Air Quality Assessment
308-312 Gray's Inn Road

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Executive summary

Overview

Eight Versa has been commissioned to carry out an Air Quality Assessment (AQA) for the proposed development at 308-312 Gray's Inn Road, London, WC1X 8DP, in the London Borough of Camden. The proposal consists of a refurbishment of a six-storey office building.

The entire borough was declared as an Air Quality Management Area (AQMA) in 2002 for exceedances of the National Air Quality Objectives (NAQOs) for nitrogen dioxide (NO_2) and 24-hour mean exceedance for particulate matter (PM_{10}). Even though the NAQOs for PM_{10} and $PM_{2.5}$ are currently being met, it remains a pollutant of concern. The site is located in a NO_2 Focus Area.

A total of six NO_2 diffusion tubes and three automatic monitoring station, monitoring mean annual NO_2 concentrations, have been identified close to the development site. The data show that the NAQO for mean annual NO_2 concentration (for the mean annual concentration to be no more than 40 μg/m^3) closest to the development site, has been consistently achieved at site CA28 between the latest reporting years of 2018-2021. NAQOs at monitoring sites CA4A, CA27 and CD9 were consistently exceeded for reporting years 2018-2021. The remaining sites demonstrated some achievements. Moreover, there is a decreasing trend in NO_2 levels. Additionally, air quality is predicted to improve in the future with actions such as the introduction of electric vehicles.

Additionally, the NAQO for the hourly mean (for no more than 18 exceedances of the 200 μg/m^3 hourly mean) has been consistently achieved at all automatic monitoring stations for the years 2018-2021, where relevant. The Defra modelled background concentration of NO_2 is 36.4 μg/m^3 for 2021, decreasing to 34.8 μg/m^3 by 2023. It is likely that mean annual NO_2 concentrations currently achieve the NAQO but exceed the WHO guidelines at the development site.

Nearby monitored mean annual PM_{10} concentrations and 24-hourly PM_{10} concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of PM_{10} is 19.5 μg/m^3 for 2021, decreasing to 19.1 μg/m^3 by 2023. It is likely that the mean annual PM_{10} concentrations at the development site currently achieve the NAQO but exceed the WHO guideline at the site.

Nearby monitored mean annual $PM_{2.5}$ concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of $PM_{2.5}$ is 12.4 μg/m^3 for 2021, decreasing to 12.1 μg/m^3 by 2023. It is likely that mean annual $PM_{2.5}$ concentrations at the development site currently achieve the NAQO but exceed the WHO guidelines.

Since the development is located in a NO_2 Focus Area, atmospheric dispersion modelling was carried out. The performance of the modelled receptors at façades facing Gray's Inn Road and Acton St indicate the effects of NO_2, PM_{10} and $PM_{2.5}$ concentrations in the three different scenarios, 'Baseline 2021', '2023 no development' and '2023 with development' are not significant. Therefore, residents will not be exposed to high level of pollution.

For developments within London, the AQA methodology includes the requirement to undertake an assessment against the Air Quality Neutral (AQN) guidance. The scheme has been assessed for both the impacts of transport and building operation against the AQN guidance and it meets the requirements for AQN.

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Introduction

Project Overview

Eight Versa has been commissioned to carry out an Air Quality Assessment (AQA) for the proposed development at 308-312 Gray's Inn Road, London, WC1X 8DP, in the London Borough of Camden. The proposal consists of a refurbishment of a six-storey office building.

The London Borough of Camden has declared an Air Quality Management Area (AQMA) for the whole Borough due to continued exceedances against National Air Quality Objectives (NAQOs) for the annual mean NO_2 and 24-hour mean exceedance for PM_{10}. Additionally, the western façade faces Gray's Inn Road. Due to the proposed nature of the development, occupants will be exposed to poor air quality, an AQA has been undertaken to accompany the planning application.

Scope of Assessment

An AQA has been undertaken in accordance with relevant planning policy and best-practice guidance at national, regional and local levels. The AQA includes:

- Establishment of nearby sensitive receptors to air pollution.
- Assessment of air quality and dust impacts during the construction phase.
- Establishment and review of existing air quality.
- Evaluation of outline proposals against the Air Quality Neutral (AQN) benchmarks.
- Assessment of air quality impacts expected during the operation of the new development.
- Assessment of the mitigation strategy to limit the exposure of building users and nearby receptors, to air pollution.

Key policy and guidance documents considered in the AQA are outlined in Table 1.

Table 1: National, regional and local policies and guidance.

National	National Planning Policy Framework (Ministry of Housing, Communities & Local Government, 2021)
	The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Department for Environment, Food & Rural Affairs, Defra, 2007)
	Land-Use Planning & Development Control: Planning for Air Quality (Environmental Protection UK (EPUK), Institute of Air Quality Management (IAQM), 2017)
	Clean Air Strategy (Department for Environment, Food & Rural Affairs, Defra, 2019)
	Air Quality Plan for Nitrogen dioxide (NO_2) in UK (Defra, 2017)
	Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014)
	Environment Act 2021 (Ministry of Housing, Communities & Local Government, 2021)
	A Guide to The Assessment of Air Quality Impacts on Designated Nature Conservation Sites (IAQM, 2020)
	The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ministry of Housing, Communities & Local Government, 2019)
	Local Air Quality Management: Technical guidance LAQM.TG (19) (Department for Environment, Food & Rural Affairs, Defra, 2021)
Regional	The London Plan 2021 (Mayor of London, 2021)
	Sustainable Design and Construction: Supplementary Planning guidance (Mayor of London, 2014)
	The Control of Dust and Emissions during Construction and Demolition: Supplementary Planning Guidance (Mayor of London, 2014)
	London Local Air Quality Management Technical Guidance LLAQM.TG (19) (Mayor of London, 2019)
	Clearing the Air - The Mayor's Air Quality Strategy (Mayor of London, 2010)
	Air Quality and Planning Guidance (London Councils, 2007)
Local	Camden Local Plan 2017 (London Borough of Camden, 2017)
	Camden Planning Guidance – Air Quality (London Borough of Camden, 2021)
	Clean Air Action Plan 2019-2022 (London Borough of Camden, 2018)

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Policy Review

National Legislation and Policy

The Air Quality Standards Regulations 2016 implements the requirements of EU Directive 2008/50/EC into UK legislation. Defra, on behalf of the UK Government, has produced a series of plans for the UK to meet the EU targets in the shortest possible time, the latest being the UK plan for tackling roadside NO_2 concentrations in July 2017 (NO_2 being identified as the primary pollutant for which the EU limit values are exceeded). An overview document has been produced, together with detailed plans for 37 zones where the objectives for NO_2 were not met in 2015.

The plan for the Greater London area sets out a range of measures to reduce NO_2 concentrations and indicates that with these measures, London will be compliant by 2025.

Table 2 sets out the ambient air quality standards for a range of key pollutants requiring specific objectives for ambient concentrations for pollutants UK and WHO limit values, respectively to be achieved and maintained.

Table 2: UK and WHO limit values for key pollutants.[1]

Pollutants	UK Concentrations	WHO Concentrations	Measured as	Date to be achieved by (UK only)
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times per year	25 µg/m^3	24-hour mean	31 December 2005
	40 µg/m^3	10 µg/m^3	Annual mean	31 December 2005

Table 2: UK and WHO limit values for key pollutants (continued).

Pollutants	UK Concentrations	WHO Concentrations	Measured as	Date to be achieved by (UK only)
Particles (PM_{10})	50 µg/m^3 not to be exceeded more than 35 times per year	45 µg/m^3	24-hour mean	31 December 2004
	40 µg/m^3	15 µg/m^3	Annual mean	31 December 2004
Particles ($PM_{2.5}$)	-	15 µg/m^3	24-hour mean	-
	20 µg/m^3	5 µg/m^3	Annual mean	31 December 2010
Carbon monoxide (CO)	10 mg/m^3	-	Max. daily 8-hour mean	31 December 2003
Sulphur dioxide (SO_2)	266 µg/m^3 not to be exceeded more than 35 times per year	-	15-minute mean	31 December 2005
	350 µg/m^3 not to be exceeded more than 24 times per year	-	1 hour mean	31 December 2004
	125 µg/m^3 not to be exceeded more than 3 times per year	40 µg/m^3	24-hour mean	31 December 2004
Ozone (O_3)	100 µg/m^3 not to be exceeded more than 10 times per year	100 µg/m^3	8-hour mean	31 December 2005

[1] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020. The full 2021 WHO can be viewed on WHO website.

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National Planning Policy Framework (Ministry of Housing, Communities & Local Government, 2021)
The National Planning Policy Framework (NPPF) published in July 2021 sets out the UK Government's planning policies for England. Planning law requires that applications for planning permission must be determined in accordance with the local development plan, unless material considerations indicate otherwise.

The NPPF is also a material consideration in planning decisions. It states that the purpose of the planning system is to contribute to the achievement of sustainable development; and that planning decisions on individual applications must reflect statutory requirements. Specifically, in terms of air quality, it requires the planning system to prevent development from contributing to or being put at unacceptable risk from unacceptable levels of air pollution.

Planning policies should promote compliance with or contribute towards achievement of EU limit values and NAQOs, taking into account the presence of AQMAs and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development within an AQMA is consistent with the local Air Quality Action Plan (AQAP).

The NPPF is supported by a series of Planning Practice Guidance (PPG) documents. The guidance in relation to air quality (PGG – Air Quality, November 2019) provides guiding principles on how planning can take account of the impact of new development on air quality.

Environment Act 2021 (Ministry of Housing, Communities & Local Government, 2021)
The Secretary of State must by regulations set a target ("the $PM_{2.5}$ air quality target") in respect of the annual mean level of $PM_{2.5}$ in ambient air. The $PM_{2.5}$ air quality target may, but need not, be a long-term target. In this section "$PM_{2.5}$" means particulate matter with an aerodynamic diameter not exceeding 2.5 micrometres. Regulations setting the $PM_{2.5}$ air quality target may make provision defining "ambient air". The duty in subsection (1) is in addition to (and does not discharge) the duty in section 1(2) to set a long-term target in relation to air quality. Section 1(4) to (9) applies to the $PM_{2.5}$ air quality target and to regulations under this section as it applies to targets set under section 1 and to regulations under that section. In this Part "the $PM_{2.5}$ air quality target" means the target set under subsection.

National Air Quality Management

Part IV of the Environment Act 1995 requires the UK Government to publish an Air Quality Strategy and for local authorities to review, assess and manage air quality within their areas, known as Local Air Quality Management (LAQM).

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Defra, 2007)
The 2007 Air Quality Strategy establishes the policy for ambient air quality in the UK. It includes the National Air Quality Objectives (NAQOs) for the protection of human health and vegetation for 11 pollutants. Those NAQOs included as part of LAQM are prescribed in the Air Quality Standards Regulations 2016 and the Air Quality (Amendment) (England) Regulations 2002. It should be noted that the EU limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and legal responsibility.

The EU limit values are mandatory whereas the NAQOs are policy objectives. Local authorities are not required to achieve them but have to work towards their achievement. In addition, the EU limit values apply in all locations except where members of the public do not have access and there is no fixed habitation, on factory premises or at industrial installations, and on the carriageway/central reservation of roads except where there is normally pedestrian access. Where a local authority's review and assessment of its air quality identifies that air quality is likely to exceed the NAQOs, it must designate these areas as AQMAs and develop an Air Quality Action Plan (AQAP) setting out measures to reduce pollutant concentrations with the aim of meeting the NAQOs.

Clean Air Strategy (Defra, 2019)
Additionally, the Clean Air Strategy 2019 sets outs goals that will be more stringent than EU requirements with the aim of reducing human exposure to toxic pollutants by taking into account the World Health Organisation's guidelines. The policies in the Strategy aim to reduce $PM_{2.5}$ concentrations across the UK so that the number of people living in locations above the WHO annual mean guideline limit of 10 µg/m3 is reduced by 50% by 2025. Moreover, the Strategy will feed information to local authorities on how the cumulative impacts of nitrogen deposition in natural habitats should be assessed and mitigated through the planning system.

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Regional Policy and Guidance

The London Plan 2021 (Mayor of London, 2021)

Policy SI 1 in the Intended London Plan 'Improving air quality' states that:

A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1 Development proposals should not:

- lead to further deterioration of existing poor air quality
- create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
- create unacceptable risk of high levels of exposure to poor air quality.

2 In order to meet the requirements in Part 1, as a minimum:

- development proposals must be at least Air Quality Neutral
- development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures
- major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1
- development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

- how proposals have considered ways to maximise benefits to local air quality, and
- what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D In order to reduce the impact on air quality during the construction and demolition phase, development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

Clearing the Air - The Mayor's Air Quality Strategy (Mayor of London, 2010)

The Mayor of London produced an Air Quality Strategy in 2002 under the requirements of the Greater London Authority Act 1999, which was superseded by the subsequent Air Quality Strategy, published in 2016. The Air Quality Strategy sets out how the National Air Quality Strategy would be implemented in London as a whole.

The Mayor's Air Quality Strategy outlines a number of policies to deliver the required reductions in PM_{10} and NO_2 concentrations in Greater London, to meet the EU limits. The planning process is required to improve air quality by ensuring that new developments, as a minimum, are 'air quality neutral'. With regard to the proposed development the key policies are as follows:

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- Policy '6 - Reducing emissions from construction and demolition sites' which states that the Mayor will work with the London Council to review and update the Best Practice guidance for construction and demolition sites and create supplementary planning guidance to assist implementation;
- Policy '7 - Using the planning process to improve air quality - new developments in London as a minimum shall be 'air quality neutral' which states that the Mayor will encourage boroughs to require emissions assessments to be carried out alongside conventional air quality assessments. Where air quality impacts are predicted to arise from developments these will have to be offset by developer contributions and mitigation measures secured through planning conditions, section 106 agreements or the Community Infrastructure Levy;
- Policy '8 - Maximising the air quality benefits of low to zero carbon energy supply' which states that the Mayor will apply emission limits for both PM and NOx for new biomass boilers and NOx emission limits for Combined Heat and Power (CHP) plant. Air quality assessments will be required for all developments proposing biomass boilers or CHP plants and operators will be required to provide evidence yearly to demonstrate compliance with the emission limits; and
- Policy '9 - Energy efficient buildings' which states that the Mayor will set CO2 reduction targets for new developments which will be achieved using the Mayor's Energy Hierarchy. These measures will result in reductions of NOx emissions.

Sustainable Design and Construction: Supplementary Planning Guidance (Mayor of London, 2014)
The Supplementary Planning Guidance (SPG), which supports the London Plan, was first published in 2006 and was updated in April 2014. The following guidance on air quality is provided in Section 4:

- Developers should design schemes to be 'Air Quality Neutral';
- Developments should be designed to minimise the generation of air pollutants;
- Developments should be designed to minimise exposure to poor air quality;
- Energy plant, including boilers and CHP) should meet relevant emission limits; and
- Developers and contractors should follow the relevant guidance on minimising impacts from construction and demolition.

The SPG states that where developers are unable to meet the 'air quality neutral' benchmark, consideration should be given to off-site NO_x and PM_{10} abatement measures.

The Control of Dust and Emissions during Construction and Demolition: Supplementary Planning Guidance (SPG) (Mayor of London, 2014)
This SPG provides detailed best practice guidance, seeking to address emissions from construction activities, including construction machinery with respect to London's 'low emission zone' for non-road mobile machinery (NRMM), introduced in 2015. The SPG incorporates the Institute of Air Quality Management (IAQM) 'Guidance on the assessment of dust from demolition and construction' approach for assessing the risk of dust impacts from construction.

London Local Air Quality Management Technical Guidance LLAQM.TG (19) (Mayor of London, 2019)
This technical guidance - London Local Air Quality Management (LLAQM) Technical Guidance – has been prepared by the Greater London Authority (GLA) to support London boroughs in carrying out their duties under the Environment Act 1995 and connected regulations.

Local Policy and Guidance

Camden Local Plan (London Borough of Camden, adopted 2017)
The Camden Local Plan sets out the Council's planning policies and replaces the Core Strategy and Development Policies planning documents (adopted in 2010)The Local Plan will cover the period from 2016-2031.The policies below relate directly to air quality and development:

Policy CC4 – Air Quality

- The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.
- The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality. Consideration must be taken to the actions identified in the Council's Air
- Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.
- Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

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Camden Planning Guidance – Air Quality (London Borough of Camden, 2021)
The whole of Camden is an Air Quality Management Area (AQMA) as it does not meet national air quality objectives for nitrogen dioxide (NO_2) and because it is widely accepted that there is no safe level for particulates (PM_{10} and smaller). Air quality is particularly severe along major roads through the borough, and in the south of borough which is characterised by high levels of traffic. Major roads are those either in the Transport for London Road Network or designated as a Major Road by Camden.

- All of Camden is a designated Air Quality Management Area due to the high concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10}).
- All developments are to protect future occupants from exposure to poor air quality.
- All developments are to limit their impact on local air quality and be at least air quality neutral.

Policy 3.5.Air quality assessments are to include the following:

- Emissions: An inventory of the PM_{10} and NO_x emissions associated with the proposed development, including the type and quantity of emission concentrations, during the construction and operational phase. This shall cover transport, stationary and mobile emission sources.
- Modelling: The application of atmospheric dispersion modelling to predicted NO_2 and PM_{10} concentrations, both with and without the proposed development. Dispersion modelling shall be the carried out in accordance with Air Quality and Planning Guidance, London Councils (2007) and London Local Air Quality Management Plan Technical Guidance 2016. Modelling should not predict improvements to future years (future vehicle emissions or future background concentrations).

Clean Air Action Plan 2019-2022 (London Borough of Camden, 2018)
Camden's Clean Air Action Plan has been produced as part of our duty to London Local Air Quality Management. It outlines the action we will take to improve air quality in Camden between 2019 and 2022.

Some relevant actions related to reducing emissions from buildings and new development include:

- Working to reduce emissions from our own estate and operations.
- Helping residents and visitors to reduce emissions and exposure.
- Using planning policy and regulation to reduce air pollution.
- Implementing innovative projects across the borough to improve air quality.
- Using our influence to lobby for increased financial and regulatory support for the mitigation of air pollution.
- Maintaining a monitoring network and ensuring the data is freely accessible.
- Raising awareness on how to reduce emissions and exposure.

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Site Overview

The development site at 308-312 Gray's Inn Road is on the east side of Gray's Inn Road in the south of the London Borough of Camden. The OS grid reference for the site is X (Eastings) 530578, Y (Northings) 182723 and the postcode is WC1X 8DP. It is bounded by commercial units to the north and east, Gray's Inn Road to the west and Acton Street to the south, as illustrated in in Figure 1.

The total area of the site is approximately 400m^2 (0.04 ha). The building on site a six-storey building in use as an office.

Figure 1: The red line illustrates the approximate location of the development site.

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Development Overview

Description of Proposed Development
The proposal consists of a refurbishment of a six-storey office building. Illustrations of the proposed ground floor plan, first floor plan and the elevation of the development are shown in Figure 2, Figure 3 and Figure 4, respectively.

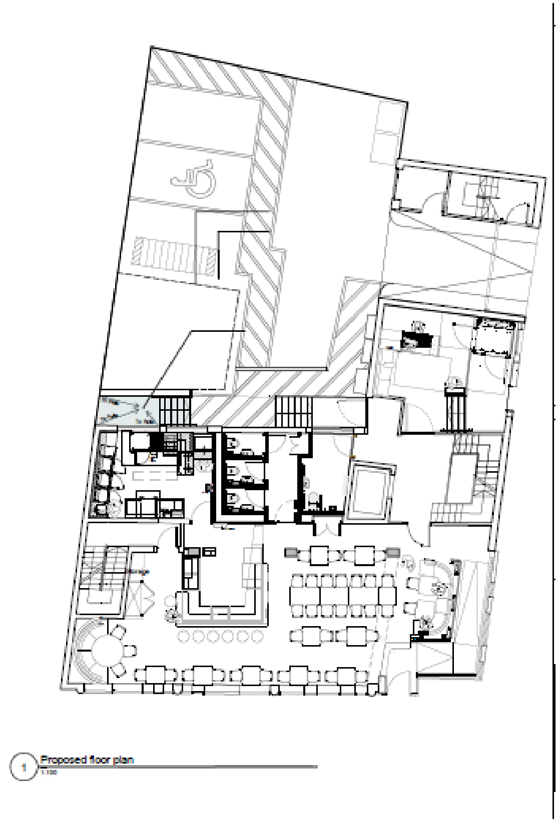

Figure 2: Proposed ground floor plan showing the commercial space.

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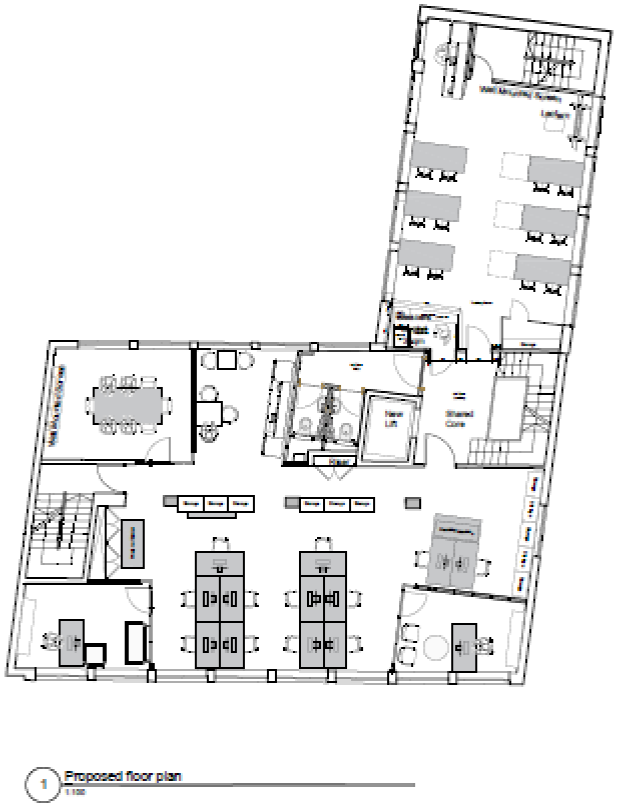

Figure 3: Proposed first floor plan illustrating the commercial space.

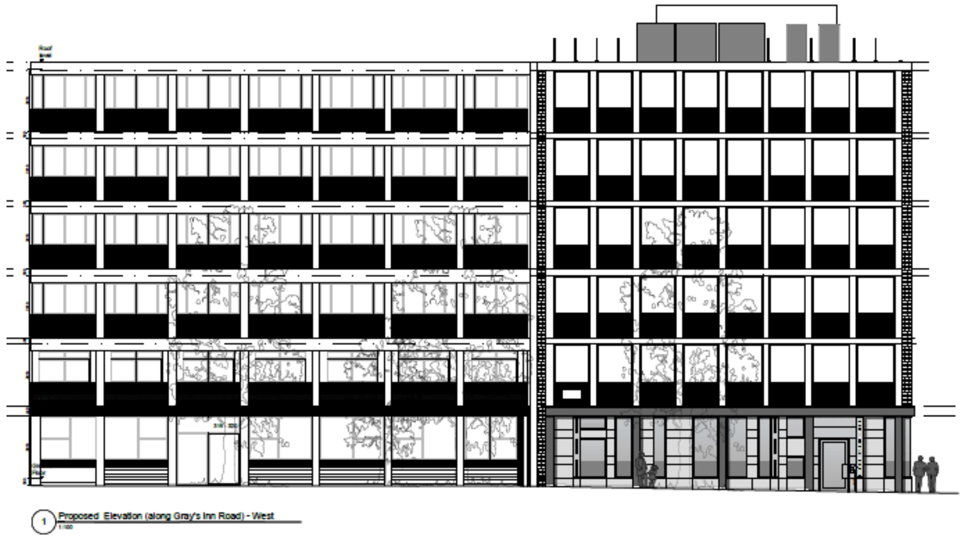

Figure 4: Elevation of the development at Gray's Inn Road.

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Local Receptors

Overview of Local Sensitive Receptors

A sensitive receptor is a location that may be affected by the emission of pollutants and / or particulate matter during construction or from the operation of a completed development, including from building plant and transport uses as a result of the new development.

In accordance with the Institute of Air Quality Management (IAQM) ‘Guidance on the assessment of dust from demolition and construction’, the need for a detailed assessment of the air quality impacts from construction should be determined where the following receptors are present:

- Where there is a human receptor within:
  - 350m of the boundary of the site; and/or
  - 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- Where there is an ecological receptor within:
  - 50m of the boundary of the site; and/or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

For the purposes of identifying receptors, which may be sensitive to potential air quality impacts of dust and emissions from construction, a 350m radius from the development site is used for human receptors, a 50m radius for ecological receptors and a 500m radius is used for the trackout route for both types of receptors, as shown in Figure 5.

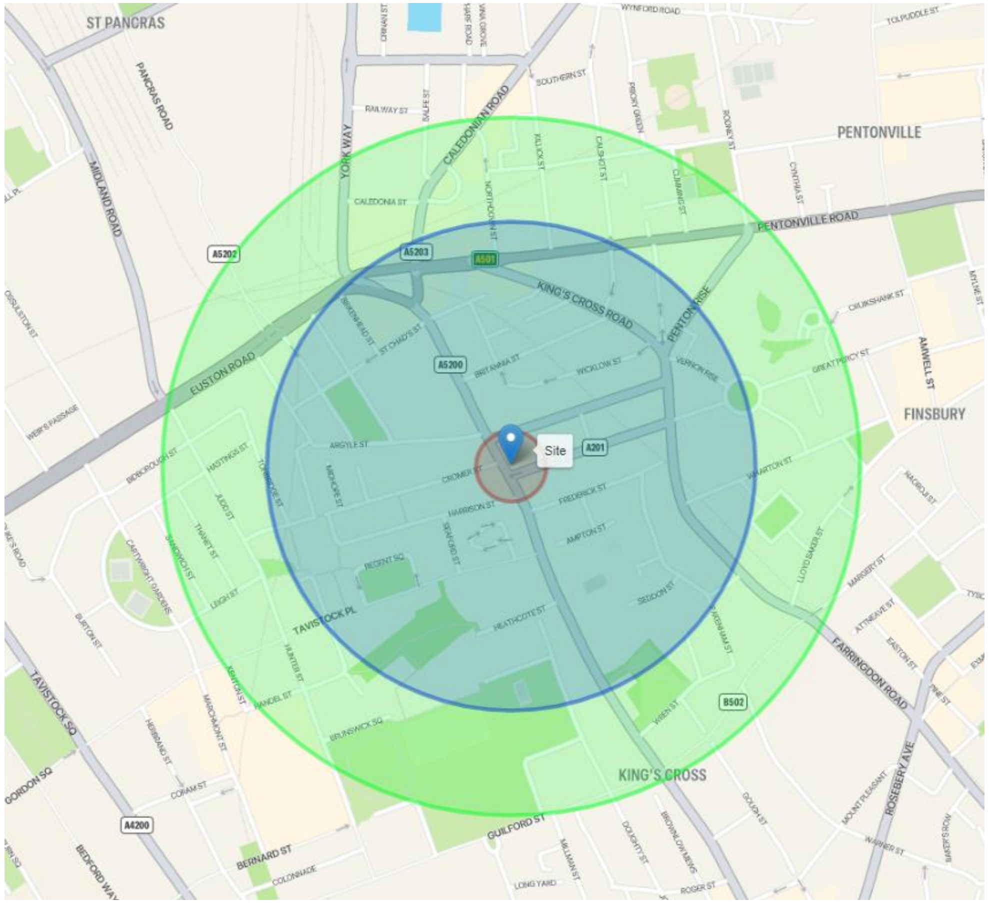

Figure 5: Map view showing a 500m radius (green), a 350m radius (blue) and a 50m radius (red) from the site.

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Human Receptors

A human receptor refers to any location where a person or property may experience the adverse effects of airborne dust or dust soiling, or exposure to PM_{10} over a time period relevant to the air quality objectives, as defined in the Government's technical guidance for Local Air Quality Management. In terms of annoyance effects, this will most commonly relate to residential dwellings, but may also refer to other premises such as schools, hospitals, museums, vehicle showrooms, food manufacturers and amenity areas.

The surrounding area consists predominantly of office and retail spaces. Key human receptors are described below (all distances detailed are approximate).

Schools

The following schools have been identified within 350m of the development or within 500m of the trackout route:

- Kingdom Drama School – approximately 180m south.
- Pre-School Learning Alliance – approximately 270m southeast.
- The Poor School – approximately 300m north.
- Argyle Primary School – approximately 360m west.
- Coram Shakespeare Schools Foundation – approximately 360m south.

Nurseries

The following nurseries / pre-schools have been identified within 350m of the development or within 500m of the trackout route:

- Thomas Coram Centre - approximately 340m south.
- WonderHedge - Semiramis Limited– approximately 360m west.
- Collingham Gardens Nursery - approximately 380m south-west.

Hospitals

No hospitals have been identified within 350m of the development or within 500m of the trackout route.

Doctors

The following doctors have been identified within 500m of the trackout route:

- London Doctors Clinic Private GP - approximately 215m north.
- Bloomsbury Surgery - approximately 380m south west.

Ecological Receptors

Potential sensitive ecological receptors have been determined using geographic information obtained from MAGIC's website, according to a Guide to the Assessment of Air Quality Impacts On Designated Nature Conservation Sites (IAQM, 2020) and the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (Ministry of Housing, Communities & Local Government, 2019).

No statutory or non-statutory ecological sites have been identified within 50m of the development or within 500m of the trackout route.

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Existing Air Quality

Current Local Status

The London Borough of Camden was declared an AQMA for the entire borough in 2002. The AQMA has been declared due to annual mean exceedances of NO_2 and 24-hour mean exceedances of PM_{10}. Currently, the borough meets all the NAQOs except for NO_2. Even though the NAQOs for PM_{10} and $PM_{2.5}$ are being met, they remain pollutants of concern. These pollutants are primarily produced by road traffic. However, other contributors include construction, domestic gas use and industry.

The AQAP 2018-2023 identified four Focus Areas, based on modelling using the London Atmospheric Emissions Inventory (LAEI) 2013[2]. Table 3 and Figure 6 illustrate the Focus Areas as determined by LAEI 2016 modelling data. Focus Areas are locations designated as having high levels of pollution and human exposure. The site is located in the Focus Area.

Table 3: List of Focus Areas in Camden based on LAEI 2016.

ID LAEI 2016	Focus Areas
28	Camden High Street from Mornington Crescent to Chalk Farm and Camden Road
29	Holborn and Southampton Row junction
30	Kilburn Town Centre
31	Euston Road

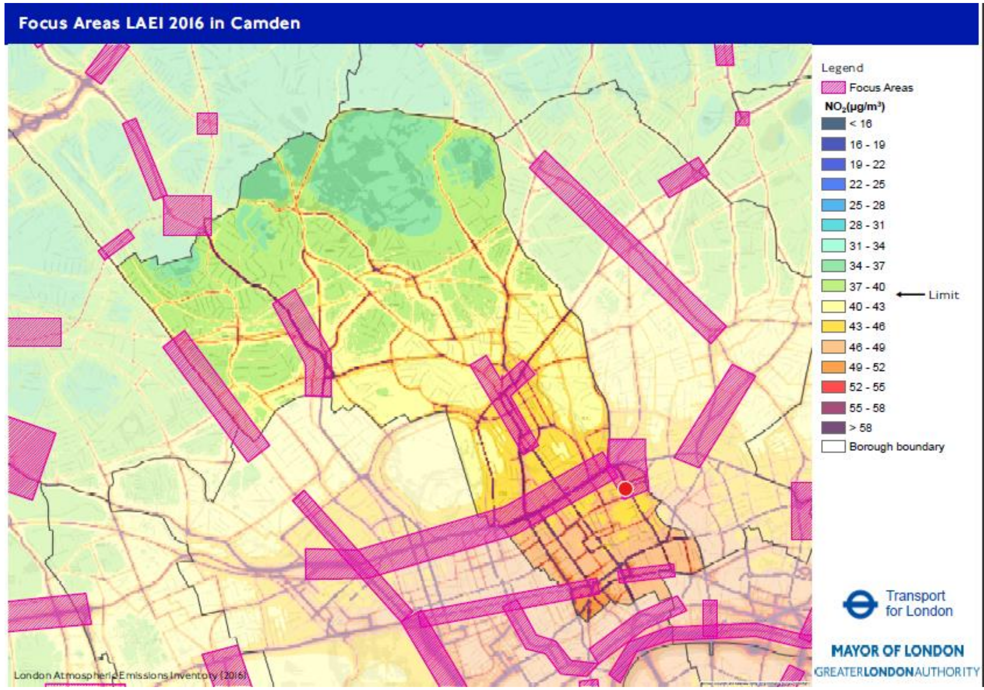

Figure 6: Focus Areas in Camden based on LAEI 2016. The red dot illustrates the approximate location of the development site.

[2] LAEI 2013 datasets were used in the AQAP.

Local Monitoring Stations

Five automatic monitoring sites and 33 non-automatic monitoring sites have been identified in the London Borough of Camden Air Quality Annual Status Report 2021. Based on their proximity to the development site, completeness of data and relevance to the site, the following monitoring sites are reviewed in Table 4. Three automatic monitoring station and six non-automatic monitoring sites have been identified that are considered to be representative of the surroundings of the site.

Table 4: Air quality monitoring stations identified near the site.

Site ID	Site name and type	Pollutants monitored	X (Eastings)	Y (Northings)	Inlet height (m)	Distance from site (m)
CA28	St. George's Gardens East, diffusion tube, Urban Background	NO_2	530512	182511	1.5	220
CA6	St. George's, diffusion tube, Urban Background	NO_2	530430	182430	1.8	330
CA4A (new)	Euston Road, diffusion tube, kerbside	NO_2	530093	182792	2.2	490
CA27	Euston Road LAQN, diffusion tube, roadside	NO_2	529907	182670	2.0	670
CD9	Euston Rd, automatic, roadside	NO_2, PM_{10} and $PM_{2.5}$	529878	182648	2.5	700
CA20A	Brill Place, diffusion tube, roadside	NO_2	529904	183138	2.5	790
CA10	Tavistock Gardens, diffusion tube, Urban Background	NO_2	529880	182334	2.5	800
BL0	London Bloomsbury, automatic, Urban Background	NO_2, PM_{10} and $PM_{2.5}$	530123	182014	4	840
KGX	Coopers Lane, automatic, Urban Background	PM_{10}	529831	183250	2.5	910

A map, showing the approximate locations of the closest automatic monitoring stations and NO_2 diffusion tubes, in relation to the development site, is shown in Figure 7.

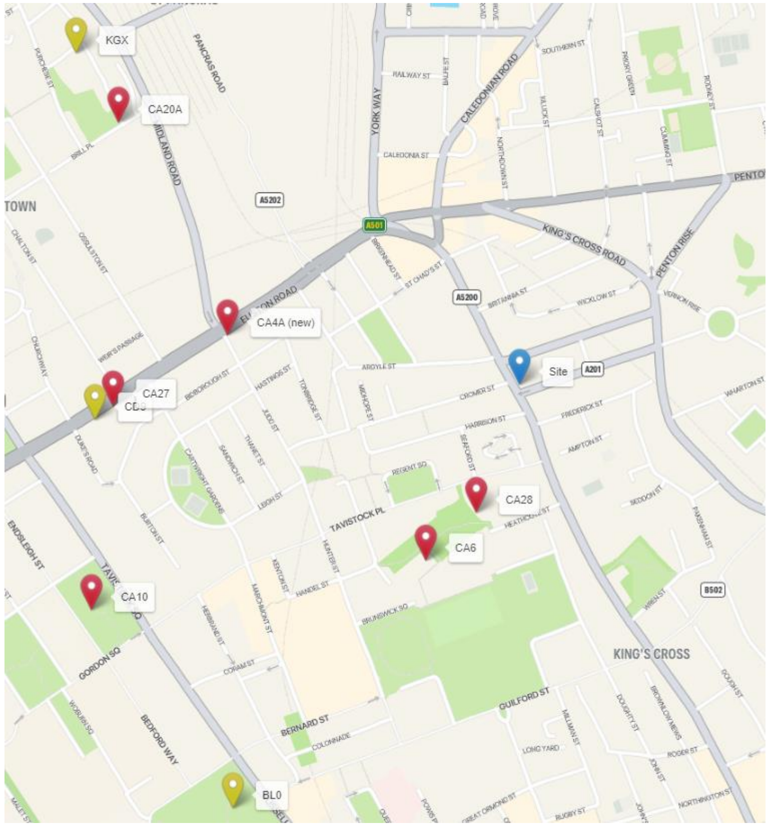

Figure 7: Map showing location of development site (shown in blue) in relation to nearby automatic monitoring stations (shown in yellow) and NO_2 diffusion tubes (shown in red).

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Monitored Nitrogen Dioxide (NO_2)

A summary of the latest monitoring results for NO_2 annual mean concentrations at the closest monitoring stations to the development site is given in Table 5. Exceedances of the NO_2 annual mean AQO of 40µg/m³ are shown in bold. NO_2 annual means in excess of 60µg/m³, indicating a potential exceedance of the NO_2 hourly mean AQS objective are shown in bold and underlined.

The data show that the NAQO for mean annual NO_2 concentration (for the mean annual concentration to be no more than 40 µg/m³) closest to the development site, has been consistently achieved at site CA28 between the latest reporting years of 2019-2021. NAQOs at monitoring sites CA4A, CA27 and CD9 were consistently exceeded for reporting years 2018-2021. The remaining sites demonstrated some achievements. Moreover, there is a decreasing trend in NO_2 levels. Additionally, air quality is predicted to improve in the future with actions such as the introduction of electric vehicles.

Table 5: 2018-2021 NO_2 annual mean concentrations near the site.[3]

Site ID	Monitoring station type	Distance from site (m)	Annual mean concentration (µg/m³)			
			2021	2020	2019	2018
CA28	St. George's Gardens East, diffusion tube, Urban Background	220	17.44	22.47	28.31	-
CA6	St. George's, diffusion tube, Urban Background	330	-	-	25.22	26.67
CA4A (new)	Euston Road, diffusion tube, kerbside	490	**57.14**	**53.68**	**70.65**	-
CA27	Euston Road LAQN, diffusion tube, roadside	670	**46.78**	**46.57**	**65.28**	-
CD9	Euston Rd, automatic, roadside	700	**48**	**43**	**70**	**82**
CA20A	Brill Place, diffusion tube, roadside	790	34.46	**43.89**	**44.12**	-
CA10	Tavistock Gardens, diffusion tube, Urban Background	800	22.32	26.78	33.90	35.35
BL0	London Bloomsbury, automatic, Urban Background	840	27	28	32	36

A summary of the latest monitoring results for the annual exceedances of the NO_2 hourly mean concentration of 200 µg/m³ is given in Table 6. The NAQO (for no more than 18 exceedances of the 200 µg/m³ hourly mean) has been consistently achieved at all automatic monitoring stations for the years 2018-2021, where relevant.

Table 6: 2018-2021 NO_2 annual exceedances of hourly mean of 200 µg/m³ near the site.

Site ID	Monitoring station type	Distance from site (m)	Count of annual exceedances of hourly mean of 200 µg/m³			
			2021	2020	2019	2018
CD9	Euston Rd, automatic, roadside	700	1	0	7	18
BL0	London Bloomsbury, automatic, Urban Background	840	0	0	0	0

[3] Data are obtained from the London Borough of Camden Air Quality Annual Status Report 2021. A National Bias Adjustment Factor of 0.83 is applied to diffusion tubes data for 2021. PM_{10} monitoring does not require correction.

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Monitored Particulate Matter under 10 µm diameter (PM_{10})

A summary of the latest monitoring results for PM_{10} annual mean concentrations at the closest monitoring stations to the development site is given in Table 7. The NAQO (for the mean annual concentration to be no more than 40 µg/m^3) has consistently been met at all automatic monitoring sites for the years 2018-2021, where relevant.

Table 7: 2018-2021 PM_{10} annual mean concentrations near the site.[3]

Site ID	Monitoring station type	Distance from site (m)	Annual mean concentration (µg/m^3)			
			2021	2020	2019	2018
CD9	Euston Rd, automatic, roadside	700	19	18	22	21
BL0	London Bloomsbury, automatic, Urban Background	840	16	16	18	17
KGX	Coopers Lane, automatic, Urban Background	910	13	13	15	15

A summary of the latest monitoring results for the annual exceedances of the PM_{10} daily mean concentration of 50 µg/m^3 is given in Table 8. The NAQO (for no more than 35 exceedances of the 50 µg/m^3 daily mean) has been consistently met at all automatic monitoring sites for the years 2018-2021, where relevant.

Table 8: 2018-2021 PM_{10} annual exceedances of daily mean of 50 µg/m^3 near the site.

Site ID	Monitoring station type	Distance from site (m)	Count of annual exceedances of daily mean of 50 µg/m^3			
			2021	2020	2019	2018
CD9	Euston Rd, automatic, roadside	700	2	2	8	2
BL0	London Bloomsbury, automatic, Urban Background	840	0	4	9	1
KGX	Coopers Lane, automatic, Urban Background	910	0	1	5	1

Monitored Fine Particulate Matter 2.5 µm diameter ($PM_{2.5}$)

A summary of the latest monitoring results for $PM_{2.5}$ annual mean concentrations at the closest monitoring stations to the development site is given in Table 7. The NAQO (for the mean annual concentration to be no more than 20 µg/m^3) has consistently been met at all automatic monitoring sites for the years 2018-2021, where relevant.

Table 9: 2018-2021 $PM_{2.5}$ annual mean concentrations near the site.

Site ID	Monitoring station type	Distance from site (m)	Annual mean concentration (µg/m^3)			
			2021	2020	2019	2018
CD9	Euston Rd, automatic, roadside	700	11	11	14	15
BL0	London Bloomsbury, automatic, Urban Background	840	9	9	11	10

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Modelled Background Concentrations

Defra provides modelled background concentrations for key pollutants across the UK. The 2021-2023 modelled background concentrations for NO_2, PM_{10} and $PM_{2.5}$ for the area surrounding the site are given in Table 10. The background concentrations for NO_2, PM_{10} and $PM_{2.5}$ consistently achieve the NAQOs and unfailingly decrease between the modelled years of 2021-2023.

Table 10: 2021-2023 modelled background concentrations near the site.[4]

Pollutant/particulate matter	Background concentration (µg/m³)		
	2023	2022	2021
NO_2	34.8	35.5	36.4
PM_{10}	19.1	19.3	19.5
$PM_{2.5}$	12.1	12.3	12.4

Existing Air Quality Conclusions

Nitrogen Dioxide (NO_2)

A total of six NO_2 diffusion tubes and three automatic monitoring station, monitoring mean annual NO_2 concentrations, have been identified close to the development site. The data show that the NAQO for mean annual NO_2 concentration (for the mean annual concentration to be no more than 40 µg/m³) closest to the development site, has been consistently achieved at site CA28 between the latest reporting years of 2018-2021. NAQOs at monitoring sites CA4A, CA27 and CD9 were consistently exceeded for reporting years 2018-2021. The remaining sites demonstrated some achievements. Moreover, there is a decreasing trend in NO_2 levels. Additionally, air quality is predicted to improve in the future with actions such as the introduction of electric vehicles.

Additionally, the NAQO for the hourly mean (for no more than 18 exceedances of the 200 µg/m³ hourly mean) has been consistently achieved at all automatic monitoring stations for the years 2018-2021, where relevant. The Defra modelled background concentration of NO_2 is 36.4 µg/m³ for 2021, decreasing to 34.8 µg/m³ by 2023. It is likely that mean annual NO_2 concentrations currently achieve the NAQO but exceed the WHO guidelines at the development site.

Coarse particulate matter (PM_{10})

Nearby monitored mean annual PM_{10} concentrations and 24-hourly PM_{10} concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of PM_{10} is 19.5 µg/m³ for 2021, decreasing to 19.1 µg/m³ by 2023. It is likely that the mean annual PM_{10} concentrations at the development site currently achieve the NAQO but exceed the WHO guideline at the site.

Fine particulate matter ($PM_{2.5}$)

Nearby monitored mean annual $PM_{2.5}$ concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of $PM_{2.5}$ is 12.4 µg/m³ for 2021, decreasing to 12.1 µg/m³ by 2023. It is likely that mean annual $PM_{2.5}$ concentrations at the development site currently achieve the NAQO but exceed the WHO guidelines.

[4] Defra Local Air Quality Management – Background Maps. Data are obtained for the London Borough of Camden for the nearest grid square (X coordinate 530500, Y coordinate 182500) for years 2021-2023 (from 2018 baseline).

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Dispersion Modelling

Operational Impacts: Dispersion Modelling

A detailed assessment, of the feasibility of openable windows facing Gray's Inn Road and of effects of the development onto existing sensitive receptors, has been undertaken using the atmospheric dispersion modelling software, ADMS-Roads Extra[5].

ADMS-Roads is a comprehensive tool for investigating air pollution problems due to networks of roads that may be in combination with industrial sites, for instance small towns or rural road networks. The software uses a steady state gaussian dispersion model and incorporates advanced meteorological pre-processing, along with computation of vertical profiles of wind, turbulence, and temperature.

Model Inputs

A summary of the key model inputs and parameters is given in Appendix B. An overview of the dispersion model scenarios is given in this section of the report.

Modelled scenarios

Three scenarios are modelled as part of the assessment:

- '2021 baseline' – existing baseline traffic flows, 2021 meteorological data and emissions factors.
- '2023 no development' – projected 2023 traffic flows, 2021 meteorological data and 2021 emissions factors.
- '2023 with development' – projected 2023 traffic flows and additional traffic from the proposed 308-312 Gray's Inn Road development (0 AADT), 2021 meteorological data and 2021 emissions factors.

Emissions sources

For the purpose of this assessment, emissions from local roads close to the site, and for which adequate traffic flow data exists, have been modelled. These roads predominantly comprise the primary access routes to the proposed development site. Pollutant concentrations from all other sources, including all non-local emissions and local emissions from all other sources apart from the roads which are predicted to significantly change are derived from the Defra modelled background concentrations.

Traffic flow data

An overview of all traffic flow data is given in Appendix C. Baseline traffic flow data for the average annual daily traffic flow (AADF) for the local road network has been obtained from the Department for Transport (DfT) website[6]. The latest DfT reporting year, 2021, has been selected for the '2021 baseline' scenario.

[5] ADMS-Roads Extra version 5 (Cambridge Environmental Research Consultants (CERC)). Further details can be found on the website.

[6] Department for Transport (DfT) Road Traffic Statistics. Accessed from the website.

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Traffic flow data for 2023, the projected opening year of the development, has been obtained using the English and Welsh Regional Traffic Growth and Speed Forecasts (RTFs) and the local TEMPRO factor[7], as illustrated in Table 11.

- Final Growth Factor = RTF factor x (Local TEMPRO factor / Regional TEMPRO factor)[8]

Table 11: Traffic growth factor values for the period of 2021-2023.

Growth Factor	Value
RTF 2023	1.0259
TEMPRO Growth Factor for Inner London (2021-2023)	1.0187
TEMPRO Growth Factor for London Borough of Camden (2021-2023)	1.0144
Final Growth Factor for 2023	1.0216

The final growth factor can then be used to predict the AADF in 2023 in the 'no development' scenario.

The scheme has not proposed any additional parking spaces; therefore, the traffic generation is negligible.

Thus, the final growth factor and the additional trips above are used in the '2023 with development' scenario.

Traffic speeds

Traffic speeds have been estimated based on-site observations and national speed limits. As such, an average traffic speed of 30 miles/hour is applied to all the road sections. Furthermore, it is assumed that the average traffic speeds on the local road network are the same for the opening year of 2023, as they are for the baseline year of 2021. See Appendix C for the full traffic flow data used for each modelling scenario and Appendix D for the layout of roads used in the model.

Street canyon effect

Narrow streets with tall buildings on either side have the potential to create a confined space, which can interfere with the dispersion of pollution from traffic and may result in heightened pollutant concentrations in these streets. In dispersion modelling, these narrow streets are described as street canyons, defined as 'narrow streets where the height of buildings on both sides of the road is greater than the road width'. ADMS-Roads includes a street canyon module to account for the additional turbulent flow patterns occurring inside such a narrow street, with relatively tall buildings on both sides. Street canyon effects have not been incorporated in the dispersion model.

[7] The TEMPRO factor is obtained from Trip End Model Presentation Program (TEMPro) (Department for Transport).

[8] The methodology is obtained from LAQM.

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Modelled pollutants

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been modelled. Note that NO_2 concentrations have been modelled as NO_x and converted to NO_2, using the Defra NO_x to NO_2 Calculator[9], in accordance with Local Air Quality Management: Technical Guidance (TG19) (Defra, 2021).

Meteorological data

Hourly meteorological data from the London City Airport meteorological station, as the closest and most applicable station, has been used. Wind speed and direction data from London City Airport meteorological station has been plotted as a wind rose in Figure 8. Most frequent wind is from south-west with most frequent wind speed 3.1-5.1 m/s

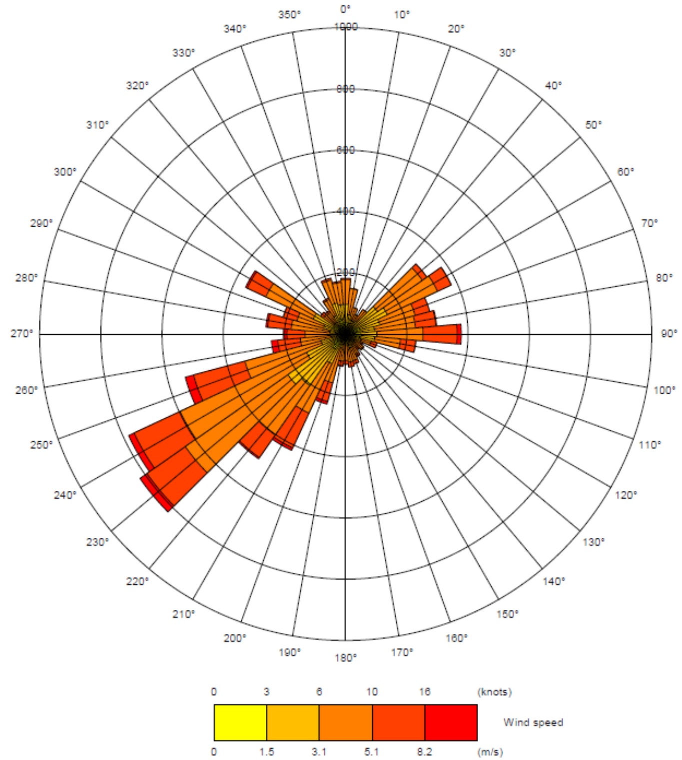

Figure 8: Wind rose for London City Airport (2021).

[9] Defra (2020) NO_x to NO_2 Calculator v8.1. Accessed from the website.

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Background concentrations

Background concentrations of pollutants and particulate matter have been obtained from Defra as listed in Table 10. Defra provides a breakdown of the contribution of background concentrations from specific source types for most pollutants. The background concentration contributed by road transport from within the local area has been removed, to isolate the modelled effects of the road transport emissions on concentrations.

2021 background concentrations are used for the '2021 baseline', '2023 no development' and '2023 with development' scenarios.

Model Outputs

Dispersion models cannot predict short-term concentrations as accurately as mean annual concentrations. Furthermore, model verification for short-term concentrations is challenging, particularly with limited monitoring stations capable of recording short-term concentrations. As such, only mean annual concentrations of NO_2 and PM_{10} and $PM_{2.5}$ will be modelled. TG19 (Defra, 2021) provides guidance on estimating NO_2 hourly NAQO and PM_{10} 24-hourly NAQO exceedances, where it is not possible to model the hourly and 24-hourly impacts, respectively. See the sections 'Results for NO_2' and 'Results for PM_{10}' for further details.

Model Verification

Systematic errors in dispersion modelling results may arise from a range of factors, such as uncertainties in vehicle traffic flows, speeds, and the composition of the vehicle fleet. Such errors can be addressed and corrected for by making comparisons with monitoring data. The accuracy of the future year modelling results is relative to the accuracy of the base year results. Therefore, greater confidence can be placed in the future year concentrations if good agreement is found for the base year.

Verification of the dispersion model has been undertaken, by comparing modelled pollutant concentrations to monitored pollutant concentrations for the baseline year. Model verification is used to determine the performance of the model against 'real-world' monitored pollutant concentrations and has been undertaken in accordance with the Local Air Quality Management: Technical Guidance (TG19) (Defra, 2021).

Discrepancies between modelled and measured concentrations can arise for a number of reasons, for example:

- Traffic data uncertainties, including uncertainties in emissions factors caused by discrepancies between test cycle and real-world emissions.
- Background concentration estimates.
- Meteorological data uncertainties.
- Sources not explicitly included within the model e.g. car parks and bus stops.
- Overall model limitations, including treatment of roughness and meteorological data, treatment of traffic speeds, slowing down and idling at junctions).
- Uncertainty in monitoring data, particularly diffusion tubes.

Dispersion models may perform differently when comparing results for kerbside, roadside and background monitoring sites. For example, models may predict reasonable concentrations towards background sites, but under-predict at locations closer to the roadside. In addition to the consideration of kerbside, roadside and background sites during model verification, the different types of locations should be considered when comparing modelled and monitored concentrations. For example, modelling undertaken for roadside sites in urban areas (including areas with street canyons) may require a different adjustment to modelling undertaken for roadside sites near motorways or trunk roads in open settings.

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Model refinement
Initially, the dispersion model was run using all the receptors identified in Table 4. The roads identified were A501, A4200 and A5200. Several refinements were carried out and the final model consisted only of monitoring sites CA4A (new), CA27 and CD9.

Comparison
Mean annual NO_2 concentrations have been used for model verification. A comparison of monitored and modelled concentrations is given in Table 12.

Table 12: Comparison of modelled and monitored concentrations for NO_x and NO_2 (µg/m³).

Site ID	2021 monitored NO_2	2021 monitored road contribution NO_x	2021 modelled road contribution NO_x	Ratio of monitored to modelled road contribution NO_x
CA4A (new)	57.14	54.02	7.32	7.38
CA27	46.78	26.05	6.43	4.05
CD9	48	29.15	5.79	5.04

The mathematical relationship between monitored and modelled road contribution NO_x is given in Figure 9, with a trendline passing through zero and its derived equation.

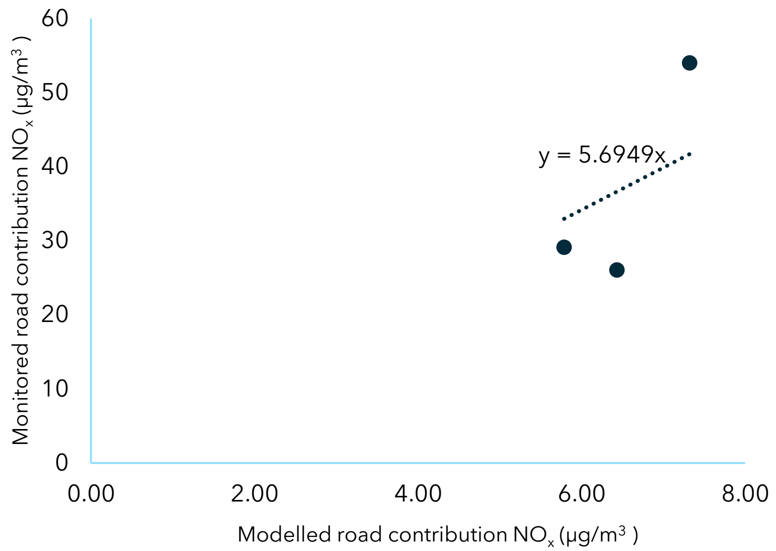

Figure 9: Comparison of monitored and modelled road contribution of NO_x at monitoring sites.

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Adjustment

The adjustment factor derived from Figure 9 (5.6949) has been applied to the modelled road contribution NO_x concentrations before being converted to annual mean NO_2 concentrations using the Defra NO_x to NO_2 calculator (Table 13).

Table 13: Model verification results for NO_x and NO_2 (μg/m^3).

Site ID	Road contribution NO_x adjustment factor	Adjusted 2021 modelled road contribution NO_x	2021 modelled total NO_2	2021 monitored NO_2	% difference modelled to monitored NO_2
CA4A (new)	5.6949	41.7	52.75	57.1	8.3%
CA27	5.6949	36.6	50.87	46.8	-8.0%
CD9	5.6949	33.0	49.47	48.0	-3.0%

The correlation between modelled and monitored NO_2 concentrations at the monitoring sites has been achieved by applying a model correction factor, detailed in Table 13. The final adjusted model results in modelled concentrations that are within 10% of the monitored concentrations, as required by TG19 (Defra, 2021). This demonstrates that the adjusted model predictions are in line with the 'real-world' monitoring concentrations.

The NO_x adjustment process and derived road contribution NO_x adjustment factor has subsequently been applied to predicted concentrations at receptors for the '2021 baseline', '2023 no development' and '2023 with development' scenarios. The road contribution NO_x adjustment factor (5.6949) has subsequently been applied to all predicted concentrations of PM_{10} and $PM_{2.5}$, in accordance with TG19 (Defra, 2021).

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Modelled Receptors

Dispersion modelling determines the concentrations of pollutants at specified receptors. Receptors have been modelled at façades facing Gray's Inn Road and Acton St, as well as at existing sensitive receptors but at different heights as detailed in Table 14. A plan of the modelled receptor locations is given in Figure 10.

Table 14: Summary of modelled receptors.

Receptor ID	X coordinate	Y coordinate	Description	Height (m)
RA1	530578	182726	Façade facing Gray's Inn Road, ground floor	2.5
RA2	530578	182726	Façade facing Gray's Inn Road, first floor	5.5
RA3	530578	182726	Façade facing Gray's Inn Road, third floor	8.5
RA4	530578	182726	Façade facing Gray's Inn Road, fifth floor	11.5
RB1	530591	182724	Façade facing Acton St, ground floor	2.5
RB2	530591	182724	Façade facing Acton St, first floor	5.5
RB3	530591	182724	Façade facing Acton St, third floor	8.5
RB4	530591	182724	Façade facing Acton St, fifth floor	11.5
EA1	530498	182722	Gatesden, Cromer Street, King, ground floor	2.5
EA2	530498	182722	Gatesden, Cromer Street, King, first floor	5.5
EA3	530498	182722	Gatesden, Cromer Street, King, second floor	8.5
EB1	530641	182722	47, Acton Street, King, ground floor	2.5
EB2	530641	182722	47, Acton Street, King, first floor	5.5
EB3	530641	182722	47, Acton Street, King, second floor	8.5

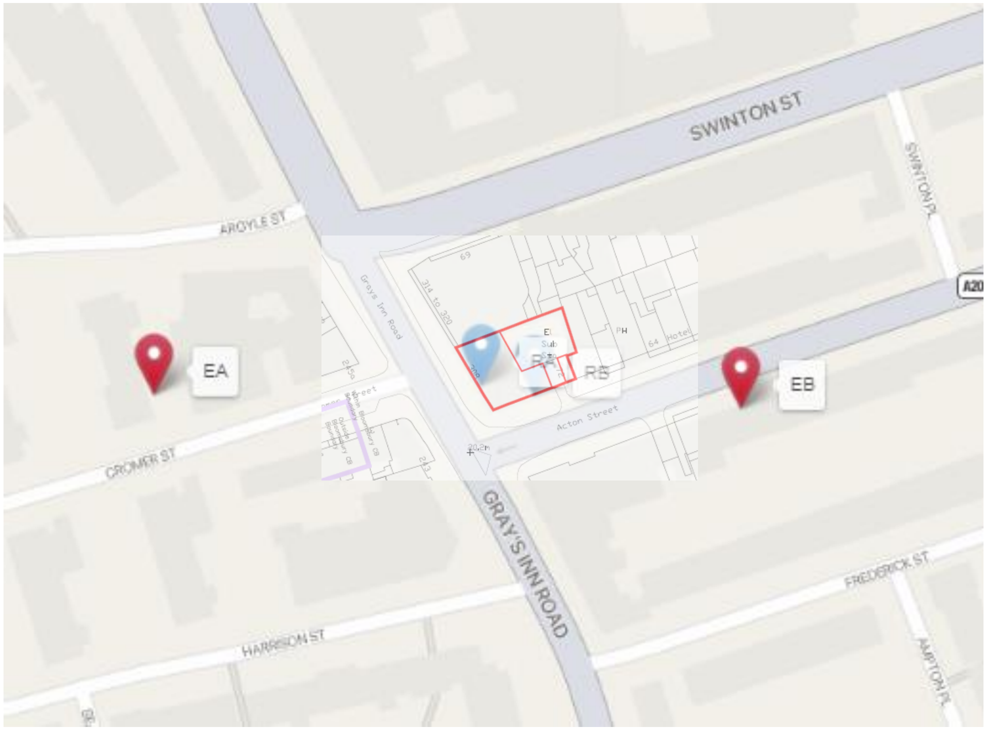

Figure 10: Plan of modelled receptors at the Gray's Inn Road development and existing sensitive receptors.

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Significance of Effects

The significance of effects from the operational phase of the development may be assessed by comparing the change in mean annual concentrations at receptors between the modelled scenarios, in accordance with the EPUK and IAQM's 'Land-Use Planning & Development Control: Planning For Air Quality' (2017) guidance. Significance of the effects of changing concentrations is defined in accordance with the qualitative descriptors and thresholds defined in Table 15.

The significance of effects is a measure of both the pre-development concentration at a receptor (for the '2023 no development' scenario), and the change from the pre-development concentration to post-development ('2023 with development' scenario), against the relevant Air Quality Assessment Level (AQAL). In this case, the AQAL is the respective National Air Quality Objective (NAQO) for NO_2, PM_{10} and $PM_{2.5}$. Note that changes of 0% or less (i.e. less than 0.5%) are described as 'negligible'.

Table 15: Significance of effects matrix.

Long-term average concentration at receptor	% change in mean annual concentration relative to AQAL			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

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Results for NO_2

Table 16: Results of NO_2 annual mean concentrations (µg/m^3) for '2021 baseline', '2023 no development' and '2023 with development' and significance of effects from NO_2 mean concentrations for '2023 with development'.

Receptor ID	2021 baseline	2023 no development	2023 with development	Significance of effects from NO_2
RA1	37.5	37.6	37.6	Negligible
RA2	36.8	36.9	36.9	Negligible
RA3	36.0	36.1	36.1	Negligible
RA4	35.5	35.5	35.5	Negligible
RB1	36.8	36.8	36.8	Negligible
RB2	36.4	36.4	36.4	Negligible
RB3	35.9	35.9	35.9	Negligible
RB4	35.5	35.5	35.5	Negligible
EA1	35.9	36.0	36.0	Negligible
EA2	35.8	35.8	35.8	Negligible
EA3	35.6	35.6	35.6	Negligible
EB1	35.6	35.6	35.6	Negligible
EB2	35.5	35.5	35.5	Negligible
EB3	35.4	35.4	35.4	Negligible

NO_2 annual mean concentration

Table 16 provides an overview of the predicted mean annual NO_2 concentrations for all modelled receptors at the development site:

- NO_2 concentrations for the '2021 baseline' were below the NAQO (mean annual NO_2 concentration of 40 µg/m^3) but slightly above 36 µg/m^3, accounting for a potential 10% margin for error at all receptors.
- NO_2 concentrations for the '2023 no development' and '2023 with development' scenarios are predicted to be significantly below the NAQO but slightly above 36 µg/m^3, accounting for a potential 10% margin for error at all receptors. The concentrations of NO_2 are similar for both scenarios because the proposed trips for deliveries are minimal. The WHO limit (mean annual NO_2 concentration of 10 µg/m^3) is exceeded at all receptors.
- Residents using the amenity spaces and existing sensitive receptors are predicted not to be exposed to high level of NO_2 annual mean concentrations, taking into account improvements of emission factors and background concentrations.

NO_2 hourly mean NAQO exceedances

Research undertaken on behalf of Defra in 2003[10] identified that exceedances of the NO_2 hourly mean NAQO are unlikely to occur where the annual mean is below 60 µg/m^3. In accordance with TG19 (Defra, 2021), this assumption is still considered to be valid, particularly for roadside locations, where road traffic is the primary source of emissions. The dispersion modelling predicts that this would be achieved at all receptors for the '2023 no development' and '2023 with development' scenarios.

Significance of impacts

With reference to the EPUK and IAQM's (2017) guidance, the significance of effects from NO_2 concentrations on the proposed development is 'negligible' at all modelled receptors, as shown in Table 16. As the percentage change in relation to NAQO is never greater than, or equal to, 0.5%, the significance of effects at all receptors is defined as 'negligible'. The impact of NO_2 concentrations on the development and existing sensitive receptors is not deemed to be significant.

[10] Laxen D and Marner B (2003) Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites. Accessed here.

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Results for PM_{10}

Table 17: Results of PM_{10} annual mean concentrations (µg/m^3) for '2021 baseline', '2023 no development' and '2023 with development' and significance of effects from PM_{10} mean concentrations for '2023 with development'.

Receptor ID	2021 baseline	2023 no development	2023 with development	Significance of effects from PM_{10}
RA1	20.5	20.5	20.5	Negligible
RA2	20.3	20.3	20.3	Negligible
RA3	20.0	20.0	20.0	Negligible
RA4	19.7	19.8	19.8	Negligible
RB1	20.2	20.2	20.2	Negligible
RB2	20.1	20.1	20.1	Negligible
RB3	19.9	19.9	19.9	Negligible
RB4	19.7	19.8	19.8	Negligible
EA1	19.9	19.9	19.9	Negligible
EA2	19.9	19.9	19.9	Negligible
EA3	19.8	19.8	19.8	Negligible
EB1	19.8	19.8	19.8	Negligible
EB2	19.8	19.8	19.8	Negligible
EB3	19.7	19.7	19.7	Negligible

PM_{10} annual mean concentration

Table 17 provides an overview of the predicted mean annual PM_{10} concentrations for all modelled receptors at the development site:

- PM_{10} concentrations at the site are predicted to be slightly higher for the '2021 baseline' scenario (Table 17), very similar for the '2023 no development' and '2023 with development' scenarios. PM_{10} concentrations for the '2021 baseline' were significantly below the NAQO (mean annual PM_{10} concentration of 40 µg/m^3) and below 36 µg/m^3, accounting for a potential 10% margin for error at all receptors. The WHO guideline (mean annual PM_{10} concentration of 15 µg/m^3) was exceeded at all receptors.
- PM_{10} concentrations are predicted to be well below the NAQO (mean annual PM_{10} concentration of 40 µg/m^3) and below 36 µg/m^3, accounting for a potential 10% margin for error, for the '2023 no development' and '2023 with development' scenarios at all receptors. The WHO limit (mean annual PM_{10} concentration of 15 µg/m^3) is exceeded at all receptors.
- Residents using the amenity spaces and existing sensitive receptors are predicted not to be exposed to high level of PM_{10} annual mean concentrations.

PM_{10} 24-hour mean NAQO exceedances

TG19 (Defra, 2021) provides a methodology to estimate the likely 24-hourly concentrations for PM_{10} from annual mean concentrations as shown in the equation below. The highest PM_{10} concentration for the '2021 baseline' scenario (20.5 µg/m^3) results in an estimated number of annual occurrences of the 24-hourly mean above 200 µg/m^3 of 4.1 (significantly less than the NAQO of 18). It is therefore concluded that this NAQO would be achieved at the site.

$$likely\ 24\ hourly\ PM_{10}\ concentrations\ = -18.5 + 0.00145 \times Annual\ Mean^3 + \frac{206}{Annual\ Mean}$$

Significance of impacts

The significance of effects of PM_{10} concentrations on the proposed development and existing sensitive receptors is deemed to be 'negligible' at all receptors, as demonstrated in Table 17.

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Results for $PM_{2.5}$

Table 18: Results of $PM_{2.5}$ annual mean concentrations (µg/m^3) for '2021 baseline', '2023 no development' and '2023 with development' and significance of effects from $PM_{2.5}$ mean concentrations for '2023 with development'.

Receptor ID	2021 baseline	2023 no development	2023 with development	Significance of effects from $PM_{2.5}$
RA1	13.0	13.0	13.0	Negligible
RA2	12.8	12.8	12.8	Negligible
RA3	12.7	12.7	12.7	Negligible
RA4	12.5	12.5	12.5	Negligible
RB1	12.8	12.8	12.8	Negligible
RB2	12.7	12.7	12.7	Negligible
RB3	12.6	12.6	12.6	Negligible
RB4	12.5	12.5	12.5	Negligible
EA1	12.6	12.6	12.6	Negligible
EA2	12.6	12.6	12.6	Negligible
EA3	12.6	12.6	12.6	Negligible
EB1	12.6	12.6	12.6	Negligible
EB2	12.5	12.5	12.5	Negligible
EB3	12.5	12.5	12.5	Negligible

$PM_{2.5}$ annual mean concentration

Table 18 provides an overview of the predicted mean annual $PM_{2.5}$ concentrations for all modelled receptors at the development site:

- $PM_{2.5}$ concentrations at the site are predicted to be marginally higher for the '2021 baseline' scenario (Table 18), similar for the '2023 no development' and '2023 with development' scenarios. $PM_{2.5}$ concentrations for the '2021 baseline' were significantly below the NAQO (mean annual $PM_{2.5}$ concentration of 20 µg/m^3) and below 18 µg/m^3, accounting for a potential 10% margin for error at all receptors. However, the WHO guideline was not achieved.
- $PM_{2.5}$ concentrations are predicted to be well below the NAQO (mean annual $PM_{2.5}$ concentration of 20 µg/m^3) and below 18 µg/m^3, accounting for a potential 10% margin for error for 2023 no development' and '2023 with development' scenarios at all receptors. The WHO limits (mean annual $PM_{2.5}$ concentration of 5 µg/m^3) are exceeded at all modelled receptors.
- Residents using the amenity spaces and existing sensitive receptors are predicted not to be exposed to high level of PM2.5 annual mean concentrations.

Significance of impacts

The significance of effects from $PM_{2.5}$ concentrations on the proposed development and existing sensitive receptors is deemed to be 'negligible' at all receptors, as demonstrated in Table 18.

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Air Quality Neutral

Operational Impacts: Air Quality Neutral

Policy SI 1 in the London Plan 2021, 'Improving air quality' requires that development proposal should not lead to further deterioration of exiting poor air quality and that they must be at least Air Quality Neutral (AQN). The proposed development has been assessed for its performance against the AQN guidance and benchmarks, for both transport and building-related emissions.

Air Quality Neutral: Transport Emissions

The AQN guidance provides a methodology for calculating the Transport Emissions Benchmark (TEB) for specific land use types. The TEB has been calculated for the development (Table 19) using the factors for Class E (commercial space).

The existing site has two parking spaces, but no additional parking spaces are proposed, so traffic generated is minimal.

Table 19: Transport Emissions Benchmark (TEB).

Development metric	Commercial
Applicable planning use class for TEB	Commercial (E)
Gross Internal Area (m^2)	1,325.8
Number of dwellings – residential only	0
Location (CAZ/inner/outer)	CAZ
NO_x TEB factor ($g/m^2/year$) – non-residential	1.3
NO_x TEB factor (g/dwelling/year) - residential	0.0
Total NO_x TEB (kg/year)	**1.7**
PM_{10} TEB factor ($g/m^2/year$) – non-residential	0.2
PM_{10} TEB factor (g/dwelling/year) - residential	0.0
Total PM_{10} TEB (kg/year)	**0.3**

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Table 20: Comparison of calculated transport emissions against TEBs.

Development metric	Commercial
Applicable planning use class for TEB	Commercial (E)
Daily trips by car	0
Annual car trips by car	0
Location (CAZ/inner/outer)	CAZ
Average distance travelled per car trip (km)	3.0
Annual distance travelled by car (km/year)	0.0
NO_x emissions factor (g/km)	0.422
Total NO_x emissions (kg/year)	0.0
Difference from NO_x TEB to actual	-1.7
Transport NO_x AQN result	Pass
PM_{10} emissions factor (g/km)	0.0733
Total PM_{10} emissions (kg/year)	0.0
Difference from PM_{10} TEB to actual	-0.3
Transport PM_{10} AQN result	Pass

The development passes the AQN test for transport emissions based on the proposed trip generations (Table 20).

Air Quality Neutral: Building Emissions

The AQN guidance provides a methodology for calculating the Building Emissions Benchmark (BEB) for specific land use types. The BEB has been calculated for the development (Table 21) using the factors for Class E.

Table 21: Building Emissions Benchmark (BEB).

Development metric	Commercial
Applicable planning use class for BEB	Commercial (E)
Gross internal area (m^2)	1,325.8
NO_x BEB factor ($g/m^2/year$)	75.2
Total NO_x BEB (kg/year)	99.7
PM_{10} BEB factor ($g/m^2/year$)	1.77
Total PM_{10} BEB (kg/year)	2.3

An Energy Statement was produced by Eight Versa in October 2022, which is based on a strategy to reduce energy demand as far as practically and economically possible, by implementing energy efficiency measures before applying low carbon and renewable energy technologies. The use of biomass, combined heat and power (CHP) have been excluded from the scheme. It is proposed that space heating is provided by a combination of gas boiler and ASHP. It is proposed to use a gas boiler to provide hot water to the commercial spaces.

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The development passes the AQN test for building emissions (Table 22).

Table 22: Comparison of calculated building emissions against BEBs.

Development metric	Commercial
Applicable planning use class for BEB	Commercial (E)
Total annual gas consumption from boilers (mg/kWh)	3,221
Boilers NO_x emissions factor (mg/kWh)	23.1
Total NO_x emissions from boilers (kg/year)	0.1
Total annual gas consumption from CHP (kWh/year)	0.0
CHP NO_x emissions factor (mg/kWh)	0.0
Total NO_x emissions from CHP (kg/year)	0.0
Total NO_x emissions (kg/year)	0.1
Difference from NO_x BEB to actual	-99.6
Building NO_x AQN result	Pass
Total annual oil or solid fuel consumption (kWh/year)	0.0
PM_{10} emissions factor (mg/kWh)	0.0
Total PM_{10} emissions (kg/year)	0.0
Difference from PM_{10} BEB to actual	-2.3
Building PM_{10} AQN result	Pass

Air Quality Neutral Statement

The Sustainable Design and Construction SPG issued by the Mayor of London, sets out the requirement for all major developments in Greater London to undertake an AQN Test and be designed so that they are at least 'air quality neutral'. A development is considered to be AQN if it can be demonstrated that both emissions from the operation of a proposed development and transport as a result of the proposed development achieve the relevant emissions benchmarks provided in the AQN guidance.

The development achieves both the TEB and BEB and, therefore, passes the AQN test. No additional mitigation for the purposes of AQN is required.

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Conclusion

Conclusions

The entire borough was declared as an Air Quality Management Area (AQMA) in 2002 for exceedances of the National Air Quality Objectives (NAQOs) for nitrogen dioxide (NO_2) and 24-hour mean exceedance for particulate matter (PM_{10}). Even though the NAQOs for PM_{10} and $PM_{2.5}$ are currently being met, it remains a pollutant of concern. The site is located in a NO_2 Focus Area.

A total of six NO_2 diffusion tubes and three automatic monitoring station, monitoring mean annual NO_2 concentrations, have been identified close to the development site. The data show that the NAQO for mean annual NO_2 concentration (for the mean annual concentration to be no more than 40 $\mu g/m^3$) closest to the development site, has been consistently achieved at site CA28 between the latest reporting years of 2018-2021. NAQOs at monitoring sites CA4A, CA27 and CD9 were consistently exceeded for reporting years 2018-2021. The remaining sites demonstrated some achievements. Moreover, there is a decreasing trend in NO_2 levels. Additionally, air quality is predicted to improve in the future with actions such as the introduction of electric vehicles.

Additionally, the NAQO for the hourly mean (for no more than 18 exceedances of the 200 $\mu g/m^3$ hourly mean) has been consistently achieved at all automatic monitoring stations for the years 2018-2021, where relevant. The Defra modelled background concentration of NO_2 is 36.4 $\mu g/m^3$ for 2021, decreasing to 34.8 $\mu g/m^3$ by 2023. It is likely that mean annual NO_2 concentrations currently achieve the NAQO but exceed the WHO guidelines at the development site.

Nearby monitored mean annual PM_{10} concentrations and 24-hourly PM_{10} concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of PM_{10} is 19.5 $\mu g/m^3$ for 2021, decreasing to 19.1 $\mu g/m^3$ by 2023. It is likely that the mean annual PM_{10} concentrations at the development site currently achieve the NAQO but exceed the WHO guideline at the site.

Nearby monitored mean annual $PM_{2.5}$ concentrations at all automatic monitoring stations consistently achieved the NAQOs. The Defra modelled background concentration of $PM_{2.5}$ is 12.4 $\mu g/m^3$ for 2021, decreasing to 12.1 $\mu g/m^3$ by 2023. It is likely that mean annual $PM_{2.5}$ concentrations at the development site currently achieve the NAQO but exceed the WHO guidelines.

Since the development is located in a NO_2 Focus Area, atmospheric dispersion modelling was carried out. The performance of the modelled receptors at façades facing Gray's Inn Road and Acton St indicate the effects of NO_2, PM_{10} and $PM_{2.5}$ concentrations in the three different scenarios, 'Baseline 2021', '2023 no development' and '2023 with development' are not significant. Therefore, residents will not be exposed to high level of pollution.

For developments within London, the AQA methodology includes the requirement to undertake an assessment against the Air Quality Neutral (AQN) guidance. The scheme has been assessed for both the impacts of transport and building operation against the AQN guidance and it meets the requirements for AQN.

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Appendix A

Dispersion Model Inputs

Table B- 1: Summary of inputs and parameters used in dispersion model.

Parameter	Description	Input value
Software type	ADMS-Roads Extra version 5.0.1.3	-
Coordinate system	Setting to align geographical data with a coordinate system.	*OSGB 1936 / British National Grid* used.
Chemistry	Settings to calculate the atmospheric chemical reactions between nitric oxide (NO), ozone (O_3) and volatile organic compounds (VOCs).	No atmospheric chemistry parameters included.
Meteorology	Representative meteorological data from a local source.	*London City Airport meteorological station*, hourly sequential data used.
Surface roughness	Setting to define the surface roughness of the model area based on its location and surface characteristics.	*1.5m* selected, representing a typical surface roughness for *large urban areas*.
Latitude	Setting to allow the location of the model area to be defined.	*52°* selected for United Kingdom.
Advanced dispersion site data	Settings to define specific surface albedo, minimum Monin-Obukhov length, Priestley-Taylor parameter and precipitation factor for site.	Advanced dispersion site parameters included for Minimum Monin-Obukhov length, and model defaults used for all other parameters.
Elevation of roads	Setting to allow the height of road links above ground level to be specified.	All road links set to ground level at *0m*.
Road width	Setting to allow the width of the road links to be specified.	Road widths selected for individual road links based on data obtained from OS map data.
Topography	Setting to allow complex terrain data to be included within the model in order to account for topographical effects on turbulence and plume spread.	No regional topographical data files available to complex terrain data inputs not used.
Time varied emissions	Setting to enable daily, weekly or monthly variations in emissions to be applied to emissions sources.	Time varied emissions data inputs are not used.
Road type	Setting to allow the effect of different types of roads to be assessed.	London (central) road type selected.
Road speeds	Setting to accommodate the effects of road speeds on different roads on emissions sources.	Individual road speeds based on national speed limits and observations from street images.

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Table B- 1: Summary of inputs and parameters used in dispersion model (continued).

Parameter	Description	Input value
Street canyon modelling	Settings to enable both 'basic' and 'advanced' street canyon modelling of road links.	Street canyon modelling is not relevant for this site.
Road source emissions	Settings to input road source emissions based on road traffic emission calculation method.	UK Emissions Factor Toolkit (EFT) version 11.0 selected for the respective baseline and proposed operational years of the development.
Point source emissions	Settings to input point sources, for example from industrial sources and energy centres.	No point source emissions included.

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Appendix B

Dispersion Model Traffic Inputs

Table C- 1: Traffic flow data [average speed, annual average daily traffic flow (AADT) and % contribution of heavy duty vehicles (HDVs) to AADT] for each modelled scenario.

Road name	Speed (km/h)	2021 baseline		2023 no development		2023 with development	
		AADT	% HDV	AADT	% HDV	AADT	% HDV
A501	48	43,509	8%	44,447	8%	44,447	8%
A4200	48	20,281	10%	20,718	10%	20,718	10%
A5200	32	8,054	7%	8,228	7%	8,228	7%

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Appendix C

Dispersion Model Area

Figure D- 1: Dispersion model area, showing road emissions sources (in blue) and modelled receptors around the development (in green).