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AIR QUALITY ASSESSMENT

PROPOSED EXTENSION

OXFORD BIOMEDICA, OXFORD

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WHP ENGINEERING LTD

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CONTENTS

1 INTRODUCTION 1

2 LEGISLATION AND POLICY 3

3 SCOPE AND METHODOLOGY 10

4 BASELINE 14

5 ASSESSMENT 16

6 MITIGATION AND RESIDUAL EFFECTS 23

7 CONCLUSIONS 26

FIGURES

Figure 1 Site Location and Assessment Extents 27
Figure 2 Modelled Road and Receptor Locations 27
Figure 3 Wind Rose of 2019 Benson Meteorological Data 27

APPENDICES

APPENDIX A - REPORT LIMITATIONS

APPENDIX B - GLOSSARY

APPENDIX C – IAQM CONSTRUCTION DUST ASSESSMENT METHODOLOGY

APPENDIX D – MODEL INPUT PARAMETERS

1 INTRODUCTION

1.1 Overview

1.1.1 NoiseAir Limited has been commissioned to undertake an Air Quality Assessment (AQA) in support of a planning application for a proposed extension at Oxford Biomedica, Oxford.

1.1.2 The Proposed Development has the potential to cause air quality impacts as a result of fugitive dust emissions during construction and road traffic exhaust emissions associated with vehicles travelling to and from the Site during operation. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and assess potential effects as a result of the scheme.

1.1.3 Limitations of this report are outlined in **Appendix A**.

1.2 Site Location and Context

1.2.1 The Site is located at Oxford Biomedica, Oxford, at approximate National Grid Reference (NGR): 454715, 204285.

1.2.2 The Site is located in an area where air quality is mainly influenced by road traffic emissions along the local road network and as such, elevated pollutant concentrations may be experienced in this area. Subsequently, the Proposed Development may lead to adverse impacts at nearby sensitive receptors as a result of fugitive dust emissions during construction and road vehicle exhaust emissions during operation. As such, an AQA is required to determine baseline conditions at the Site, consider its suitability for the proposed use and to assess potential impacts associated with the Proposed Development in accordance with the requirements of the National Planning Policy Framework (NPPF).

1.2.3 The Proposed Development is located within the jurisdiction of Oxford City Council (OCC). The Site is occupied by Oxford Biomedica. The Site is bound to the east by Alec Issigonis Way and commercial properties, to the south by Garsington Road, to the north by residential dwellings and to the west by Hollow Way.

1.2.4 The report presents the findings of an assessment of the potential air quality impacts of the Proposed Development during the operational and construction phases. The type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these described.

1.2.5 The standard limitations associated with this assessment are presented in **Appendix A**.

1.2.6 A glossary of terms used in this report is provided in **Appendix B**.

2 LEGISLATION AND POLICY

2.1 Air Quality Legislation and Policy

2.1.1 A summary of the relevant air quality legislation and policy is provided below.

UK Air Quality Strategy

2.1.2 The government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)[1] with the latest framework for Local Authority delivery within England published in 2023[2]. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union Legislation.

2.1.3 The AQS also sets standards and objectives for nine key pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs).

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

2.1.5 The Air Quality Objectives (AQOs) are medium-term policy-based targets set by the Government, which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to EPAQS recommended standards or WHO guideline limits, whereas other involve a margin of tolerance, i.e. a limited number of permitted exceedances of standards over a given period.

2.1.6 **Table 1** presents the AQOs for pollutants considered within this assessment.

Table 1: National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health

Pollutant	Applies to	Objective	Measured As
NO_2	UK	40µg/m^3	Annual mean

[1] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2).
[2] Department for Environment, Food and Rural Affairs (Defra, 2023) Policy paper Air quality strategy: framework for local authority delivery [Online] Available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england/air-quality-strategy-framework-for-local-authority-delivery#introduction [Accessed 09/10/2023].

Table 1: National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health			
	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
PM_{10}	UK (except Scotland)	40µg/m^3	Annual mean
	UK (except Scotland)	50µg/m^3 not to be exceeded more than 35 times a year	24-hour mean
$PM_{2.5}$	UK (except Scotland)	Interim target 12µg/m^3 by 2028 Target of 22% reduction in population exposure by 2028 compared to 2018	Annual mean

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

Air Quality Regulations (2016)

2.1.8 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] for the purpose of Local Air Quality Management (LAQM).

2.1.9 These Regulations require that likely exceedances of the AQS objectives are assessed in relation to:

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

2.1.10 The Air Quality Standards (Amendment) Regulations 2016[5] amends the Air Quality Standards Regulations 2010 that transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10},

[3] The Air Quality (England) Regulations 2000 – Statutory Instrument 2000 No.928.
[4] The Air Quality (England) (Amendment) Regulations 2002 – Statutory Instrument 2002 No.3043.
[5] The Air Quality Standards (Amendment) Regulations 2016 - Statutory Instrument 2016 No. 1184.

$PM_{2.5}$ and NO_2. The limit values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS objectives and the limit value for $PM_{2.5}$ is an interim target concentration of 12µg/m^3 by 2028.

Environmental Protection Act 1990 – Control of Dust and Particles Associated with Construction

2.1.11 Section 79 of the Environmental Protection Act 1990[6] gives the following definitions of statutory nuisance relevant to dust and particles:

> *'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance'; and*
>
> *'Any accumulation or deposit which is prejudicial to health or a nuisance'.*

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

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

Environment Act 1995

2.1.14 Under Part IV of the Environment Act 1995[7], local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

[6] Environmental Protection Act. London 1990. HMSO.
[7] Environment Act 1995. London HMSO.

Clean Air Strategy (2019)

2.1.15 In 2019, the UK government released its Clean Air Strategy 2019[8], part of its 25 Year Environment Plan[9]. The Strategy sets out the comprehensive action that is considered to be required from across all parts of government and society.

2.1.16 The primary focus of air quality management has primarily related to NO_2, and its principal source in the UK, road traffic. The 2019 Strategy aims to broaden the focus to other areas, including actions on clean growth, and emissions from domestic wood burning stoves, industry and agriculture.

2.2 Planning Policy

2.2.1 A summary of the national and local planning policy relevant to the Proposed Development and air quality is provided below.

National Planning Policy Framework (2023)

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

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

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

2.2.4 In relation to air quality, the following paragraphs in the document are relevant:

- Paragraph 55, which 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.';

[8] Department for Environment, Food and Rural Affairs (2019) Clean Air Strategy 2019.
[9] Department for Environment Food and Rural Affairs (Defra) (2018) A Green Future: Our 25 Year Plan to Improve the Environment.
[10] Ministry of Housing, Communities & Local Government (2023) National Planning Policy Framework.

- Paragraph 105, which states 'The planning system should actively manage patters 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.';
- Paragraph 174, which 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 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 185, which 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 186, which states '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.'; and
- Paragraph 188, which states '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'.

2.2.5 These were reviewed and the relevant guidance considered as necessary throughout the undertaking of the assessment.

Local Planning Policy

Oxford City Council Air Quality Action Plan 2021 - 2025 (AQAP)

2.2.6 The Air Quality Action Plan 2021-2025[11] has been produced by OCC, as required by the Local Air Quality Management framework, and aims to improve air quality across Oxford.

2.3 Guidance

2.3.1 A summary of the publications referred to in undertaking this assessment is provided below.

Local Air Quality Management Review and Assessment Technical Guidance (2022)

2.3.2 The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their review and assessment work[12]. This guidance, referred to in this document as LAQM.TG22, has been used where appropriate in the assessment presented herein.

Land-Use Planning & Development Control: Planning for Air Quality (2017)

2.3.3 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance[13] that offers comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures that may be implemented to minimise these impacts.

Guidance on the Assessment of Dust from Demolition and Construction (2023)

2.3.4 This document[14] published by the IAQM was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

[11] OCC (2021). Oxford City Council Air Quality Action Plan 2021 - 2025.
[12] Department for Environment, Food and Rural Affairs (Defra) (2021) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG22.
[13] Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017) Land Use Planning & Development Control: Planning for Air Quality.
[14] Institute of Air Quality Management (Version 2.1 Updated August 2023) Guidance on the Assessment of Dust from Demolition and Construction.

National Planning Practice Guidance – Air Quality (2019)

2.3.5 This guidance[15] provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, it explains how much detail air quality assessments need to include for proposed developments, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by local authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

[15] Department of Communities and Local Government (DCLG) (Updated November 2019) National Planning Practice Guidance.

3 SCOPE AND METHODOLOGY

3.1 Scope

3.1.1 The scope of the assessment has been determined in the following way:

- A review of the Masterplan of the Proposed Development;
- Desktop study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality; and
- Review of OCC's latest available Air Quality Annual Status Report[16] (ASR) and air quality data surrounding the Site including data from Defra[17] and the Environment Agency (EA)[18].

3.1.2 The scope of the assessment includes consideration of the potential impact on local air quality resulting from:

- Dust and particle matter generated by on-site activities during the construction phase;
- Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant; and
- Increases in pollutant concentrations as a result of exhaust emissions arising from traffic generated by the Proposed Development once operational.

3.2 Construction Phase Assessment

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

3.2.2 The smaller particles of dust, known as particulate matter (PM), with less than 10μm in aerodynamic diameter (PM_{10}) representing only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5μm). As these particles are at the smaller end of the size range of dust particles, they remain

[16] OCC 2022 Air Quality Annual Status Report 2023.
[17] Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) Support Pages [Online] Available at https://laqm.defra.gov.uk/ [Accessed 09/10/2023]
[18] Department for Environment, Food and Rural Affairs (Defra, 2022) Pollution Inventory [Online] Available at https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory [Accessed 09/10/2023]

suspended in the atmosphere for a longer period of time than the larger dust particles, they can therefore be transported by wind over a wider area. $PM_{2.5}$ are small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health. However, it is worth noting that, according to the IAQM guidance, the majority of fugitive particulate emissions arising from construction sites are expected to relate to the coarser fractions (i.e. $PM_{2.5-10}$) with just 10-15% expected to comprise $PM_{2.5}$. The IAQM guidance therefore focusses on PM_{10} for the purposes of assessment.

3.2.3 An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for this phase of the Proposed Development provided by the Client and/or Project Team; and, the professional judgement of the NoiseAir team.

3.2.4 The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition, earthworks, construction and trackout. It considers the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in PM_{10} levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been identified, the significance of residual effects can be determined. A summary of the IAQM assessment methodology is provided in **Appendix C**.

3.2.5 In addition to the impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the application Site and in the vicinity of the application Site itself. As information on the number of vehicles and plant associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and considering the following:

- The number and type of construction traffic and plant likely to be generated by this phase of the Proposed Development;
- The number and proximity of sensitive receptors to the application Site and along the likely routes to be used by construction vehicles; and,
- The likely duration of the construction phase and the nature of the construction activities undertaken.

3.3 Operational Phase Assessment

3.3.1 The Proposed Development has the potential to expose existing and future receptors to air quality issues.

3.3.2 The EPUK & IAQM guidance sets out two stages for determining when an assessment of potential impacts on the local area is likely to be necessary. The Stage 1 criteria for an air quality assessment is presented below:

A. If any of the following apply:

- 10 or more residential units or a site area of more than 0.5ha; or,
- More than 1,000 m^2 of floor space for all other uses or a site area greater than 1ha.

B. Coupled with any of the following:

- The development has more than 10 parking spaces; or,
- The development will have a centralised energy facility or other centralised combustion process.

3.3.3 Should these criteria not be met, then the EPUK and IAQM guidance considers air quality impacts associated with a scheme to be negligible and no further assessment is required. Should the criteria be met or exceeded, proceed to Stage 2. Stage 2 of the EPUK & IAQM guidance document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:

- Proposals that will cause a change in Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA or more than 500 elsewhere;
- Proposals that will cause a change in Heavy Duty Vehicle (HDV) flows of more than 25 AADT within or adjacent to an AQMA or more than 100 elsewhere;
- Proposals that would realign roads within an AQMA by more than 5m;
- Proposals that will introduce new junctions or remove existing junctions near relevant receptors; and
- Proposals that will introduce or change a bus station or change flows of buses by more than 25 AADT within an AQMA or more than 100 AADT elsewhere;
- Proposals which will include an underground car park with extraction system which will be within 20m of a relevant receptor and have more than 100 movements per day;
- Proposals which include either a centralised plant using biofuel, a combustion plant with single or thermal input >300KWh or a standby emergency generator associated with a centralised energy centre; and

- Proposals which include combustion processes of any size.

3.3.4 Should these criteria not be met, then the EPUK and IAQM guidance documents consider air quality impacts associated with a scheme to be not significant and no further assessment is required.

3.3.5 Should screening of the above indicate that any of the criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the predicted change in pollutant concentrations as a result of the proposed development.

3.3.6 The significance of predicted impacts can then be determined in accordance with the methodology outlined in the EPUK and IAQM guidance.

3.4 Significance Criteria

Construction Phase

3.4.1 The IAQM assessment methodology recommends that significance criteria is only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

3.4.2 For the assessment of the impact of exhaust emissions from plant used on-site and construction vehicles accessing and leaving the Site on local concentrations of NO_2 and particulate matter; the significance of residual effects has been determined using professional judgement and the principles outlined in the IAQM guidance, which are described below.

Operational Phase

3.4.3 The approach provided in the EPUK & IAQM guidance has been used within this assessment to assist in describing the air quality effects of additional emissions from traffic generated by the Proposed Development once operational.

Future Exposure

3.4.4 The Proposed Development is a biotechnology facility and so annual mean AQOs will not apply to future users as the Site is an employment site.

4 BASELINE

4.1 Introduction

4.1.1 Existing air quality conditions in the vicinity of the Site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

4.2 Local Air Quality Management

4.2.1 As required by the Environment Act (1995), as amended by the Environment Act (2021), OCC undertake annual review and assessment of air quality within their area of jurisdiction. In 2022, OCC monitored NO_2 through a network of 126 non-automatic monitoring locations. OCC also undertook automatic monitoring at three locations.

4.2.2 An AQMA was declared in 2010 covering the whole City, for measured exceedances of the annual mean and 1-hour mean NO_2 AQOs. The Site is located within this AQMA.

4.3 Air Quality Monitoring

4.3.1 Monitoring of pollutant concentrations is undertaken by OCC throughout their area of jurisdiction. Local authority monitoring data from locations in the vicinity of the Site are presented below in **Table 2**.

Table 2: Monitoring Results – NO_2

Monitoring Site Name	Site Type	Distance to Site (m)	Monitored NO_2 Concentration (µg/m^3)			
			2019	2020	2021	2022
DT7	Roadside	175	32	27	30	30
DT8	Roadside	295	31	24	29	29
DT80	Roadside	10	37	31	35	34

4.3.2 As shown in **Table 2** the annual mean AQO for NO_2 was not exceeded at any local authority monitoring locations close to the Site in recent years. It should be noted that 2019 is considered the last year for which 'normal' monitoring data is available before the impacts of the Covid-19 pandemic on travel behaviours.

4.4 Background Pollutant Concentrations

4.4.1 Predictions of background pollutant concentrations on a 1 km-by-1 km basis have been produced by DEFRA for the entire of the UK to assist local authorities in their review and assessment of air quality. The proposed site is located in grid square 454500, 204500. Data for this location for 2019, the Baseline year, and 2025, the anticipated opening year, was downloaded from the DEFRA website[19] and is summarised in **Table 3**.

Table 3: Predicted Background Pollutant Concentrations

OS Grid Reference (X, Y; m)	Predicted Background Pollutant Concentration (µg/m^3)					
	2019			2025		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
454500, 204500	15.7	16.1	11.1	12.9	14.9	10.2

Rounded to 1 d.p.

4.4.2 As shown in **Table 3**, predicted background NO_2, PM_{10} and $PM_{2.5}$ concentrations are below the relevant AQOs across the assessment extents in both the baseline year and the anticipated opening year.

[19] Department for Environment, Food and Rural Affairs (Defra) (2023) Background Concentrations [Online] Available at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018 [Accessed on 09/10/2023].

5 ASSESSMENT

5.1 Introduction

5.1.1 There is the potential for air quality impacts as a result of the construction and operation of the Proposed Development. These are assessed in the following sections.

5.2 Construction Phase Assessment

5.2.1 Construction activities have the potential to generate and/ or re-suspend dust and PM_{10} sources include:

- Site clearance and preparation including demolition activities;
- Preparation of temporary access/ egress to the Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Site (including excavators and dumper trucks);
- Use of crushing and screening equipment/ plant;
- Exhaust emissions from plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hard standing alongside fabrication processes;
- Internal and external finishing and refurbishment;
- Trackout, whereby earth is carried from the Site on vehicle tyres, deposited on roads and may later become suspended in the air as a result of vehicle movements; and
- Site landscaping after completion.

5.2.2 The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g., exposed soil produced from significant earthworks activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Assessment of Potential Dust Emission Magnitude

5.2.3 The IAQM methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources:

- Demolition;
- Earthworks;
- Construction; and

- Trackout.

5.2.4 The findings of the assessment are presented below.

Demolition

5.2.5 There will be no demolition required onsite. As such, the dust emissions associated with the demolition stage can be considered **negligible** and do not need to be assessed further in this report.

Earthworks

5.2.6 The area of the Proposed Development site is less than 18,000m^2. As such, the dust emissions associated with the earthworks stage can be considered **small**.

Construction

5.2.7 The Proposed Development comprises a two-storey extension to the existing building. The total building volume to be constructed is estimated to be less than 12,000m^3. As such, the dust emissions associated with the construction stage can be considered **small**.

Trackout

5.2.8 Information on the number of HDVs associated with this phase of the Proposed Development is not available and therefore professional judgement has been used. It has been assumed that given the size of the Proposed Development area and what is required to be done to enable the proposals, there are likely to be less than 10 HDV outward movements in any one day. In addition, there will be little to no unpaved area on Site. Resultantly, it can be considered that the potential dust emission magnitude is **small** for trackout.

5.2.9 **Table 4** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 4: Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	-
Earthworks	Small
Construction	Small
Trackout	Small

Assessment of Sensitivity of the Study Area

5.2.10 The prevailing wind in the area is predominantly from the south. Therefore, receptors located to the north of the Site are more likely to be affected by dust and particulate matter emitted and re- suspended during the construction phase.

5.2.11 Under lower wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. Receptors north of the Site are expected to be affected the most as a result of the prevailing wind direction.

5.2.12 There are no ecological receptors within 50 m of the Site boundary or access route, or within 50 m of the Site entrance as identified using Multi Agency Geographic Information for the Countryside (MAGIC) website[20]. The closest ecological receptor to the Site is the Lye Valley Site of Special Scientific Interest (SSSI) which is located more than 1.7km north of the Site. As such, ecological impacts have not been assessed further within this report.

5.2.13 Taking the above into account and following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown below, in **Table 5**.

Table 5: Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	-	High	High	High
Human Health	-	Low	Low	Medium

Risk of Impacts

5.2.14 The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation **Table 6** below provides a summary of the risk of dust impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 6: Summary Dust Risk Table Defining Site Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	-	Low	Low	Low

[20] Department for Environment, Food and Rural Affairs (Defra) (2022) Multi-Agency Geographic Information for the Countryside (MAGIC) [Online] https://magic.defra.gov.uk/ [Accessed on 09/10/2023]

Table 6: Summary Dust Risk Table Defining Site Specific Mitigation				
Human Health	-	Negligible	Negligible	Negligible

Construction Vehicles and Plant

5.2.15 The greatest impact on air quality is emissions from vehicles and plant associated with the construction phase, and these impacts will be the most severe in the areas immediately adjacent to the Site access road. Construction traffic will access the Site via Garsington Road and the existing Site entrance on Alec Issigonis Way. It is considered likely that the construction traffic will be low in comparison to the existing traffic flows on these roads.

5.2.16 Final details of the exact plant and equipment likely to be used on-site will be determined by the appointed contractor, it is considered likely to comprise dump trucks, tracked excavators, diesel generators, asphalt sweaters, rollers, compressors and trucks. The number of plant and their location within the Site are likely to be variable over the construction.

5.2.17 Based on the current air quality in the area and the likely numbers of construction vehicles and plant that will be used during the construction phase, the impacts of construction vehicles and plant on local air quality are considered to be **negligible** according to the assessment significance criteria.

5.3 Operational Phase Assessment

5.3.1 Vehicle movements associated with the operation of the Proposed Development will generate exhaust emissions on the local and regional road networks. The project's Transport Consultants provided traffic data for the assessment. This indicated the development is expected to generate 605 AADT LDV trips and 8 AADT HGV trips on local road links.

5.3.2 As the Proposed Development is expected to produce more than 100 AADT LDVs on surrounding local roads, in an AQMA, a detailed assessment of the operational phase impacts on nearby receptors is required.

5.3.3 The 2025 ‘Without Development’ Scenario included anticipated baseline traffic data, inclusive of anticipated growth, for the relevant assessment year.

5.3.4 The 2025 ‘With Development’ Scenario included anticipated baseline traffic data, inclusive of anticipated growth, for the relevant assessment year in addition to predicted vehicle trips associated with the operation of the Proposed Development.

5.3.5 For the purpose of the assessment traffic data for 2025 was utilised as the development opening year. Air quality is predicted to improve in the future based on expected reduction in roadside levels as a result of improving technologies. to provide a robust assessment, background concentrations and emission factors from 2019 were utilised within the dispersion model. The use of 2025 traffic data and 2019 emission factors and background concentrations is considered to provide a worse- case scenario and therefore a sufficient level of confidence can be placed within the predicted pollutant concentrations.

5.3.6 Details of the existing sensitive receptors modelled in the assessment are included in **Table 7** below.

Table 7: Modelled Receptors and description

Receptor ID	Description
ER1	Residential - B480 Garsington Road
ER2	Residential - B480 Garsington Road
ER3	Residential - B4495 Hollow Way
ER4	Residential - B4495 Hollow Way
ER5	Residential - B4495 Hollow Way
ER6	Residential - B4495 Hollow Way
ER7	Our Lady's Catholic Primary School
ER8	Residential - B480 Oxford Road
ER9	Residential - B480 Oxford Road
ER10	Residential - B480 Oxford Road
ER11	Residential - B480 Oxford Road
ER12	Residential - B480 Oxford Road
ER13	Residential - B480 Oxford Road
ER14	Residential - Between Towns Road
ER15	Residential - Between Towns Road
ER16	Residential - Between Towns Road
ER17	Residential - Between Towns Road

Road Vehicle Exhaust Emission Impacts

5.3.7 Full results of the dispersion modelling and verification process are presented in **Appendix D**, with a summary provided below.

Nitrogen Dioxide – Annual Mean

5.3.8 Annual mean NO_2 concentrations were not predicted to exceed the AQO of 40µg/m^3 at any of the 17 modelled existing receptor locations. In 2025, the anticipated opening year of the

Proposed Development, the highest predicted concentration is at receptor ER3 (B4495 Hollow Way), with a concentration of 38.98µg/m^3 in the 'With Development' scenario. The maximum predicted increase as a result of the Proposed Development is 0.2µg/m^3 at ER8 and ER10.

5.3.9 All identified sensitive receptors within the assessment extents are predicted to experience a **negligible** impact on annual mean NO_2 concentrations, without the risk of exceedances, as a result of the Proposed Development.

5.3.10 Based on the extent of predicted population exposure to the impacts on annual mean NO_2 concentrations under guidance provided by EPUK & IAQM, the overall effect of the Proposed Development is considered to be **not significant**.

Nitrogen Dioxide – 1-hour Mean

5.3.11 The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3, and therefore hourly mean NO_2 concentrations are unlikely to cause a breach of the AQS objective. The impact of the Proposed Development on hourly mean NO_2 concentrations at existing sensitive receptors is considered to be **negligible**.

Particulate Matter (PM_{10}) – Annual Mean

5.3.12 Annual mean PM_{10} concentrations were predicted to be below the AQO of 40µg/m^3 at all sensitive receptor locations in each of the modelled 2025 scenarios. The highest concentration is predicted at ER3 (B4495 Hollow Way), with 19.69µg/m^3 in the 'With Development' scenario.

5.3.13 The predicted changes in annual mean PM_{10} concentrations are all less than 0.5% of the relevant AQS objective. Based on the EPUK & IAQM guidance, the impact of the increased emissions associated with the Proposed Development on annual mean PM_{10} concentrations is considered to be **negligible**.

5.3.14 Based on the extent of predicted population exposure to the impacts on annual mean PM_{10} concentrations and the guidance provided by the IAQM the overall effect of the Proposed Development is considered to be **not significant**.

Particulate Matter (PM_{10}) – 24-hour Mean

5.3.15 There has been no predicted increase in the number of days exceeding the daily PM_{10} limit in the 'With Development' scenario, without risk of exceedance of the AQS objective. As

such, the impacts of increased emissions associated with the operational phase of the Proposed Development are **negligible**.

Particulate Matter ($PM_{2.5}$) – Annual Mean

5.3.16 Annual mean $PM_{2.5}$ concentrations were predicted to be above the Interim Target of 12µg/m^3 at 16 sensitive receptor locations and below at one position in each of the 2025 modelled scenarios. It should be noted that there are no new predicted exceedences in the 'With Development' scenario when compared with the 'Without Development' scenario. The highest concentration is predicted at ER3 (B4495 Hollow Way), with 13.27µg/m^3 in the 'With Development' scenario.

5.3.17 The predicted changes in annual mean $PM_{2.5}$ concentrations are all less than 0.5% of the relevant AQS objective. Based on the EPUK & IAQM guidance, the impact of the increased emissions associated with the Proposed Development on annual mean $PM_{2.5}$ concentrations is considered to be **negligible**.

5.3.18 Based on the extent of predicted population exposure to the impacts on annual mean $PM_{2.5}$ concentrations and the guidance provided by the IAQM the overall effect of the Proposed Development is considered to be **not significant**.

Summary

5.3.19 Based on the extent of predicted population exposure to the impacts on pollutant concentrations and the guidance provided by the IAQM, the overall effect of the Proposed Development is considered to be **not significant**.

6 MITIGATION AND RESIDUAL EFFECTS

6.1 Construction Phase

6.1.1 Based on the construction phase assessment results, mitigation will be required for this phase. As the Site poses a maximum of 'Low' risk for dust impacts, the IAQM's highly recommended mitigation measures for a 'Low' risk site are presented below:

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.
- Develop and implement a Dust Management Plan, which may include measures to control other emissions, approved by the Local Authority.

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 LA upon request.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.

Monitoring

- Carry out regular site inspections, record inspection results, and make an inspection log available to the LA upon request.
- Increase the frequency of site inspections 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 PM_{10} 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 affairs commences. Further guidance is provided by IAQM demolition, earthworks and construction.

Site Preparation

- 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.
- Avoid site runoff of water or mud.

Operating/Vehicle Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel- or petrol-powered generators where possible and use mains electricity or battery powered equipment where practicable.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques.
- Ensure an adequate water supply on the site for effective dust suppression, 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 wherever appropriate.

Waste Management

- Avoid bonfires or burning of waste materials.

6.1.2 Detailed mitigation measures to control construction traffic should be discussed with the Local Authority to establish the most suitable access and haul routes for the Site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (i.e., congested roads, residential roads or unsuitable junctions for large vehicles) where possible. Construction vehicles should be kept clean through the use of wheel washers and sheeted when on public highways. Timing of large- scale vehicle movements to avoid peak hours on the local road network would also be of benefit.

6.2 Residual Effects

6.2.1 The residual effects of dust and PM_{10} generated by construction activities following the application of the mitigation measures described above and good Site practice is considered to be **not significant**.

6.2.2 The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **not significant**.

6.3 Operational Phase

Mitigation

6.3.1 The changes in pollutant concentrations attributable to traffic emissions associated with the operational phase of the Proposed Development (i.e., impacts on local air quality) are **negligible** and therefore, in accordance with the assessment criteria, mitigation is not required.

7 CONCLUSIONS

7.1.1 NoiseAir has carried out an AQA in support of a planning application for a proposed extension at Oxford Biomedica, Oxford.

7.1.2 There is the potential for the proposals to expose existing surrounding receptors to elevated pollution levels, both in terms of NO_2 and PM as a result of the operational phase. An AQA was therefore requested in order to determine the potential impact of the Proposed Development on air quality and on existing sensitive residential receptors near the Site.

7.1.3 A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Proposed Development using the IAQM methodology. This identified that there is a maximum of **Low** risk of dust soiling impacts and a **Negligible** risk of increase in particulate matter concentrations due to unmitigated construction activities for human health. However, through good site practice and the implementation of highly recommended mitigation measures, the effect of dust and particulate matter releases would be significantly reduced. The residual effects of dust and particulate matter generated by construction activities on air quality are therefore considered to be **not significant**. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **not significant**.

7.1.4 During the operational phase of the Proposed Development, there is the potential for air quality impacts from traffic exhaust emissions associated with vehicles travelling to and from the Site. These were assessed using ADMS-roads modelling software and at the worst-case location, minimal increases of 0.2µg/m^3 were observed. This shows that additional vehicles using the local road network associated with the Site has a **Negligible** impact on air quality and pollutant levels at the façade of the nearest worst case sensitive receptors.

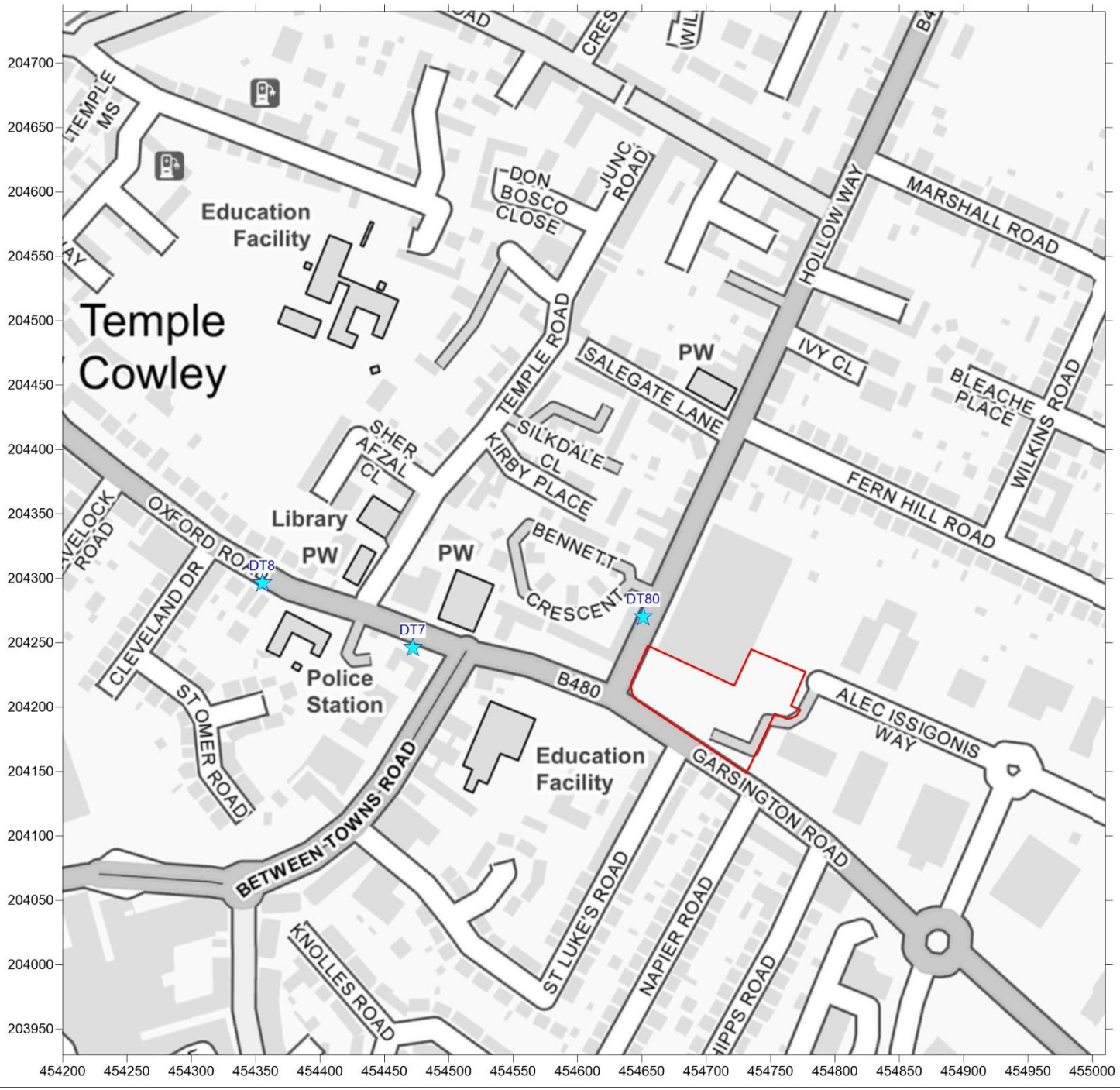
7.1.5 Based on the assessment results, following best practice guidance, air quality issues are not considered a constraint to the Proposed Development.

Figures

Figure 1 Site Location and Assessment Extents

Figure 2 Modelled Road and Receptor Locations

Figure 3 Wind Rose of 2019 Benson Meteorological Data



Legend

Site Boundary

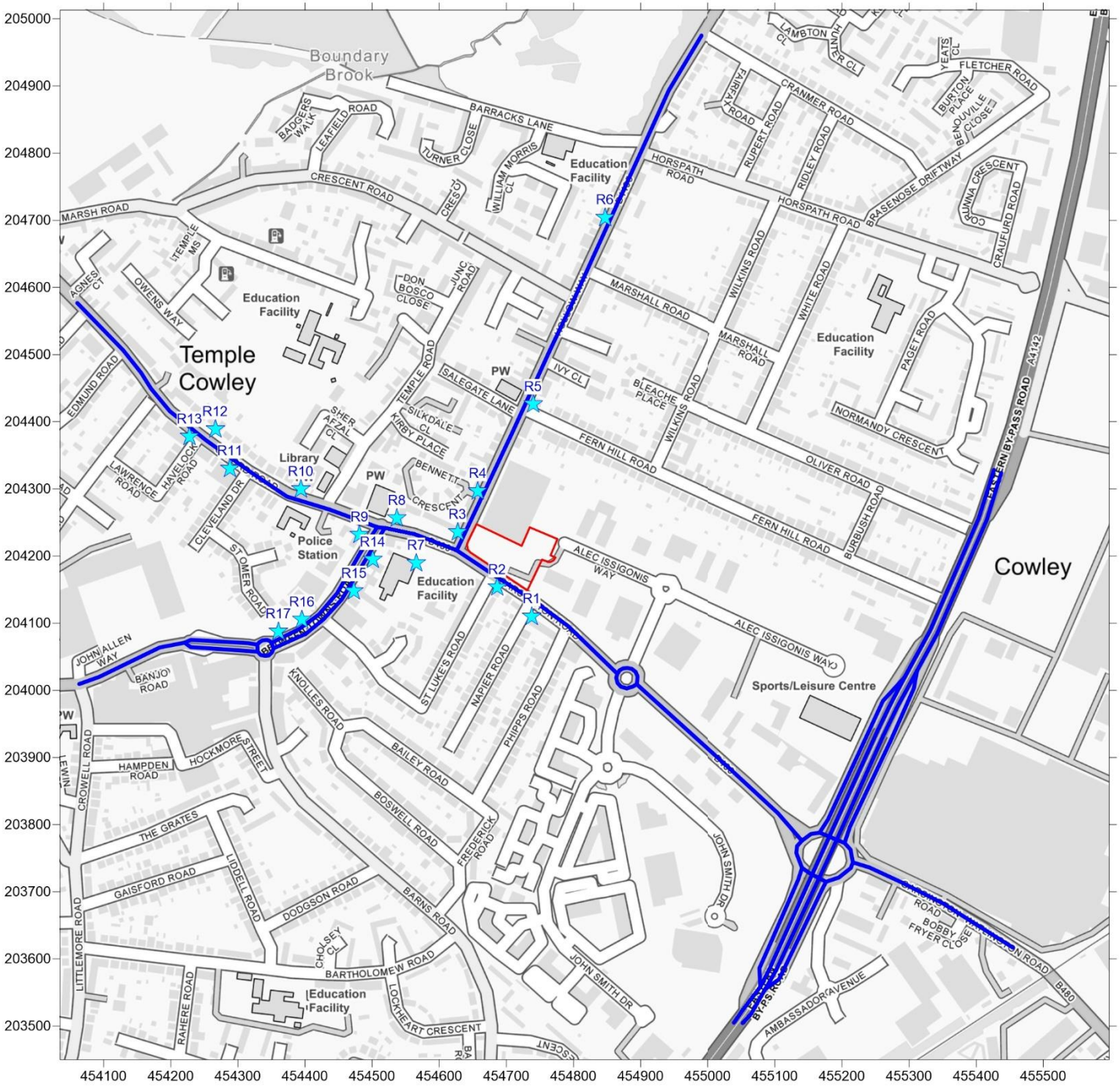
Monitor

Title

Figure 1 - Site Location and Assessment Extents

Project

Oxford Biomedica, Oxford



Legend

Site Boundary

Road Link

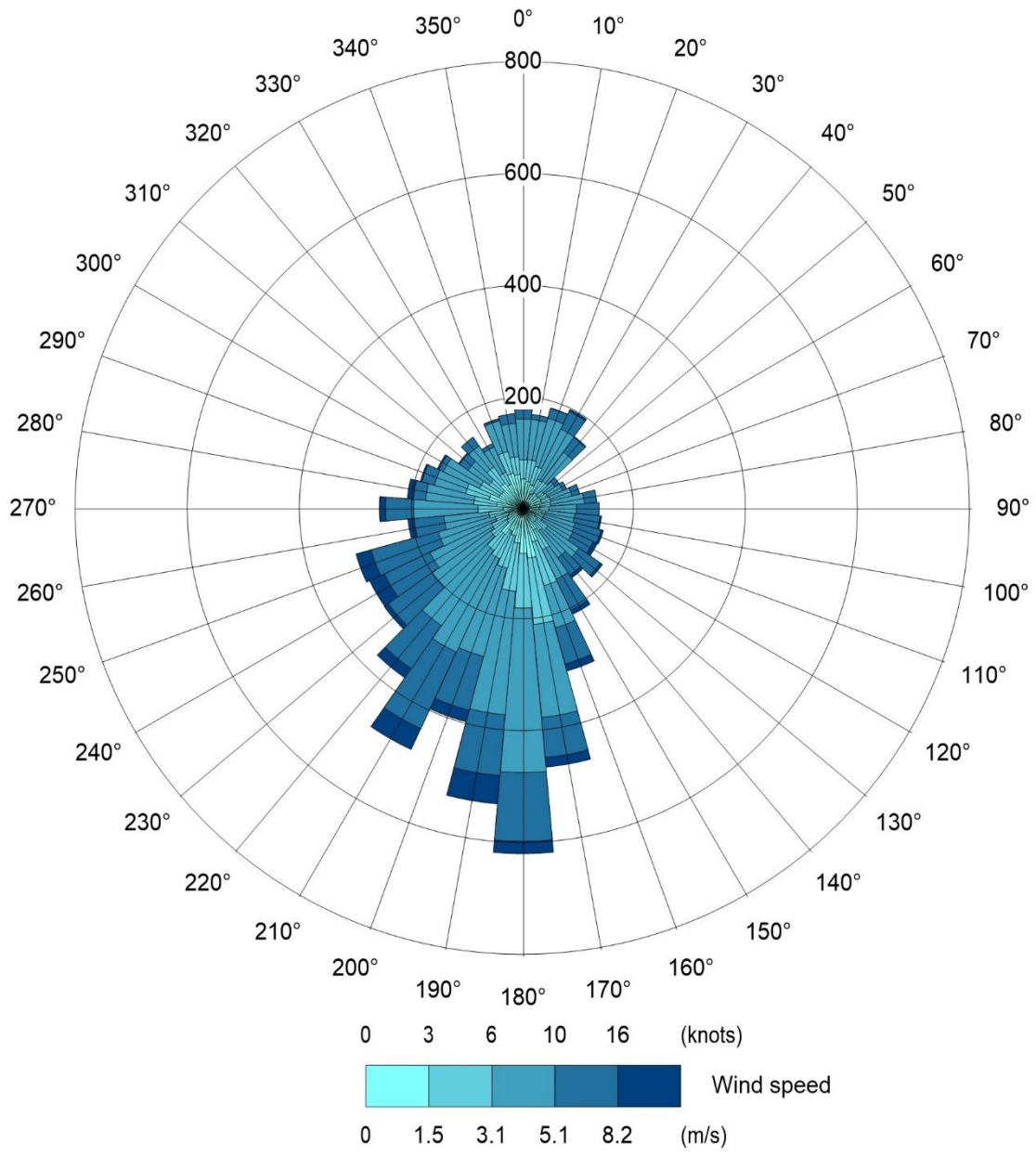
Sensitive Receptor

Title

Figure 2 - Modelled Road and Receptor Locations

Project

Oxford Biomedica, Oxford



Legend

Title

Figure 3 - Wind Rose of 2019 Benson Meteorological Data

Project

Oxford Biomedica, Oxford

APPENDIX A - REPORT LIMITATIONS

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APPENDIX B - GLOSSARY

Air Quality Management Area	An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives.
Air Quality Objective	The name given to the maximum ambient pollutant concentration that is not to be exceeded either without exception or within a permitted number of exceedances over a specified timescale for a pollutant outlined in the national Air Quality Strategy.
Air Quality Strategy	A national government document which contains standards, objectives and measures for improving ambient air quality.
Annual Average Daily Traffic	The number of traffic movements on a given road in a 24-hour period as an average across one year.
Background Concentration	The pollutant concentration assumed to represent baseline concentrations in the atmosphere across the modelled area.
Heavy Duty Vehicle	Vehicles with a gross weight of greater than 3.5 tonnes.

APPENDIX C – IAQM CONSTRUCTION DUST ASSESSMENT METHODOLOGY

IAQM CONSTRUCTION DUST ASSESSMENT METHODOLOGY

Step 1 – Screening the Need for a Detailed Assessment

An assessment will normally be required where there are:

- 'human receptors' within 50m of the site boundary; all within 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s); and/ or
- 'ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway up to 250m from the site entrance(s)

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

Step 2a – Define the Potential Dust Emission Magnitude

The following are examples of how the potential dust emission magnitude for different activities can be defined. Note that not all criteria need to be met for a particular class. Other criteria can be justified within the assessment.

Table C1: Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	- Total volume of building to be demolished greater than 75,000 m^3. - Potentially dusty material (e.g., concrete). - On-site crushing and screening. - Demolition activities more than 12m about ground level.
	Earthworks	- Total site area greater than 110,000m^2. - Potentially dusty soil type (e.g., clay, which will be prone to suspension when dry due to small particle size). - More than 10 heavy earth moving vehicles active at any one time. - Formation of bunds greater than 6m in height.
	Construction	- Total building volume greater than 75,000 m^3. - On site concrete batching. - Sandblasting.
	Trackout	- More than 50 Heavy Duty Vehicle (HDV) trips per day. - Potentially dusty surface material (e.g., high clay content). - Unpaved road length greater than 100m.

Table C1: Construction Dust - Magnitude of Emission		
Magnitude	**Activity**	**Criteria**
Medium	Demolition	- Total volume of building to be demolished between 12,000 m^3 and 75,000 m^3. - Potentially dusty construction material. - Demolition activities 6m to 12m above ground level.
	Earthworks	- Total site area 18,000m^2 to 110,000 m^2. - Moderately dusty soil type (e.g., silt). - 5 to 10 heavy earth moving vehicles active at any one time. - Formation of bunds 3m to 6m in height.
	Construction	- Total building volume 12,000m^3 to 75,000m^3. - Potentially dusty construction material (e.g., concrete). - On site concrete batching.
	Trackout	- 20 to 50 HDV trips per day. - Moderately dusty surface material (e.g., high clay content). - Unpaved road length 50m to 100m.
Small	Demolition	- Total volume of building to be demolished less than 12,000 m^3. - Construction material with low potential for dust release (e.g., metal cladding or timber). - Demolition activities less than 6m above ground and during wetter months.
	Earthworks	- Total site area less than 18,000 m^2. - Soil type with large grain size (e.g., sand). - Less than 5 heavy earth moving vehicles active at any one time. - Formation of bunds less than 4m in height.
	Construction	- Total building volume less than 12,000 m^3. - Construction material with low potential for dust release (e.g., metal cladding or timber).
	Trackout	- Less than 20 HDV trips per day. - Surface material with low potential for dust release. - Unpaved road length less than 50 m.

Step 2b – Define the Sensitivity of the Area

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow sensitivity of individual receptors 2 to soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table C2: Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
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 C3: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	1-10	Low	Low	Low	Low	Low

Table C4: Sensitivity of the Area to Ecological Impacts		
Receptor Sensitivity	Distance from the Source (m)	
	<20	<50
High	Medium	Medium
Medium	Medium	Low
Low	Low	Low

Step 2c – Define the Risk of Impacts

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

Table C5: Risk of Dust Impacts			
Sensitivity of Surrounding	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3 – Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site- specific measures to be adopted. These measures will be related to whether the site is considered to be a law, medium or high risk Site. The IAQM guidance details the mitigation measures required for low, medium and high risk sites as determined in Step 2C.

Step 4 – Determine Significant Effects

Once the risk of dust impacts has been determined in Step 2C under the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are

significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors I'm there for the residual effects will normally be negligible.

APPENDIX D – MODEL INPUT PARAMETERS

MODEL INPUT PARAMETERS

Traffic Flow Data

2019 is the most recent year for which monitoring data and meteorological data are available to enable verification of the model results, and so this year has been used for this assessment. 2025 is the anticipated opening year of the Proposed Development.

Baseline traffic data for use in the assessment, including 24-hour AADT Flows and fleet composition as HDV percentage was obtained from the Air Quality Assessment[21] produced in support of a proposed residential development approximately 340m north of the Site.

The baseline traffic data was converted to the site opening year utilising a factor obtained from TEMPro (version 8.0). This software package has been development by the Department for Transport (DfT) to calculate future traffic growth throughout the UK.

Proposed Development trip generation was provided from the appointed Transport Consultants. Flows were added to the relevant links to provide and estimation of traffic flows with the Proposed Development in place.

Table D1: 2019 Verification Traffic Data

ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L1	11,200	2.70	30	0.05261	0.00474	0.00279
L2	11,200	2.70	20	0.06256	0.00486	0.00291
L3	17,285	6.70	20	0.11907	0.00843	0.00508
L4	17,285	6.70	20	0.11907	0.00843	0.00508
L5	15,329	6.50	20	0.10460	0.00743	0.00448
L6	15,329	6.50	30	0.08481	0.00722	0.00426
L7	9,320	5.30	20	0.05995	0.00437	0.00263
L8	9,320	5.30	30	0.04910	0.00425	0.00251
L9	9,320	5.30	20	0.05995	0.00437	0.00263
L10	9,320	5.30	30	0.04910	0.00425	0.00251
L11	18,640	5.30	20	0.11990	0.00874	0.00525
L12	9,320	5.30	20	0.05995	0.00437	0.00263
L13	9,320	5.30	20	0.05995	0.00437	0.00263
L14	19,240	6.90	20	0.13378	0.00943	0.00569
L15	19,240	6.90	45	0.08738	0.00893	0.00518
L16	19,240	6.90	45	0.08738	0.00893	0.00518
L17	16,411	3.91	45	0.06751	0.00702	0.00407
L18	5,148	4.03	45	0.02127	0.00221	0.00128

[21] Proposed Residential Development, Temple Cowley Pool, Oxford, Air Quality Assessment, SLR, 2015.

Table D1: 2019 Verification Traffic Data						
ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L19	20,591	4.03	50	0.08133	0.00880	0.00509
L20	13,680	4.27	80	0.05020	0.00586	0.00337
L21	15,890	4.27	80	0.05830	0.00680	0.00392
L22	16,436	4.28	80	0.06032	0.00704	0.00405
L23	13,786	4.52	80	0.05083	0.00594	0.00342
L24	20,327	4.52	80	0.07495	0.00876	0.00504
L25	3,973	4.27	80	0.01458	0.00170	0.00098
L26	4,109	4.28	50	0.01636	0.00177	0.00102
L27	5,082	4.52	80	0.01874	0.00219	0.00126
R1	4,497	6.90	20	0.03127	0.00220	0.00133
R2	9,620	6.90	20	0.06689	0.00472	0.00284
R3	4,660	5.30	20	0.02997	0.00218	0.00131

Table D2: 2025 Baseline Traffic Data						
ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L1	11,670	2.70	30	0.05482	0.00493	0.00290
L2	11,670	2.70	20	0.06518	0.00506	0.00303
L3	18,010	6.70	20	0.12406	0.00878	0.00529
L4	18,010	6.70	20	0.12406	0.00878	0.00529
L5	15,972	6.50	20	0.10898	0.00774	0.00467
L6	15,972	6.50	30	0.08836	0.00752	0.00444
L7	9,711	5.30	20	0.06246	0.00455	0.00274
L8	9,711	5.30	30	0.05116	0.00442	0.00261
L9	9,711	5.30	20	0.06246	0.00455	0.00274
L10	9,711	5.30	30	0.05116	0.00442	0.00261
L11	19,421	5.30	20	0.12493	0.00910	0.00548
L12	9,711	5.30	20	0.06246	0.00455	0.00274
L13	9,711	5.30	20	0.06246	0.00455	0.00274
L14	20,046	6.90	20	0.13940	0.00983	0.00593
L15	20,046	6.90	45	0.09104	0.00930	0.00540
L16	20,046	6.90	45	0.09104	0.00930	0.00540
L17	17,099	3.91	45	0.07034	0.00732	0.00424
L18	5,363	4.03	45	0.02216	0.00230	0.00134
L19	21,454	4.03	50	0.08473	0.00917	0.00530
L20	14,254	4.27	80	0.05230	0.00610	0.00351
L21	16,556	4.27	80	0.06075	0.00709	0.00408
L22	17,125	4.28	80	0.06285	0.00733	0.00422
L23	14,364	4.52	80	0.05296	0.00619	0.00356
L24	21,179	4.52	80	0.07809	0.00913	0.00525

Table D2: 2025 Baseline Traffic Data						
ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L25	4,139	4.27	80	0.01519	0.00177	0.00102
L26	4,281	4.28	50	0.01705	0.00184	0.00107
L27	5,295	4.52	80	0.01952	0.00228	0.00131
R1	4,685	6.90	20	0.03258	0.00230	0.00139
R2	10,023	6.90	20	0.06970	0.00491	0.00296
R3	4,855	5.30	20	0.03123	0.00228	0.00137

Table D3: 2025 With Development Traffic Data						
ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
L1	11,670	2.70	30	0.05482	0.00493	0.00290
L2	11,670	2.70	20	0.06518	0.00506	0.00303
L3	18,312	6.61	20	0.12561	0.00891	0.00537
L4	18,312	6.61	20	0.12561	0.00891	0.00537
L5	16,275	6.40	20	0.11054	0.00787	0.00474
L6	16,275	6.40	30	0.08969	0.00764	0.00451
L7	9,711	5.30	20	0.06246	0.00455	0.00274
L8	9,711	5.30	30	0.05116	0.00442	0.00261
L9	9,711	5.30	20	0.06246	0.00455	0.00274
L10	9,711	5.30	30	0.05116	0.00442	0.00261
L11	19,421	5.30	20	0.12493	0.00910	0.00548
L12	9,711	5.30	20	0.06246	0.00455	0.00274
L13	9,711	5.30	20	0.06246	0.00455	0.00274
L14	20,349	6.82	20	0.14095	0.00995	0.00600
L15	20,349	6.82	45	0.09218	0.00942	0.00547
L16	20,349	6.82	45	0.09218	0.00942	0.00547
L17	17,099	3.91	45	0.07034	0.00732	0.00424
L18	5,515	3.96	45	0.02273	0.00236	0.00137
L19	21,605	4.01	50	0.08528	0.00923	0.00534
L20	14,254	4.27	80	0.05230	0.00610	0.00351
L21	16,707	4.25	80	0.06127	0.00715	0.00411
L22	17,276	4.26	80	0.06337	0.00739	0.00426
L23	14,364	4.52	80	0.05296	0.00619	0.00356
L24	21,330	4.50	80	0.07861	0.00919	0.00529
L25	4,290	4.17	80	0.01571	0.00183	0.00105
L26	4,432	4.18	50	0.01759	0.00190	0.00110
L27	5,446	4.43	80	0.02005	0.00234	0.00135
R1	4,837	6.73	20	0.03336	0.00236	0.00142
R2	10,326	6.74	20	0.07125	0.00504	0.00304

Table D3: 2025 With Development Traffic Data						
ADMS Road ID	AADT	%HDV	Speed (km/hr)	NO_x Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
R3	4,855	5.30	20	0.03123	0.00228	0.00137

Roughness Length

The roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents and 0.3m for the meteorological site. These values of z_0 are considered appropriate for the morphology of both areas and are suggested within the ADMS-Roads as being suitable for 'parkland, open suburbia' and 'agricultural areas (max)', respectively.

Monin-Obukhov

The Monin-Obukhov Length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used to describe the modelling extents and 10m for the meteorological station site. These values are considered appropriate for the nature of both areas under suggested within ADMS-Roads as being suitable for the respective areas.

Model Verification

Introduction

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

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

Nitrogen Dioxide

Most NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_X = NO + NO_2), in line with the guidance provided within LAQM.TG22).

The model has been run to predict the 2019 annual mean road-NO_X contribution at three roadside diffusion tubes within the muddled road network at the verification locations deemed to have the most suitable monitoring data and traffic data. The model outputs of road-NO_X have been compared with 'measured' road-NO_X, which was determined from the NO_2 concentration measured using the diffusion tube at the monitoring location, utilising the NO_X to NO_2 calculator provided by Defra and the NO_2 background concentration (from the Defra background map). as discussed in the methodology section, the most suitable data available for model verification purposes is from 2019. Later years have not been used due to the COVID-19 pandemic.

Table D4: Model Verification

Site ID	2019 Monitored Total NO_2 ($\mu g/m^3$)	2019 Background NO_2 ($\mu g/m^3$)	2019 Monitored Road Contribution NO_X($\mu g/m^3$)	2019 Modelled Road Contribution NO_X ($\mu g/m^3$)	Ratio
DT7	32.0	15.74	32.1	13.0	2.5
DT8	31.0	15.74	30.0	10.8	2.8
DT80	37.0	15.74	43.0	12.8	3.3

The road NO_X adjustment factor was determined as the slope of the best fit line between the 'measured' move contribution and the model derived road contribution, forced through 0 (Figure D1). this resulted in a factor of **2.8741**, indicating that the model was under predicting. The percentage difference between the total monitored NO_2 and total modelled NO_2 fell within 10%, and this is good indication that the model does not need adjusting. The total NO_2 concentration was then determined by importing the adjusted modelled road-NO_X concentration and background NO_2 concentration into the NO_X to NO_2 calculator.

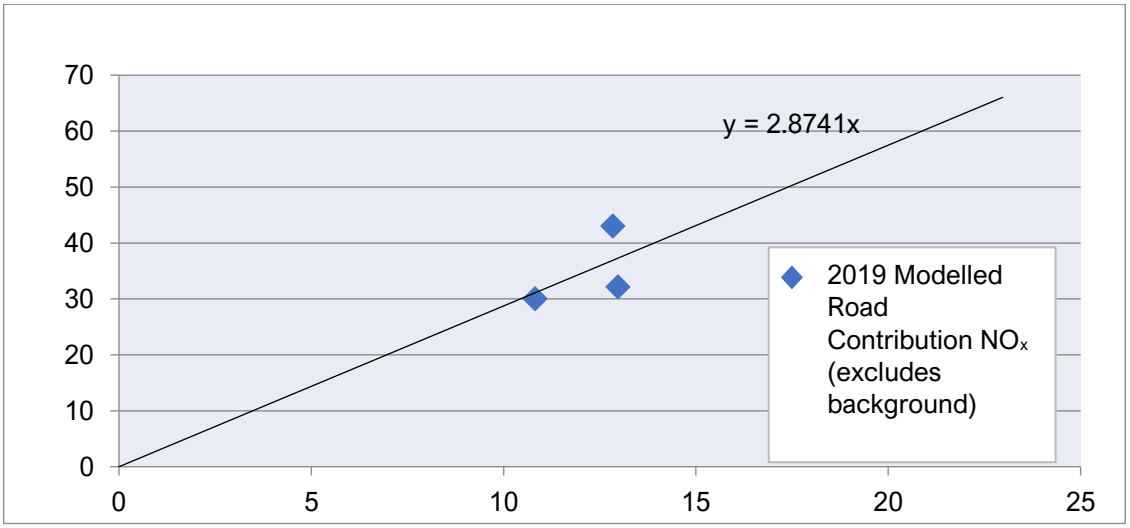

Figure D1 Comparison of Modelled Road-NO_X with Unadjusted Modelled Road NO_X

PM

There are no local PM_{10} or $PM_{2.5}$ monitoring data against which the model could be verified. Consequently, the verification factor determined above for adjusting the road-NO_X contribution has been applied to the predicted road-PM_{10} and $PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG22.

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in the model results. LAQM.TG22 Identifies a number of statistical procedures that are appropriate to evaluate model performance add assess the uncertainty. These include:

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

These parameters estimate how the model results agree or diverge from the monitored observations. Nations can be carried out prior to, and after adjustment, and can provide useful information on model improvement. Full details can be found in box 7.17 of LAQM.TG22.

To assess the and certainty of a model, the RMSE is the simplest parameter to calculate providing an estimate of the average over of the model in the same unit as the model predictions. It is also often easier to interpret the RMSE over other statistical parameters and therefore it has been calculated in this assessment to understand the model uncertainty.
The overall weighted RMSE value calculated after verification was below 25% and therefore the final predictions are considered to be acceptable.

Results

Full results of the dispersion modelling assessment are included below.

Table D5: Annual Mean NO_2 Results					
Receptor	**2019 Baseline NO_2 ($\mu g/m^3$)**	**2025 Without Development NO_2 ($\mu g/m^3$)**	**2025 With Development NO_2 ($\mu g/m^3$)**	**Change (With – Without)**	**EPUK Impact**
ER1	24.8	25.2	25.3	0.1	Negligible
ER2	30.0	30.6	30.7	0.2	Negligible
ER3	38.0	38.8	38.9	0.1	Negligible
ER4	31.2	31.8	31.8	0.0	Negligible
ER5	27.1	27.6	27.6	0.0	Negligible
ER6	28.8	29.3	29.3	0.0	Negligible
ER7	24.5	24.8	24.9	0.1	Negligible
ER8	36.4	37.2	37.4	0.2	Negligible
ER9	36.6	37.3	37.5	0.1	Negligible
ER10	30.9	31.5	31.7	0.2	Negligible
ER11	24.8	25.2	25.3	0.1	Negligible
ER12	27.6	28.1	28.2	0.2	Negligible
ER13	25.1	25.4	25.6	0.1	Negligible
ER14	35.8	36.5	36.6	0.1	Negligible
ER15	33.7	34.3	34.4	0.0	Negligible
ER16	35.5	36.2	36.2	0.0	Negligible
ER17	34.0	34.7	34.7	0.0	Negligible

Table D6: Annual Mean PM_{10} Results					
Receptor	**2019 Baseline PM_{10} ($\mu g/m^3$)**	**2025 Without Development PM_{10} ($\mu g/m^3$)**	**2025 With Development PM_{10} ($\mu g/m^3$)**	**Change (With – Without)**	**EPUK Impact**
ER1	17.8	17.9	17.9	0.0	Negligible
ER2	18.6	18.7	18.7	0.0	Negligible
ER3	19.5	19.7	19.7	0.0	Negligible
ER4	18.7	18.8	18.8	0.0	Negligible
ER5	18.1	18.2	18.2	0.0	Negligible
ER6	18.4	18.5	18.5	0.0	Negligible
ER7	17.4	17.4	17.4	0.0	Negligible
ER8	19.2	19.3	19.3	0.0	Negligible
ER9	19.3	19.4	19.4	0.0	Negligible
ER10	18.6	18.7	18.7	0.0	Negligible
ER11	17.6	17.6	17.6	0.0	Negligible
ER12	18.1	18.1	18.2	0.0	Negligible
ER13	17.6	17.7	17.7	0.0	Negligible
ER14	19.1	19.3	19.3	0.0	Negligible
ER15	18.9	19.0	19.0	0.0	Negligible
ER16	19.3	19.5	19.5	0.0	Negligible

Table D6: Annual Mean PM_{10} Results					
Receptor	**2019 Baseline PM_{10} (µg/m³)**	**2025 Without Development PM_{10} (µg/m³)**	**2025 With Development PM_{10} (µg/m³)**	**Change (With – Without)**	**EPUK Impact**
ER17	19.0	19.1	19.1	0.0	Negligible

Table D7: Annual Mean $PM_{2.5}$ Results					
Receptor	**2019 Baseline $PM_{2.5}$ (µg/m³)**	**2025 Without Development $PM_{2.5}$ (µg/m³)**	**2025 With Development $PM_{2.5}$ (µg/m³)**	**Change (With – Without)**	**EPUK Impact**
ER1	12.1	12.1	12.2	0.0	Negligible
ER2	12.6	12.7	12.7	0.0	Negligible
ER3	13.2	13.3	13.3	0.0	Negligible
ER4	12.6	12.7	12.7	0.0	Negligible
ER5	12.3	12.3	12.3	0.0	Negligible
ER6	12.5	12.5	12.5	0.0	Negligible
ER7	11.9	11.9	11.9	0.0	Negligible
ER8	12.9	13.0	13.0	0.0	Negligible
ER9	13.0	13.1	13.1	0.0	Negligible
ER10	12.6	12.7	12.7	0.0	Negligible
ER11	12.0	12.0	12.0	0.0	Negligible
ER12	12.3	12.3	12.3	0.0	Negligible
ER13	12.0	12.1	12.1	0.0	Negligible
ER14	12.9	13.0	13.0	0.0	Negligible
ER15	12.8	12.8	12.8	0.0	Negligible
ER16	13.0	13.1	13.1	0.0	Negligible
ER17	12.8	12.9	12.9	0.0	Negligible

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