NO_X contribution. This is a common experience with this and most other roads models.

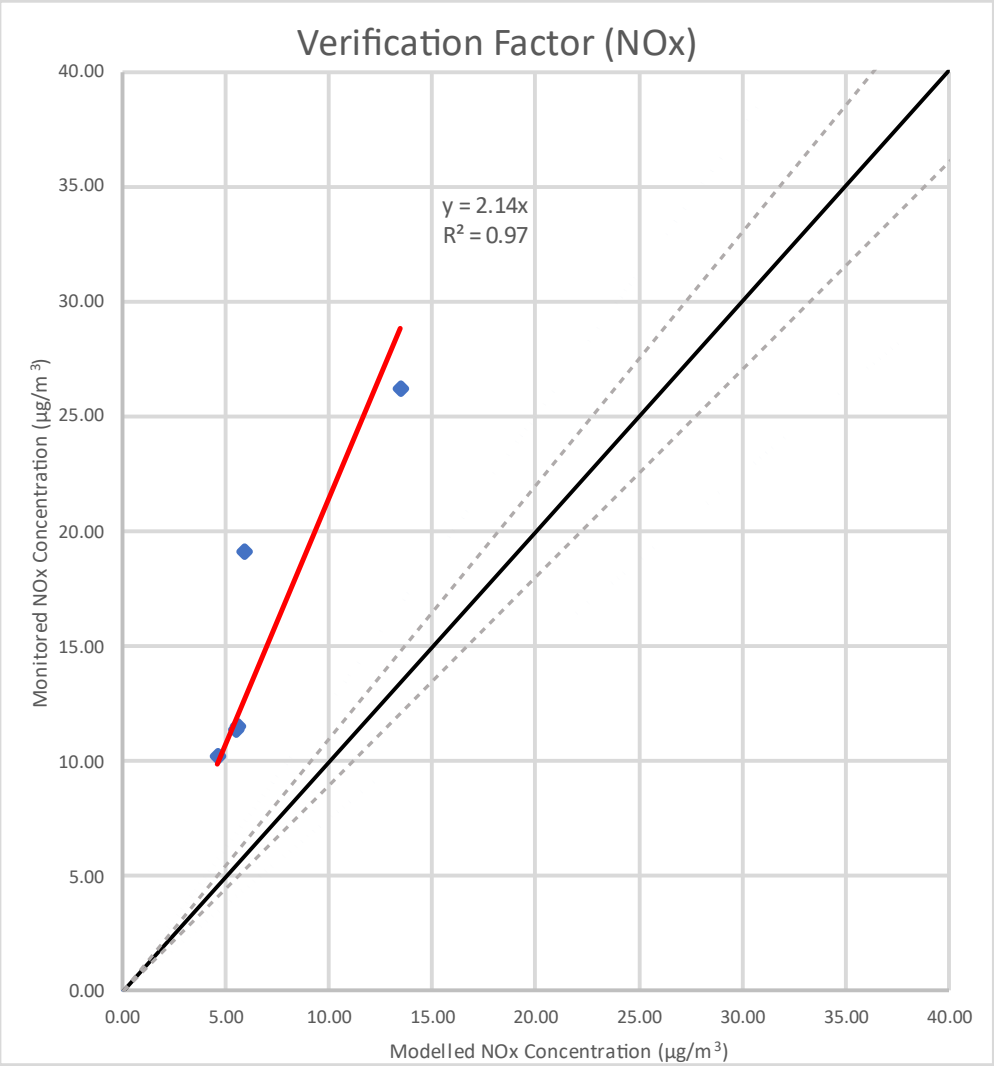

Figure A10.7: Comparison of Measured Road NO_x to Unadjusted Modelled Road NO_x Concentrations for Monitoring Sites.

Table A10.15 provides the inputs for the comparison of the adjusted modelled NO_2 and monitored NO_2, which were used to calculate the adjustment factor.

Table A10.15: Comparison of Measured Road NOx to Unadjusted and Adjusted Modelled Road NOx concentrations for monitoring sites

Monitoring Location	Modelled NO_x Road Contribution ($\mu g/m^3$)	Monitored NO_x Road Contribution ($\mu g/m^3$)	Adjusted Modelled NO_x Road Contribution ($\mu g/m^3$)	Monitored Total NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference ($\mu g/m^3$)
11	5.9	19.1	12.7	21.2	17.9	-3.3

Monitoring Location	Modelled NO_x Road Contribution ($\mu g/m^3$)	Monitored NO_x Road Contribution ($\mu g/m^3$)	Adjusted Modelled NO_x Road Contribution ($\mu g/m^3$)	Monitored Total NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference ($\mu g/m^3$)
12	5.6	11.5	12.0	17.3	17.5	0.2
13	4.6	10.2	9.9	17.5	17.3	-0.2
15	13.5	26.2	28.8	25.6	26.9	1.3
16	5.5	11.4	11.7	18.1	18.3	0.2
Adjustment Factor	2.14					

Statistical analysis of model performance

LAQM.TG(22) recommends three statistical procedures that should be applied to evaluate model performance and assess the overall uncertainty. These are:

- Root mean square error (RMSE) defines the average error or uncertainty in the model. Ideally a RMSE within 10% of the air quality objective which is being assessed would be derived (for the annual mean NO_2 objective the ideal RMSE would be < 4 $\mu g/m^3$). Where the RMSE is greater than 25% of the objective being assessed (i.e. 10 $\mu g/m^3$ for the annual mean NO_2 objective) it is advised to revisit the model parameters and verification;
- Fractional bias identifies whether the model has a tendency to under-predict (positive value) or over-predict (negative value). The ideal value is zero but may range from +2 to -2; and
- Correlation coefficient provides a measure of the linear relationship between modelled and measured data. Values range between zero (no relationship) and 1 (perfect relationship).

The values for each of these methods are provided in Table A10.16 below.

Table A10.16: Summary of model verification statistical analysis

Method	Value
RMSE	1.6
Fractional Bias	<0.1
Correlation Coefficient	0.9

The verification gives a RMSE of 4.0% of the annual mean NO_2 objective which shows the average error. The fractional bias shows a slight tendency to under-predict, and the correlation coefficient shows a strong relationship.

PM_{10} and $PM_{2.5}$.

There are no PM_{10} or $PM_{2.5}$ monitors within the study area; therefore, the model outputs of road-PM have been adjusted by applying the primary adjustment factor calculated for road NO_x in line with LAQM.TG(22)[15].

Appendix 10.5 – Full modelling results (DS)

Impacts from operational road traffic emissions (DS scenario)

The impacts of emissions from the operational road traffic associated with the Proposed Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations have been assessed at 32 existing sensitive receptors in the vicinity of the Site for the DS scenario (additional operational traffic flows for the Proposed Development only). The locations of the existing sensitive receptors are illustrated in Figure 10.1 and the predicted pollutant concentrations are outlined below. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22).

NO_2 concentrations

The predicted NO_2 concentrations are provided in Table A10.17 below for both the DM and DS scenarios. The impact descriptor at each individual existing sensitive receptor, in accordance with the EPUK/IAQM Guidance, is also provided. The long term AQAL for assessment of exceedance of the annual mean AQO is 40 µg/m^3. The short term AQAL for assessment of the 1-hour mean NO_2 AQO is 60 µg/m^3. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22).

Table A10.17: Predicted operational phase impacts on annual mean and 1-hour mean NO_2 concentrations at existing sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m^3)	DS Scenario (µg/m^3)	Difference expressed as % long-term AQAL	Concentration in DS (2030) as % of long-term AQAL	Concentration in DS (2030) as % of short-term AQAL	Impact Descriptor		Short-term (ST) or long-term (LT) receptor?
R1	1.5	15.2	15.2	0.2	38.1	25.4	Adverse	Negligible	LT/ST
R2	1.5	14.3	14.4	0.2	36.0	24.0	Adverse	Negligible	LT/ST
R3	1.5	12.0	12.1	0.1	30.2	20.1	Adverse	Negligible	LT/ST
R4	1.5	13.0	13.0	0.1	32.6	21.7	Adverse	Negligible	LT/ST
R5	1.5	13.6	13.7	0.2	34.1	22.8	Adverse	Negligible	LT/ST
R6	1.5	12.5	12.6	0.2	n/a	21.0	n/a	n/a	ST
R7	1.5	12.0	12.0	0.1	30.0	20.0	Adverse	Negligible	LT/ST
R8	1.5	11.5	11.5	0.1	28.8	19.2	Adverse	Negligible	LT/ST
R9	1.5	13.9	14.0	0.1	34.9	23.3	Adverse	Negligible	LT/ST
R10	1.5	15.7	15.7	0.2	39.3	26.2	Adverse	Negligible	LT/ST
R11	1.5	14.5	14.6	0.1	36.5	24.3	Adverse	Negligible	LT/ST
R12	1.5	15.4	15.4	0.1	38.6	25.7	Adverse	Negligible	LT/ST
R13	1.5	14.7	14.8	0.0	36.9	24.6	Adverse	Negligible	LT/ST

ID	Height (m)	DM Scenario (µg/m^3)	DS Scenario (µg/m^3)	Difference expressed as % long-term AQAL	Concentration in DS (2030) as % of long-term AQAL	Concentration in DS (2030) as % of short-term AQAL	Impact Descriptor		Short-term (ST) or long-term (LT) receptor?
R14	1.5	15.7	15.8	0.1	39.4	26.3	Adverse	Negligible	LT/ST
R15	1.5	12.7	12.8	0.1	31.9	21.3	Adverse	Negligible	LT/ST
R16	1.5	12.8	12.8	0.1	32.1	21.4	Adverse	Negligible	LT/ST
R17	1.5	12.4	12.4	0.1	31.1	20.7	Adverse	Negligible	LT/ST
R18	1.5	14.0	14.1	0.2	35.3	23.5	Adverse	Negligible	LT/ST
R19	1.5	11.4	11.4	0.1	28.5	19.0	Adverse	Negligible	LT/ST
R20	1.5	12.0	12.1	0.1	30.1	20.1	Adverse	Negligible	LT/ST
R21	1.5	11.4	11.5	0.1	28.7	19.1	Adverse	Negligible	LT/ST
R22	1.5	11.2	11.2	0.1	n/a	18.7	n/a	n/a	ST
R23	4.4	10.8	10.8	0.1	27.0	18.0	Adverse	Negligible	LT/ST
R24	1.5	15.1	15.2	0.2	38.0	25.3	Adverse	Negligible	LT/ST
R25	1.5	11.8	11.8	0.1	29.5	19.7	Adverse	Negligible	LT/ST
R26	1.5	12.7	12.7	0.1	31.8	21.2	Adverse	Negligible	LT/ST
R27	1.5	12.5	12.5	0.1	31.3	20.8	Adverse	Negligible	LT/ST
R28	1.5	11.9	11.9	0.1	29.9	19.9	Adverse	Negligible	LT/ST
R29	1.5	11.2	11.2	0.1	28.0	18.7	Adverse	Negligible	LT/ST
R30	1.5	14.8	14.9	0.2	37.3	24.9	Adverse	Negligible	LT/ST
R31	1.5	11.7	11.7	0.1	29.2	19.5	Adverse	Negligible	LT/ST
R32	1.5	13.1	13.2	0.2	33.0	22.0	Adverse	Negligible	LT/ST

Notes:

n/a = not applicable

PM_{10} concentrations

The predicted PM_{10} concentrations are provided in Table A10.18 for the DM and DS scenarios for the existing sensitive long-term receptors where the annual mean applies (R6 and R22 excluded as short-term receptors). The impact descriptor at the 30 existing long-term sensitive receptors, in accordance with the EPUK/IAQM Guidance, is also provided. The long term AQAL for assessment of exceedance of the annual mean AQO is 40 µg/m^3. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22) and so the annual mean PM_{10} concentrations have not been reported at these two receptors.

Table A10.18: Predicted operational phase impacts on annual mean PM_{10} concentrations at existing long-term sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m^3)	DS Scenario (µg/m^3)	Difference expressed as % AQAL (40 µg/m^3)	Concentration in DS 2030 as % of AQAL	No. of days in exceedance of 50 µg/m^3	Impact Descriptor	
R1	1.5	18.0	18.1	0.2	45.2	1	Adverse	Negligible
R2	1.5	17.1	17.2	0.1	42.9	1	Adverse	Negligible
R3	1.5	15.6	15.6	0.1	38.9	0	Adverse	Negligible
R4	1.5	15.8	15.9	0.1	39.6	0	Adverse	Negligible
R5	1.5	16.8	16.8	0.1	42.0	1	Adverse	Negligible
R7	1.5	15.2	15.2	0.1	38.0	0	Adverse	Negligible
R8	1.5	14.8	14.8	0.1	37.1	0	Adverse	Negligible
R9	1.5	16.7	16.7	0.1	41.8	1	Adverse	Negligible
R10	1.5	15.6	15.6	0.1	39.0	0	Adverse	Negligible
R11	1.5	16.9	17.0	0.1	42.4	1	Adverse	Negligible
R12	1.5	17.3	17.3	0.1	43.3	1	Adverse	Negligible
R13	1.5	16.8	16.9	0.0	42.1	1	Adverse	Negligible
R14	1.5	17.4	17.4	0.1	43.5	1	Adverse	Negligible
R15	1.5	15.2	15.3	0.1	38.1	0	Adverse	Negligible
R16	1.5	15.0	15.0	0.1	37.5	0	Adverse	Negligible
R17	1.5	14.7	14.7	0.1	36.8	0	Adverse	Negligible
R18	1.5	15.5	15.6	0.1	38.9	0	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m³)	DS Scenario (µg/m³)	Difference expressed as % AQAL (40 µg/m³)	Concentration in DS 2030 as % of AQAL	No. of days in exceedance of 50 µg/m³	Impact Descriptor	
R19	1.5	13.9	13.9	0.1	34.7	0	Adverse	Negligible
R20	1.5	14.1	14.2	0.1	35.4	0	Adverse	Negligible
R21	1.5	13.7	13.7	0.1	34.3	0	Adverse	Negligible
R23	4.4	13.2	13.2	0.1	33.1	0	Adverse	Negligible
R24	1.5	16.6	16.6	0.2	41.5	1	Adverse	Negligible
R25	1.5	14.7	14.7	0.1	36.8	0	Adverse	Negligible
R26	1.5	15.6	15.6	0.1	39.0	0	Adverse	Negligible
R27	1.5	14.5	14.5	0.1	36.2	0	Adverse	Negligible
R28	1.5	14.0	14.1	0.1	35.2	0	Adverse	Negligible
R29	1.5	13.5	13.5	0.1	33.8	0	Adverse	Negligible
R30	1.5	16.9	16.9	0.1	42.3	1	Adverse	Negligible
R31	1.5	15.5	15.5	0.1	38.7	0	Adverse	Negligible
R32	1.5	15.0	15.0	0.2	37.6	0	Adverse	Negligible

$PM_{2.5}$ concentrations

The predicted annual mean $PM_{2.5}$ concentrations are provided in Table A10.19 for the DM and DS scenarios for the existing sensitive long-term receptors where the annual mean applies (R6 and R22 excluded as short-term receptors). The impact descriptor at the 30 existing sensitive long-term (residential) receptors, in accordance with the EPUK/IAQM Guidance, is also provided. The long term AQAL for assessment of exceedance of the annual mean AQO is 20 µg/m³. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22) and so the annual mean $PM_{2.5}$ concentrations have not been reported at these two receptors.

Table A10.19: Predicted operational phase impacts on annual mean $PM_{2.5}$ concentrations at existing long-term sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m³)	DS Scenario (µg/m³)	Difference expressed as % AQAL (20 µg/m³)	Concentration in DS 2030 as % of AQAL	Impact Descriptor	
R1	1.5	9.6	9.6	0.2	48.1	Adverse	Negligible
R2	1.5	9.1	9.2	0.1	45.8	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m^3)	DS Scenario (µg/m^3)	Difference expressed as % AQAL (20 µg/m^3)	Concentration in DS 2030 as % of AQAL	Impact Descriptor	
R3	1.5	8.3	8.3	0.1	41.5	Adverse	Negligible
R4	1.5	8.5	8.5	0.1	42.4	Adverse	Negligible
R5	1.5	8.9	8.9	0.1	44.6	Adverse	Negligible
R7	1.5	8.4	8.4	0.1	41.9	Adverse	Negligible
R8	1.5	8.2	8.2	0.1	40.9	Adverse	Negligible
R9	1.5	8.9	8.9	0.1	44.6	Adverse	Negligible
R10	1.5	8.8	8.8	0.1	44.1	Adverse	Negligible
R11	1.5	9.0	9.0	0.1	45.1	Adverse	Negligible
R12	1.5	9.2	9.2	0.1	46.0	Adverse	Negligible
R13	1.5	9.0	9.0	0.0	44.9	Adverse	Negligible
R14	1.5	9.5	9.5	0.1	47.7	Adverse	Negligible
R15	1.5	8.4	8.4	0.1	42.2	Adverse	Negligible
R16	1.5	8.5	8.5	0.1	42.4	Adverse	Negligible
R17	1.5	8.3	8.3	0.1	41.7	Adverse	Negligible
R18	1.5	8.8	8.8	0.1	44.0	Adverse	Negligible
R19	1.5	7.9	7.9	0.1	39.7	Adverse	Negligible
R20	1.5	8.0	8.0	0.1	40.2	Adverse	Negligible
R21	1.5	7.8	7.8	0.1	39.1	Adverse	Negligible
R23	1.5	7.6	7.6	0.1	37.8	Adverse	Negligible
R24	1.5	9.0	9.0	0.2	44.9	Adverse	Negligible
R25	1.5	8.1	8.1	0.1	40.7	Adverse	Negligible
R26	1.5	8.4	8.4	0.1	42.2	Adverse	Negligible
R27	1.5	8.2	8.2	0.1	41.1	Adverse	Negligible
R28	1.5	8.0	8.0	0.1	40.0	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m^3)	DS Scenario (µg/m^3)	Difference expressed as % AQAL (20 µg/m^3)	Concentration in DS 2030 as % of AQAL	Impact Descriptor	
R29	1.5	7.7	7.7	0.1	38.6	Adverse	Negligible
R30	1.5	9.0	9.0	0.1	45.1	Adverse	Negligible
R31	1.5	8.2	8.2	0.1	41.1	Adverse	Negligible
R32	1.5	8.5	8.5	0.2	42.5	Adverse	Negligible

Appendix 10.6 – Full modelling results (IC-DS)

Impacts from operational road traffic emissions (IC-DS scenario)

The impacts of emissions from the operational road traffic associated with the Proposed Development on NO_2, PM_{10} and $PM_{2.5}$ concentrations have been assessed at 32 existing sensitive receptors in the vicinity of the Site for the In Combination DS (IC-DS) scenario (additional operational traffic flows for the Proposed Development alongside those for the two cumulative schemes 'Land at Toton East' and 'Land at Toton North'). The locations of the existing sensitive receptors are illustrated in Figure 10.1 and the predicted pollutant concentrations are outlined below. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22).

NO_2 concentrations

The predicted NO_2 concentrations are provided in Table A10.20 below for both the DM and IC-DS scenarios. The impact descriptor at each individual existing sensitive receptor, in accordance with the EPUK/IAQM Guidance, is also provided. The long term AQAL for assessment of exceedance of the annual mean AQO is 40 µg/m^3. The short term AQAL for assessment of the 1-hour mean NO_2 AQO is 60 µg/m^3. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22).

Table A10.20: Predicted operational phase impacts on annual mean and 1-hour mean NO_2 concentrations at existing sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m^3)	IC-DS Scenario (µg/m^3)	Difference expressed as % long-term AQAL	Concentration in IC-DS (2030) as % long-term AQAL	Concentration in IC-DS (2030) as % short-term AQAL	Impact Descriptor		Short-term (ST) or long-term (LT) receptor?
R1	1.5	15.2	15.4	0.7	38.6	25.7	Adverse	Negligible	LT/ST
R2	1.5	14.3	14.6	0.6	36.5	24.3	Adverse	Negligible	LT/ST
R3	1.5	12.0	12.2	0.4	30.4	20.3	Adverse	Negligible	LT/ST
R4	1.5	13.0	13.2	0.5	33.0	22.0	Adverse	Negligible	LT/ST
R5	1.5	13.6	13.8	0.6	34.6	23.1	Adverse	Negligible	LT/ST
R6	1.5	12.5	12.7	N/A	N/A	21.1	n/a	n/a	ST
R7	1.5	12.0	12.2	0.5	30.4	20.3	Adverse	Negligible	LT/ST
R8	1.5	11.5	11.6	0.4	29.1	19.4	Adverse	Negligible	LT/ST
R9	1.5	13.9	14.1	0.6	35.3	23.5	Adverse	Negligible	LT/ST
R10	1.5	15.6	15.9	0.7	39.8	26.5	Adverse	Negligible	LT/ST
R11	1.5	14.5	14.7	0.4	36.8	24.5	Adverse	Negligible	LT/ST
R12	1.5	15.4	15.5	0.3	38.8	25.9	Adverse	Negligible	LT/ST

ID	Height (m)	DM Scenario (µg/m^3)	IC-DS Scenario (µg/m^3)	Difference expressed as % long-term AQAL	Concentration in IC-DS (2030) as % long-term AQAL	Concentration in IC-DS (2030) as % short-term AQAL	Impact Descriptor		Short-term (ST) or long-term (LT) receptor?
R13	1.5	14.7	14.8	0.2	37.1	24.7	Adverse	Negligible	LT/ST
R14	1.5	15.7	15.9	0.5	39.8	26.5	Adverse	Negligible	LT/ST
R15	1.5	12.7	12.9	0.3	32.2	21.4	Adverse	Negligible	LT/ST
R16	1.5	12.8	12.9	0.4	32.4	21.6	Adverse	Negligible	LT/ST
R17	1.5	12.4	12.6	0.4	31.4	20.9	Adverse	Negligible	LT/ST
R18	1.5	14.0	14.3	0.6	35.7	23.8	Adverse	Negligible	LT/ST
R19	1.5	11.4	11.5	0.3	28.7	19.1	Adverse	Negligible	LT/ST
R20	1.5	12.0	12.2	0.4	30.4	20.3	Adverse	Negligible	LT/ST
R21	1.5	11.4	11.6	0.4	28.9	19.3	Adverse	Negligible	LT/ST
R22	1.5	11.2	11.3	0.2	18.8	18.8	n/a	n/a	ST
R23	4.4	10.8	10.9	0.3	27.2	18.2	Adverse	Negligible	LT/ST
R24	1.5	15.1	15.4	0.6	38.5	25.7	Adverse	Negligible	LT/ST
R25	1.5	11.8	11.9	0.3	29.7	19.8	Adverse	Negligible	LT/ST
R26	1.5	12.7	12.8	0.4	32.1	21.4	Adverse	Negligible	LT/ST
R27	1.5	12.5	12.6	0.4	31.5	21.0	Adverse	Negligible	LT/ST
R28	1.5	11.9	12.1	0.4	30.2	20.1	Adverse	Negligible	LT/ST
R29	1.5	11.2	11.3	0.4	28.3	18.9	Adverse	Negligible	LT/ST
R30	1.5	14.9	15.1	0.5	37.6	25.1	Adverse	Negligible	LT/ST
R31	1.5	11.7	11.8	0.4	29.6	19.7	Adverse	Negligible	LT/ST
R32	1.5	13.1	13.4	0.8	33.6	22.4	Adverse	Negligible	LT/ST

Notes:

n/a = not applicable

PM_{10} concentrations

The predicted PM_{10} concentrations are provided in Table A10.21 for the DM and IC-DS scenarios for the existing sensitive long-term receptors where the annual mean applies (R6 and R22 excluded as short-term receptors). The impact descriptor at the 30 existing long-term sensitive receptors, in accordance with the EPUK/IAQM Guidance, is also provided. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22) and so the annual mean PM_{10} concentrations have not been reported at these two receptors.

Table A10.21: Predicted operational phase impacts on annual mean PM_{10} concentrations at existing long-term sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m³)	IC-DS Scenario (µg/m³)	Difference expressed as % AQAL (40 µg/m³)	Concentration in IC-DS 2030 as % of AQAL	No. of days in exceedance of 50 µg/m³	Impact Descriptor	
R1	1.5	18.0	18.2	0.5	45.6	2	Adverse	Negligible
R2	1.5	17.1	17.3	0.4	43.2	1	Adverse	Negligible
R3	1.5	15.6	15.7	0.3	39.1	0	Adverse	Negligible
R4	1.5	15.8	15.9	0.3	39.8	0	Adverse	Negligible
R5	1.5	16.8	16.9	0.5	42.3	1	Adverse	Negligible
R7	1.5	15.2	15.3	0.4	38.3	0	Adverse	Negligible
R8	1.5	14.8	14.9	0.3	37.3	0	Adverse	Negligible
R9	1.5	16.7	16.8	0.3	42.0	1	Adverse	Negligible
R10	1.5	15.6	15.7	0.3	39.2	0	Adverse	Negligible
R11	1.5	16.9	17.0	0.2	42.6	1	Adverse	Negligible
R12	1.5	17.3	17.4	0.2	43.4	1	Adverse	Negligible
R13	1.5	16.8	16.9	0.1	42.2	1	Adverse	Negligible
R14	1.5	17.4	17.5	0.4	43.8	1	Adverse	Negligible
R15	1.5	15.2	15.3	0.2	38.3	0	Adverse	Negligible
R16	1.5	15.0	15.1	0.3	37.7	0	Adverse	Negligible
R17	1.5	14.7	14.8	0.3	37.0	0	Adverse	Negligible
R18	1.5	15.5	15.7	0.4	39.2	0	Adverse	Negligible
R19	1.5	13.9	14.0	0.2	34.9	0	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m³)	IC-DS Scenario (µg/m³)	Difference expressed as % AQAL (40 µg/m³)	Concentration in IC-DS 2030 as % of AQAL	No. of days in exceedance of 50 µg/m³	Impact Descriptor	
R20	1.5	14.1	14.3	0.3	35.6	0	Adverse	Negligible
R21	1.5	13.7	13.8	0.3	34.5	0	Adverse	Negligible
R23	4.4	13.2	13.3	0.2	33.2	0	Adverse	Negligible
R24	1.5	16.6	16.8	0.5	41.0	1	Adverse	Negligible
R25	1.5	14.7	14.8	0.2	37.0	0	Adverse	Negligible
R26	1.5	15.6	15.7	0.3	39.2	0	Adverse	Negligible
R27	1.5	14.5	14.6	0.3	36.4	0	Adverse	Negligible
R28	1.5	14.0	14.2	0.3	35.4	0	Adverse	Negligible
R29	1.5	13.5	13.6	0.2	34.0	0	Adverse	Negligible
R30	1.5	16.9	17.0	0.2	42.5	1	Adverse	Negligible
R31	1.5	15.4	15.6	0.3	38.9	0	Adverse	Negligible
R32	1.5	15.0	15.2	0.6	38.0	0	Adverse	Negligible

$PM_{2.5}$ concentrations

The predicted annual mean $PM_{2.5}$ concentrations are provided in Table A10.22 for the DM and IC-DS scenarios for the existing sensitive long-term receptors where the annual mean applies (R6 and R22 excluded as short-term receptors). The impact descriptor at the 30 existing sensitive long-term receptors, in accordance with the EPUK/IAQM Guidance, is also provided. The long term AQAL for assessment of exceedance of the annual mean AQO is 20 µg/m³. Only the short-term objective for NO_2 (1-hour mean AQO) applies at the two existing sensitive commercial receptors (R6 and R22) and so the annual mean $PM_{2.5}$ concentrations have not been reported at these two receptors.

Table A10.22: Predicted operational phase impacts on annual mean $PM_{2.5}$ concentrations at existing long-term sensitive receptors in 2041 using 2030 emissions factors and background concentrations.

ID	Height (m)	DM Scenario (µg/m³)	IC-DS Scenario (µg/m³)	Difference expressed as % AQAL (20 µg/m³)	Concentration in IC-DS 2030 as % of AQAL	Impact Descriptor	
R1	1.5	9.6	9.7	0.6	48.5	Adverse	Negligible
R2	1.5	9.1	9.2	0.4	46.1	Adverse	Negligible
R3	1.5	8.3	8.3	0.3	41.6	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m^3)	IC-DS Scenario (µg/m^3)	Difference expressed as % AQAL (20 µg/m^3)	Concentration in IC-DS 2030 as % of AQAL	Impact Descriptor	
R4	1.5	8.5	8.5	0.3	42.6	Adverse	Negligible
R5	1.5	8.9	9.0	0.5	44.9	Adverse	Negligible
R7	1.5	8.4	8.5	0.4	42.2	Adverse	Negligible
R8	1.5	8.2	8.2	0.3	41.2	Adverse	Negligible
R9	1.5	8.9	9.0	0.4	44.9	Adverse	Negligible
R10	1.5	8.8	9.0	0.3	44.3	Adverse	Negligible
R11	1.5	9.0	9.0	0.2	45.3	Adverse	Negligible
R12	1.5	9.2	9.2	0.2	46.1	Adverse	Negligible
R13	1.5	9.0	9.0	0.1	45.0	Adverse	Negligible
R14	1.5	9.5	9.6	0.4	48.0	Adverse	Negligible
R15	1.5	8.4	8.5	0.3	42.4	Adverse	Negligible
R16	1.5	8.5	8.5	0.3	42.7	Adverse	Negligible
R17	1.5	8.3	8.4	0.3	41.9	Adverse	Negligible
R18	1.5	8.8	8.9	0.4	44.3	Adverse	Negligible
R19	1.5	7.9	8.0	0.2	39.8	Adverse	Negligible
R20	1.5	8.0	8.1	0.3	40.4	Adverse	Negligible
R21	1.5	7.8	7.9	0.3	39.3	Adverse	Negligible
R23	1.5	7.6	7.6	0.2	37.9	Adverse	Negligible
R24	1.5	9.0	9.1	0.6	45.3	Adverse	Negligible
R25	1.5	8.1	8.2	0.2	40.9	Adverse	Negligible
R26	1.5	8.4	8.5	0.3	42.4	Adverse	Negligible
R27	1.5	8.2	8.3	0.3	41.3	Adverse	Negligible
R28	1.5	8.0	8.1	0.3	40.2	Adverse	Negligible
R29	1.5	7.7	7.8	0.2	38.8	Adverse	Negligible

ID	Height (m)	DM Scenario (µg/m^3)	IC-DS Scenario (µg/m^3)	Difference expressed as % AQAL (20 µg/m^3)	Concentration in IC-DS 2030 as % of AQAL	Impact Descriptor	
R30	1.5	9.0	9.1	0.3	45.3	Adverse	Negligible
R31	1.5	8.2	8.3	0.3	41.4	Adverse	Negligible
R32	1.5	8.5	8.6	0.6	42.9	Adverse	Negligible