Air Quality Assessment:
Royal National Throat, Nose and Ear Hospital, 330 Gray's Inn Road

November 2020

Experts in air quality management & assessment

Document Control

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Executive Summary

The air quality impacts associated with the proposed mixed-use development of the Royal National Throat, Nose and Ear Hospital, 330 Gray's Inn Road have been assessed. The development will consist of residential, hotel, office and gym uses.

The assessment has demonstrated that, with mitigation in place, future residents and users of the development will experience acceptable air quality.

The proposed development will generate traffic on the local road network, but the assessment has shown that there will be no significant effects at any existing, sensitive receptor. A number of mitigation measures will be implemented to minimise the impacts in the local vicinity. Steer Group have developed two Travel Plans, listing proposed actions to reduce development related traffic, including promotion of public transport, walking, cycling, car clubs and smarter working, and only providing accessible parking for 3% of the total residential units.

The proposed development also includes backup generators to be situated on the office building roof. The assessment has demonstrated that these will have an insignificant impact on local air quality, assuming that they are tested monthly on-load.

During the construction works, a range of best practice mitigation measures will be implemented to reduce dust emissions and the overall effect will be 'not significant'; appropriate measures have been set out in this report, to be included in the Dust Management Plan for the works.

Overall, the construction and operational air quality effects of the proposed development are judged to be 'not significant'.

The proposed development has also been shown to meet the London Plan's requirement that new developments are at least 'air quality neutral'.

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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed mixed-use development of 330 Gray's Inn Road, Camden. The proposed development is described as:

"Redevelopment of the former Royal National Throat, Nose and Ear hospital, comprising: Retention of 330 Gray's Inn Road and a two storey extension for use as hotel, demolition of all other buildings, the erection of a part 13 part 9 storey building plus upper and lower ground floors for use as a hotel including a café and restaurant; covered courtyard; external terraces; erection of a 7 storey building plus upper and lower ground floors for use as office together with terraces; erection of a 10 storey building plus upper and lower ground floors for use as residential on Wicklow Street and office space at lower ground and basement floors; erection of a 5 storey building plus upper and lower ground floors for use as residential on Swinton Street and associated residential amenity space; together with a gymnasium; new basement; rooftop and basement plant; servicing; cycle storage and facilities; refuse storage; landscaping and other ancillary and associated works."

1.2 The Site lies within a borough-wide Air Quality Management Area (AQMA) declared by the London Borough of Camden (LBC) for exceedances of the annual mean nitrogen dioxide (NO_2) objective. It is also within the GLA's King's Cross / Caledonian Road Area air quality Focus Areas; these are locations with high levels of human exposure where the EU annual mean limit value for nitrogen dioxide is exceeded.

1.3 The proposed development will introduce new residential exposure into an area of potentially poor air quality, thus an assessment is required to determine the air quality conditions that future residents will experience. The proposed development will also lead to changes in vehicle flows on local roads, which may impact on air quality at existing residential properties along the affected road network.

1.4 The main air pollutants of concern related to road traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$). The new homes, hotel and offices within the proposed development will be provided with heat and hot water by air source heat pumps (ASHPs) and electrical boilers, which have zero associated local emissions. The proposals for the development do also include backup-power generators, the emissions from which could impact upon air quality at existing residential properties, as well as at the new residential properties within the development itself. The main air pollutants of concern related to back-up power generators are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.5 The Site currently accommodates flues serving the adjacent Ear Institute building, emissions from which may also impact on air quality for future residents and users of the development. The relocation of these flues will be considered at the detailed design stage, and the client will collaborate with the adjacent landlord and occupier's professional consultant team, in order to position the flues

such that building emission impacts on future residents and users of the development are minimised. They are therefore not considered further in this assessment.

1.6 The location and setting of the proposed development are shown in Figure 1, along with the relevant nearby Focus Areas.

1.7 The Greater London Authority's (GLA's) London Plan (GLA, 2016) requires new developments to be air quality neutral. The air quality neutrality of the proposed development has, therefore, been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

1.8 The GLA has also released Supplementary Planning Guidance on the Control of Dust and Emissions from Construction and Demolition (GLA, 2014b). The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will need to be applied. A construction dust assessment has been undertaken and the appropriate mitigation has been set out.

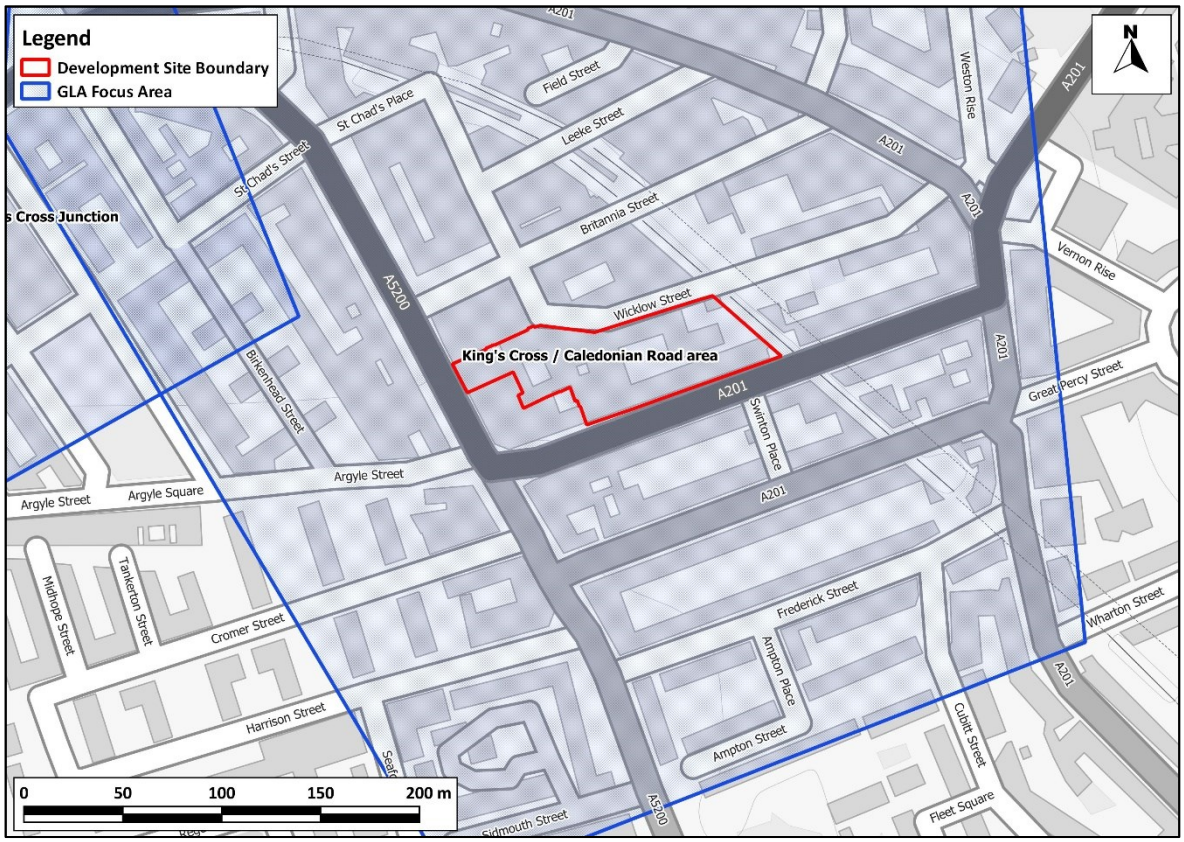

Figure 1: Proposed Development Setting in the Context of Air Quality

1.9 This report describes existing local air quality conditions (base year 2019), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2023, which is the earliest anticipated year of opening. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.10 This report has been prepared taking into account all relevant local and national guidance and regulations.

2 Policy Context

2.1 The United Kingdom formally left the European Union (EU) on 31 January 2020; until the end of 2020 there will be a transition period while the UK and EU negotiate additional arrangements. During this period EU rules and regulations will continue to apply to the UK. All European legislation referred to in this report is written into UK law and will remain in place beyond 2020, unless amended, although there is uncertainty at this point in time as to who will enforce the requirements of some of this legislation.

Air Quality Strategy

2.2 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

The Environmental Permitting (England and Wales) (Amendment) Regulations 2018

2.3 The Medium Combustion Plant Directive (MCPD) (The European Parliament and the Council of the European Union, 2015) regulates pollutant emissions from combustion plant with a rated input between 1 and 50 megawatts (MW_{th}) and was transposed into UK law in January 2018 through an amendment to the Environmental Permitting Regulations (2018). The legislation sets emission limits to be applied from December 2018 for new plant and from 2025 or 2030 for existing plant (depending on the rated input). In addition to addressing emissions from plant with a rated input of 1 to 50 MW_{th}, as required by the MCPD, the amendment also introduces emission limits on generator plant, regardless of their rated input. Generators whose sole purpose is maintaining power supply at a site during an on-site emergency, that are operated for the purpose of testing/maintenance for no more than 50 hours per year, will be exempt from the emission limits, but will be required to apply for an exemption with the regulating authority.

2.4 The backup generator within the proposed development will not require a permit under these regulations, as the generator will be tested for fewer than 50 hours per year.

Clean Air Act 1993 & Environmental Protection Act

2.5 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993 (1993). This requires the local authority to approve the chimney height. Plant which are smaller than 366 kW have no such requirement. The local authority's approval will, therefore, be required for the plant to be installed in the proposed development.

2.6 Measures to ensure adequate dispersion of emissions from discharging stacks and vents are included in Technical Guidance Note D1 (Dispersion) (1993), issued in support of the Environmental Protection Act (1990).

Clean Air Strategy 2019

2.7 The Clean Air Strategy (Defra, 2019) sets out a wide range of actions by which the UK Government will seek to reduce pollutant emissions and improve air quality. Actions are targeted at four main sources of emissions: Transport, Domestic, Farming and Industry. At this stage, there is no straightforward way to take account of the expected future benefits to air quality within this assessment.

Reducing Emissions from Road Transport: Road to Zero Strategy

2.8 The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition. This paper affirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by this year, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

2.9 The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. The Government has since announced *"plans to bring forward an end to the sale of new petrol and diesel cars and vans to 2035, or earlier if a faster transition is feasible, subject to consultation, as well as including hybrids for the first time"*. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades, likely beyond the scale of reductions forecast in the tools utilised in carrying out this air quality assessment.

Planning Policy

National Policies

2.10 The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2019a) sets out planning policy for England. It states that the purpose of the planning system is to contribute to the achievement of sustainable development, and that the planning system has three overarching objectives, one of which (Paragraph 8c) is an environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy".

2.11 To prevent unacceptable risks from air pollution, Paragraph 170 of the NPPF states that:

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

2.12 Paragraph 180 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".

2.13 More specifically on air quality, Paragraph 180 makes clear that:

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

2.14 The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019b), which includes guiding principles on how planning can take account of the impacts of new development on air quality. The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified".

2.15 Regarding plan-making, the PPG states:

"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".

2.16 The role of the local authorities through the LAQM regime is covered, with the PPG stating that a local authority Air Quality Action Plan "*identifies measures that will be introduced in pursuit of the objectives and can have implications for planning*". In addition, the PPG makes clear that *"… dust can also be a planning concern, for example, because of the effect on local amenity"*.

2.17 Regarding the need for an air quality assessment, the PPG states that:

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

2.18 The PPG sets out the information that may be required in an air quality assessment, making clear that:

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".

2.19 The PPG also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".

London-Specific Policies

2.20 The key London-specific policies are summarised below, with more detail provided, where required, in Appendix A1.

The London Plan

2.21 The London Plan (GLA, 2016) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to air quality.

2.22 Policy 7.14, 'Improving Air Quality', addresses the spatial implications of the Mayor's Air Quality Strategy and how development and land use can help achieve its objectives. It recognises that Boroughs should have policies in place to reduce pollutant concentrations, having regard to the Mayor's Air Quality Strategy.

2.23 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

2.24 The 'Intend to Publish' version of the new London Plan was published in December 2019 (GLA, 2019a), incorporating consolidated changes to previous versions suggested by the Mayor of London, as well as addressing the Inspectors' recommendations following the 2019 Examination in Public. Despite not yet being adopted, the 'Intend to Publish' London Plan is a material consideration in planning decisions and is afforded considerable weight. Policy SI1 on 'Improving Air Quality' states that:

"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".

2.25 It goes on to detail that 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".*

2.26 It also states that:

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

London Environment Strategy

2.27 The London Environment Strategy was published in May 2018 (GLA, 2018a). The strategy considers air quality in Chapter 4; the Mayor's main objective is to create a *"zero emission London by 2050".* Policy 4.2.1 aims to *"reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport".* An implementation plan for the strategy has also been published which sets out what the Mayor will do between 2018 and 2023 to help achieve the ambitions in the strategy.

Mayor's Transport Strategy

2.28 The Mayor's Transport Strategy (GLA, 2018b) sets out the Mayor's policies and proposals to reshape transport in London over the next two decades. The Strategy focuses on reducing car dependency and increasing active sustainable travel, with the aim of improving air quality and creating healthier streets. It notes that development proposals should *"be designed so that walking and cycling are the most appealing choices for getting around locally".*

GLA SPG: Sustainable Design and Construction

2.29 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a) provides details on delivering some of the priorities in the London Plan. Section 4.3 covers Air Pollution. It defines when developers will be required to submit an air quality assessment, explains how location and transport measures can minimise emissions to air, and provides emission standards for gas-fired boilers, Combined Heat and Power (CHP) and biomass plant. It also sets out, for the first time, guidance on how Policy 7.14B(c) of the London Plan relating to 'air quality neutral' (see Paragraph 2.23, above) should be implemented.

GLA SPG: The Control of Dust and Emissions During Construction and Demolition

2.30 The GLA's SPG on The Control of Dust and Emissions During Construction and Demolition (GLA, 2014b) outlines a risk assessment based approach to considering the potential for dust generation from a construction site, and sets out what mitigation measures should be implemented to minimise the risk of construction dust impacts, dependent on the outcomes of the risk assessment. This guidance is largely based on the Institute of Air Quality Management's (IAQM's) guidance (IAQM, 2016), and it states that "*the latest version of the IAQM Guidance should be used*".

Air Quality Focus Areas

2.31 The GLA has identified 187 air quality Focus Areas in London. These are locations that not only exceed the EU annual mean limit value for nitrogen dioxide, but also have high levels of human exposure. They do not represent an exhaustive list of London's air quality hotspot locations, but locations where the GLA believes the problem to be most acute. They are also areas where the

GLA considers there to be the most potential for air quality improvements and are, therefore, where the GLA and Transport for London (TfL) will focus actions to improve air quality. The proposed development is located within the King's Cross / Caledonian Road Area air quality Focus Area.

Local Transport Plan

2.32 Camden Council's Transport Strategy (LBC, 2019a) sets out the Council's vision and objectives for transport in the borough, in order to respond to changing challenges, opportunities and policy contexts, and identifies measures by which the Council will meet its transport goals. The Strategy contains one relevant objective, to air quality; Objective 5 'To reduce and mitigate the impact of transport-based emissions…'. The Objective is supported by the following policies:

"Policy 5b: Work towards the World Health Organisation (WHO) limits for Particulate Matter and Nitrogen Dioxide by 2030.

Policy 5c: Use air quality indicators (PM_{10} and NOx emissions levels) as key factors in prioritising locations for LIP-funding through our Area-wide Healthy Streets Projects.

Policy 5h: Where feasible and appropriate, we will monitor the impact of our highways/streetscape schemes using air quality monitoring, including (for example) the use of diffusion tubes to monitor Nitrogen Dioxide levels pre- and post-implementation."

2.33 Other actions within the supporting policies include:

- Continuing to develop a comprehensive network of electric vehicle charging points;
- Incentivising the update of electric vehicles; and
- Establishing the highest standards for the Council's own vehicle fleet.

Local Policies

2.34 The Camden Council Local Plan (LBC, 2017) was adopted in 2017. The Plan sets out the Council's planning policies, covering the period from 2016-2031, and replaces the Core Strategy and Development Policies planning documents (adopted in 2010).

2.35 Policy A1 on managing the impact of development states that *"The Council will seek to protect the quality of life of occupiers and neighbours" and will "seek to ensure that the amenity of communities, occupiers and neighbours is protected […] and require mitigation measures where necessary".* Factors that will be considered include odour, fumes and dust.

2.36 Policy CC4 on Air Quality states that:

"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 Quality Action Plan.

Air Quality Assessments (AQA) 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 permissions 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 emission impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan."

2.37 Policy D1 Design, has implications to air quality as well:

"The Council will seek to secure high quality design in development. The Council will require that development […]

c. is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation;

h. promotes health;

The Council will resist development of poor design that fails to take the opportunities available for improving the character and quality of an area and the way it functions…"

2.38 The plan elaborates that design can impact on air quality and health:

"The way an area is designed and managed can have a significant impact on people's quality of life, health and wellbeing. Planning has a key role in promoting good physical and mental health by creating streets, spaces and buildings which allow and encourage healthy lifestyles. Architecture and urban design can affect human health through […] air quality [...]. The Council will require applicants to consider how development will contribute to improving health."

2.39 LBC has published the 'Camden Planning Guidance' document, specifically pertaining to air quality, which forms a Supplementary Planning Document (SPD) (LBC, 2019b). The document provides information on air quality in the borough and supports Local Plan Policy CC4 Air Quality.

2.40 The document provides guidance on how to undertake air quality assessments, stating that:

- *"Modelling should not predict improvements to future years (future vehicle emissions or future background concentrations);* and

- *"Camden has adopted World Health Organisation pollution levels for nitrogen dioxide of 38µg/m^3 (as opposed to the EU limit value of 40µg/m^3)".*

Air Quality Action Plans

National Air Quality Plan

2.41 Defra has produced an Air Quality Plan to tackle roadside nitrogen dioxide concentrations in the UK (Defra, 2017); a supplement to the 2017 Plan (Defra, 2018a) was published in October 2018 and sets out the steps Government is taking in relation to a further 33 local authorities where shorter-term exceedances of the limit value were identified. Alongside a package of national measures, the 2017 Plan and the 2018 Supplement require those identified English Local Authorities (or the GLA in the case of London Authorities) to produce local action plans and/or feasibility studies. These plans and feasibility studies must have regard to measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a CAZ. There is currently no straightforward way to take account of the effects of the 2017 Plan or 2018 Supplement in the modelling undertaken for this assessment; however, consideration has been given to whether there is currently, or is likely to be in the future, a limit value exceedance in the vicinity of the proposed development. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the Air Quality Plan.

Local Air Quality Action Plan

2.42 LBC's Air Quality Action Plan (LBC, 2019c) sets out a series of measures by which they will seek to achieve the air quality objectives in their AQMAs. The Plan sets out seven themes, around which a number of actions have been developed in order to improve local air quality:

- *"Building emissions;*
- *construction emissions;*
- *transport emissions;*
- *communities and schools;*
- *delivery and freight;*
- *public health and awareness raising;*
- *lobbying."*

2.43 The plan also sets out the following roles for Camden to fulfil:

- *"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"*

3 Assessment Criteria

3.1 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations (2000) and the Air Quality (England) (Amendment) Regulations (2002).

3.2 The UK-wide objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m^3 (Defra, 2018b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour mean PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m^3 (Defra, 2018b). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 µg/m^3 it is unlikely that the 24-hour mean objective will be exceeded.

3.3 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2018b). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels, offices or retail units. The 24-hour mean objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

3.4 EU Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) sets limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$, and is implemented in UK law through the Air Quality Standards Regulations (2010). The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one. In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not normally recognise local authority monitoring or local modelling studies when determining

the likelihood of the limit values being exceeded, unless such studies have been audited and approved by Defra and DfT's Joint Air Quality Unit (JAQU).

3.5 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3 [a]
Fine Particles ($PM_{2.5}$) [b]	Annual Mean	25 µg/m^3

[a] A proxy value of 32 µg/m^3 as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM_{10} objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM_{10} objective are possible (Defra, 2018b).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Construction Dust Criteria

3.6 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management (IAQM)[1] (2016) has been used (the GLA's SPG (GLA, 2014b) recommends that the assessment be based on the latest version of the IAQM guidance). Full details of this approach are provided in Appendix A2.

Screening Criteria

Road Traffic Assessment

3.7 Environmental Protection UK (EPUK) and IAQM recommend a two-stage screening approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from road traffic generated by a development have the potential for significant air quality impacts. The approach, as described in Appendix A3, first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a detailed assessment.

3.8 The second stage then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. The screening thresholds (described in full in Appendix A3) inside an AQMA are a change in flows of more than 25 heavy duty vehicles or 100

[1] The IAQM is the professional body for air quality practitioners in the UK.

light duty vehicles per day; outside of an AQMA the thresholds are 100 heavy duty vehicles or 500 light duty vehicles. Where these criteria are exceeded, a detailed assessment is likely to be required, although the guidance advises that *"the criteria provided are precautionary and should be treated as indicative"*, and *"it may be appropriate to amend them on the basis of professional judgement"*.

3.9 While these screening criteria are specifically intended to act as a trigger for a detailed assessment, they can also be used them to identify the extent of the road network that requires assessment; where the change in traffic on a given road link is less than the relevant screening threshold, it is unlikely that a significant impact would occur, and these links can be disregarded unless there are additional sources affecting the link (e.g. emissions from a point source).

Diesel Generator Assessment

3.10 Environmental Protection UK (EPUK) and IAQM have developed an approach (Moorcroft and Barrowcliffe et al, 2017) to determine whether emissions from point sources, such as energy plant, have the potential for significant air quality impacts. The first step of the approach, as described in Appendix A3, is to screen the emissions and the emissions parameters to determine whether an assessment is necessary:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

3.11 Where this criteria is met, then the impacts are negligible and thus 'not significant'. This screening approach requires professional judgement, and the experience of the consultants preparing the assessment is set out in Appendix A4.

4 Assessment Approach

Study Area

4.1 The study area for the assessment has been identified using professional judgement. It includes the application site itself and roads in the surrounding area which are expected to impact on air quality at the Site. Specifically, the assessment has focussed on Swinton Street (A201), Acton Street (A501), Argyle Street and Argyle Square, as well as Gray's Inn Road (A5200), from York Way to Heathcote Street, and King's Cross Road (A201), from Pentonville Road to Wharton Street. The study area is shown in Figure 2.

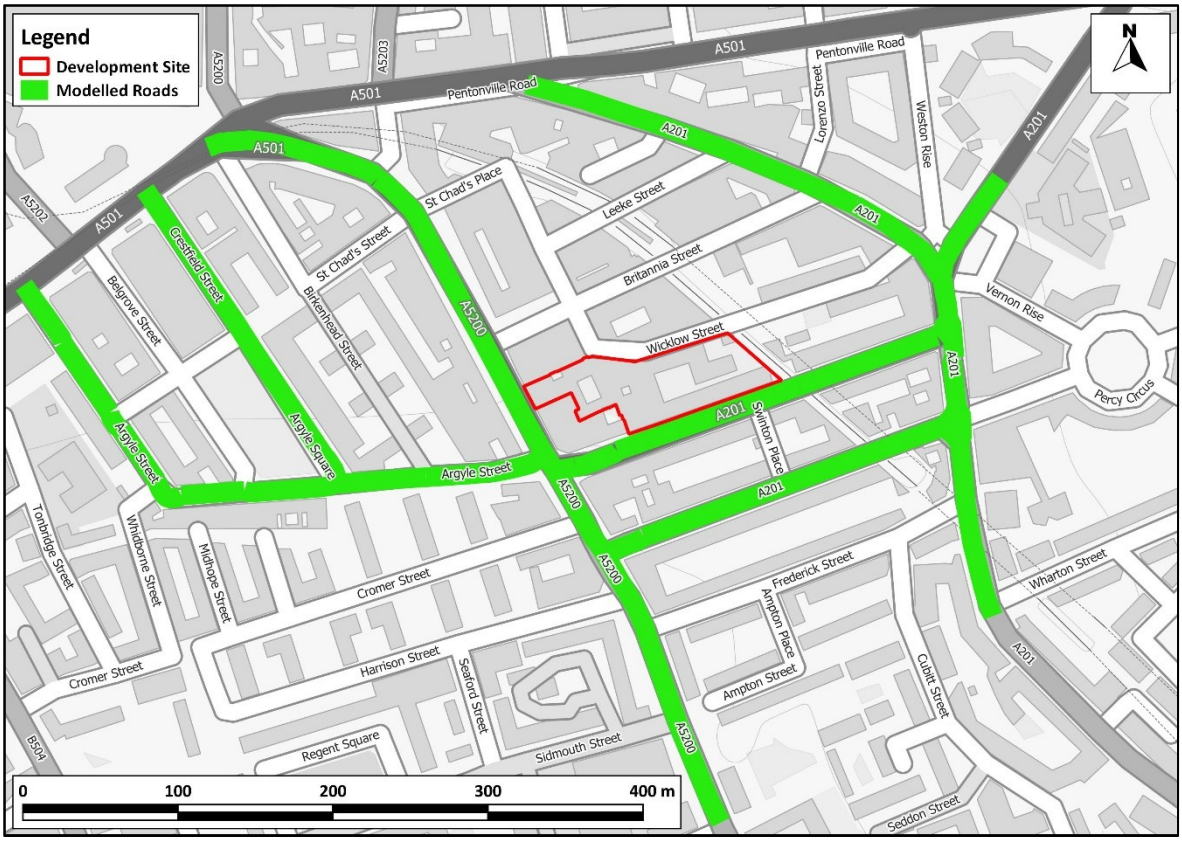

Figure 2: Study Area

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4.2 Wicklow Street has not been included within the model network, as there are no traffic data available. Nonetheless, Wicklow Street is one-way only and will be used predominantly as access to residential properties and office buildings, adjacent to the Site. It is, therefore, reasonable to assume that traffic flows will be low. Where any predicted concentrations at the Site are close to the objectives, the omission of emissions from vehicles using this road has been taken into account and considered further where considering the significance of any impacts.

Receptors

4.3 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations, within the Site, focusing on the residential and hotel uses as these receptors are relevant exposure to the air quality objectives. Receptors have been identified to represent a range of exposure, including worst-case locations (these being at the façades of the buildings fronting Swinton Street and Gray's Inn Road). Receptor locations are shown in Figure 3 and described in Table 2. Receptors were modelled at each floor level and are summarised in Table 3. Results have been verified against data from site specific monitoring locations.

Table 2: Description of Receptor Locations

Receptor	Type	X coordinate	Y coordinate
1	Residential - South	530634	182801
2	Residential - South	530645	182805
3	Residential - South	530656	182808
4	Residential - South	530669	182813
5	Residential - South	530681	182817
6	Residential - South	530677	182821
7	Residential - South	530672	182825
8	Residential - South	530666	182823
9	Residential - South	530652	182818
10	Residential - South	530642	182815
11	Residential - South	530630	182811
12	Residential - North	530648	182847
13	Residential - North	530635	182843
14	Residential - North	530620	182839
15	Hotel - Reception	530530	182801
16	Hotel - Reception	530526	182808
17	Hotel - Reception	530523	182814
18	Hotel - Rooms	530526	182815
19	Hotel - Rooms	530529	182809
20	Hotel - Rooms	530532	182803

Table 3: Modelled Receptor Heights (m)

Floor	Residential – South (1-11)	Residential – North (12-14)	Hotel – Entrance (15-17) [a]	Hotel – Rooms (18-20)
Basement	0.1	-	-	-
Ground	1.5	1.5	1.5	1.5
1st	4.7	4.8	-	5.5
2nd	7.9	8.2	-	8.5
3rd	11.2	11.5	-	11.5
4th	14.4	14.8	-	-
5th	17.6	18.2	-	-
6th	-	21.5	-	-
7th	-	24.8	-	-
8th	-	28.1	-	-
9th	-	31.5	-	-
10th	-	34.8	-	-
11th	-	38.1	-	-
12th	-	41.5	-	-

[a] The ground floor hotel façade at this location is closer to the road than the floors above. Therefore, there is no relevant exposure at higher levels.

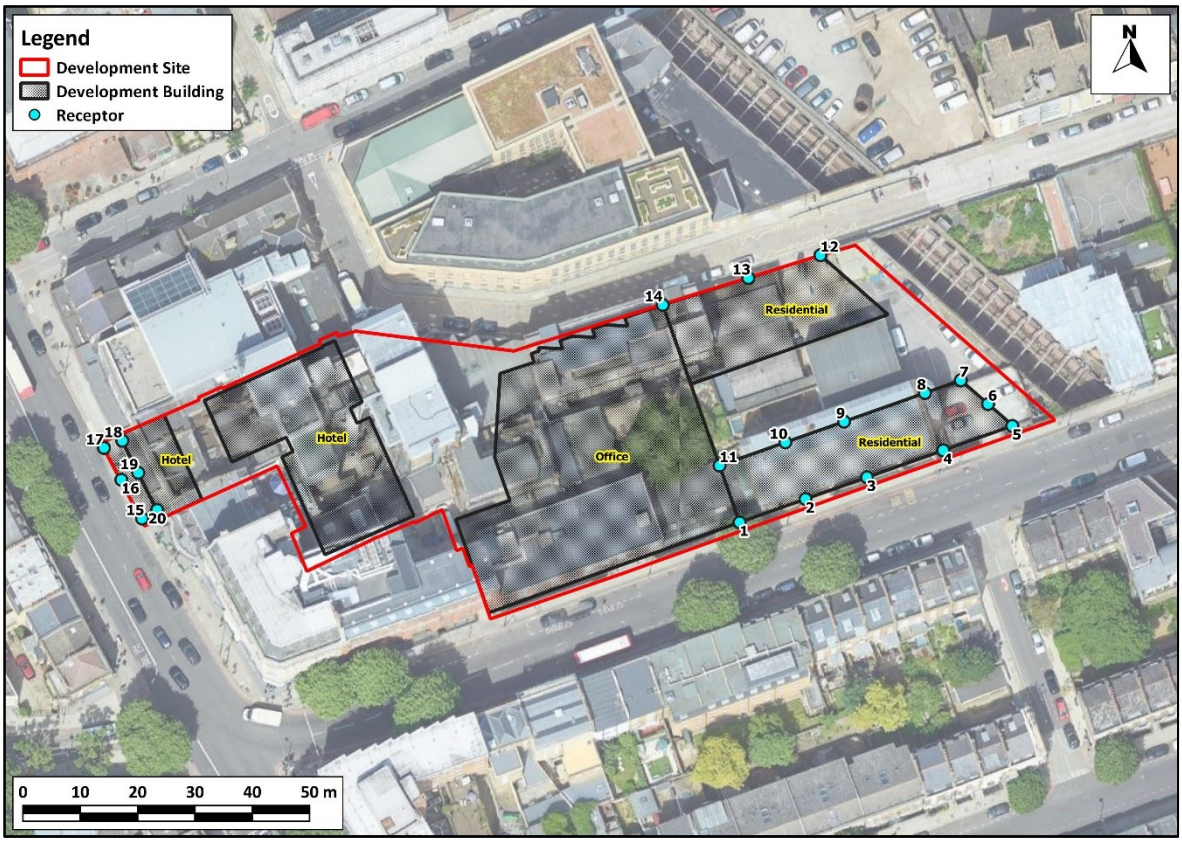

Figure 3: Receptor Locations

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infotera Ltd & Bluesky, Maxar Technologies, The GeoInformation Group.

4.4 Selected receptors may be representative of air quality conditions at a number of properties; consideration has been given to how many sensitive locations each modelled receptor represents when considering the impacts of the development and the overall significance of effects.

4.5 As discussed in Paragraphs 3.3 through 3.5, residential land-uses are most sensitive, as these represent relevant exposure for the annual mean objectives. The hotel users represent relevant exposure for the 24-hour and 1-hour mean objectives. The office uses do not represent relevant exposure to any of the national air quality objectives (but are protected by occupation exposure limits for common pollutants) and are therefore not sensitive. Predicted concentrations for the residential properties are compared to the nitrogen dioxide and PM_{10} annual mean objectives of 40 µg/m^3, and for consideration of the short-term objectives, an annual mean nitrogen dioxide concentration of 60 µg/m^3 (the proxy value identified in air quality guidance to indicate a potential exceedance of the 1-hour mean objective) and annual mean PM_{10} concentration of 32 ug/m^3 (the proxy value identified in air quality guidance to indicate a potential exceedance of the 1-hour mean objective). At the hotel façade only the proxy values for consideration of the short-term objectives are relevant.

Existing Conditions

4.6 Existing sources of emissions and baseline air quality conditions within the study area have been defined using a number of approaches:

- industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2020a);
- local sources have been identified through examination of the Council's Air Quality Review and Assessment reports;
- information on existing air quality has been obtained by conducting a site specific air quality survey, detailed in Section 5. The results of monitoring carried out by the local authority have also been included in order to provide context for the assessment;
- background nitrogen dioxide concentrations have been defined using site specific monitoring results from the top floor of the existing Royal National Throat, Nose and Ear Hospital building, fronting Wicklow Street. In addition, Defra's 2017-based background maps (Defra, 2020b) have been used to derive background PM_{10} and $PM_{2.5}$ concentrations. These cover the whole of the UK on a 1x1 km grid;
- whether or not there are any exceedances of the annual mean EU limit value for nitrogen dioxide in the study area has been identified using the maps of roadside concentrations published by Defra (2020e) (2020c), as well as from any nearby Automatic Urban and Rural Network (AURN) monitoring sites (which operate to EU data quality standards). These maps are used by the UK Government, together with the AURN results, to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2020c), which are available for the years 2009 to 2018, show no exceedances of the limit values anywhere in the UK in 2018.

Construction Impacts

4.7 The construction dust assessment considers the potential for impacts within 350 m of the Site boundary; or within 50 m of roads used by construction vehicles. The assessment methodology follows the GLA's SPG on the Control of Dust and Emissions During Construction and Demolition (GLA, 2014b), which is based on that provided by IAQM (2016). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the Site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A2 explains the approach in more detail.

Road Traffic Impacts

4.8 The first step in considering the road traffic impacts of the proposed development has been to screen the development and its traffic generation against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraph 3.7 and detailed further in Appendix A3. Where impacts can be screened out there is no need to progress to a more detailed assessment.

Impacts of the Proposed Backup-Generator Plants

4.9 The proposed development will be provided with emergency electricity using a two 1.1 MW backup diesel generator to be located on the roof of the office building. The impacts of emissions from the generators during the testing regime have been assessed.

4.10 The first step in considering the energy plant impacts has been to screen the pollutant emissions against the criteria set out in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017), as described in Paragraphs 3.10 and 3.11. The assessment has taken into account the location of the plant and frequency of the testing regime, to determine the risk of emissions causing exceedances of the objectives.

Impacts of Existing Air Quality on Future Residents

4.11 Future occupants of the proposed development itself will be subject to the impacts of emissions associated with road traffic on local roads, emissions from the proposed diesel generator, as well as impacts from energy plant located in nearby developments. The main air pollutants of concern related to traffic emissions and the diesel generator are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$), while that related to gas-fired plant in nearby energy centres is nitrogen dioxide.

4.12 The impacts of concentrations of nitrogen dioxide and particulate matter on future users of the proposed development have been assessed using detailed dispersion modelling.

Modelling Methodology

4.13 Concentrations have been predicted using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v9.0) (Defra, 2020b). Details of the model inputs and the model verification are provided in Appendix A5.

Assessment Scenarios

4.14 Nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been predicted for the proposed year of opening of the proposed development (2023). In accordance with LBC's Air Quality planning guidance (LBC, 2019b), concentrations have also been predicted assuming no improvements in emissions between 2019 and the opening year of 2023 (Appendix A6).

Uncertainty

4.15 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.

4.16 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A5). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2019) concentrations.

4.17 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future. Historically, Defra's EFT had a tendency to over-state emissions reductions into the future. However, analysis of Defra's latest EFT (AQC, 2020) suggests that, on balance, the EFT is unlikely to over-state the rate at which NOx emissions decline in the future at an 'average' site in the UK. In practice, the balance of evidence suggests that NOx concentrations are most likely to decline more quickly in the future, on average, than predicted by the EFT, especially against a base year of 2016 or later. Using EFT v9.0 for future-year forecasts thus provides a robust assessment, given that the model has been verified against measurements made in 2019. In addition, the Mayor of London confirmed in June 2018 that changes will be made to the existing LEZ in 2020, and that the Ultra Low Emission Zone (ULEZ) will be expanded in 2021. The changes are described in detail in Appendix A1, and can be expected to significantly reduce NOx emissions in London from 2020 onwards.

4.18 In spite of the large body of evidence described above indicating that the EFT vehicle projection factors are robust and LBC's own monitoring data indicating the concentrations have reduced in the borough, LBC request that concentrations are predicted assuming no improvements in vehicle emissions, which are presented in Appendix A6. For these reasons, the results presented in Appendix A6 are, therefore, very much worst-case in this regard, and it is expected that background concentrations, baseline concentrations, and the impacts of the proposed development, will actually be closer to those described in Sections 5 and 7 of this report. Appendix A6 discusses uncertainties regarding the future fleet mix in London and the scale of the reduction in NOx emissions that can be expected with the adoption of these changes. The LBC approach of ignoring future improvements in air quality will more than offset any other uncertainties in the assumptions.

4.19 As the adoption of mitigation measures has been based on the very much worst-case predictions, provided in Appendix A6, the threshold used to decide where mitigation should be implemented is the UK annual mean objective of 40 $\mu g/m^3$, rather than the LBC SPD threshold of 38 $\mu g/m^3$. This may still be considered a robust assessment, as the worst-case results provided in Appendix A6 are unrealistically high.

Assumptions

4.20 It is necessary to make a number of assumptions when carrying out an air quality assessment; in order to account for some of the uncertainty in the approach, as described above, assumptions made have generally sought to reflect a realistic worst-case scenario. Key assumptions made in carrying out this assessment are that the London City meteorological monitoring station appropriately represents conditions in the study area (this is discussed further in Appendix A5) and that much of the Site is located within street canyons (this is discussed further in Appendix A5).

Assessment of Significance

Construction Dust Significance

4.21 Guidance from IAQM (2016) is that, with appropriate mitigation in place, the effects of construction dust will be 'not significant'. This is the latest version of the guidance upon which the assessment methodology set out in the GLA guidance (GLA, 2014b) is based (the GLA guidance advises that the latest version of the IAQM guidance should always be used). The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that effects will normally be 'not significant'.

Operational Significance

4.22 There is no official guidance in the UK in relation to development control on how to assess the significance of air quality impacts. The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM)[2] (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. The overall significance of the air quality impacts is determined using professional judgement; the experience of the consultants preparing the report is set out in Appendix A4. Full details of the EPUK/IAQM approach are provided in Appendix A3.

'Air Quality Neutral'

4.23 The guidance relating to air quality neutral follows a tiered approach, such that all developments are expected to comply with minimum standards for gas and biomass boilers and for CHP plant (GLA, 2014a). Compliance with 'air quality neutral' is then founded on emissions benchmarks that have been derived for both building (energy) use and road transport in different areas of London. Developments that exceed the benchmarks are required to implement on-site or off-site mitigation to offset the excess emissions (GLA, 2014a).

4.24 Appendix A8 sets out the emissions benchmarks. The approach has been to calculate the emissions from the development and to compare them with these benchmarks.

[2] The IAQM is the professional body for air quality practitioners in the UK.

5 Baseline Conditions

Relevant Features

5.1 The Site is located near St Pancras, in Camden, within 150 m of the boundary with London Borough of Islington (LBI). The Hotel buildings within the application site are bounded by Gray's Inn Road and other buildings surrounding the Site. Both residential buildings are bounded in part by a trainline running between St Pancras and Farringdon Station, one of the buildings by Swinton Street and the other by Wicklow Street. The office building is bounded by Wicklow Street, Swinton Street and adjacent buildings. The Site currently consists of The Royal National Throat, Nose and Ear Hospital. There are existing residential, office and retail buildings in the immediate surroundings.

5.2 The Site is located within the Camden boroughwide AQMA and an air quality Focus Area, as highlighted in Figure 1.

Industrial sources

5.3 No significant industrial or waste management sources have been identified that are likely to affect the proposed development, in terms of air quality.

Site Visit

5.4 A site visit was carried out on 3rd July 2019, to commence the site-specific monitoring. Other than road traffic, no significant sources of air pollution were identified during the site visit.

Local Air Quality Monitoring

Local Authority Monitoring

5.5 LBC operates three automatic monitoring stations within its area, the closest of which are the London Bloomsbury and Euston Road sites, situated 650 and 880 m away respectively. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Gradko International (using the 50% TEA in acetone method). These include two deployed along Euston Road, within 650 m of the Site, and a number at background sites.

5.6 The Site also lies in close proximity to the London Borough of Islington. LBI operates three diffusion tube monitoring sites within 700 m of the Site, including two background locations and the Roseberry Avenue roadside site.

5.7 Annual mean results for the years 2013 to 2019 are summarised in Table 4, while results relating to the 1-hour mean objective are summarised in Table 5. Exceedances of the objectives are shown in bold. The monitoring locations are shown in Figure 4. The monitoring data have been taken from LBC's 2020 Annual Status Report (LBC, 2020) and LBI's 2019 Annual Status Report (LBI, 2019).

Table 4: Summary of Annual Mean NO_2 Monitoring (2013-2019) (µg/m³)

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018	2019
LBC – Automatic Sites									
B0	Urban Background	London Bloomsbury	**44**	**45**	**48**	**42**	38	36	32
CD9	Roadside	Euston Road	**106**	**98**	**90**	**88**	**83**	**82**	**70**
LBC - Diffusion Tubes									
CA10	Urban Background	Tavistock Gardens	**49**	**47**	**45**	**40**	**46**	35	33
CA27	Roadside	Euston Road LAQN colocation	-	-	-	-	-	-	**64**
CA28	Urban Background	St. George's Gardens East	-	-	-	-	-	-	28
CA29	Roadside	Endsleigh Gardens	-	-	-	-	-	-	**48**
CA4A (new)	Kerbside	Euston Road	-	-	-	-	-	-	**69**
CA6	Urban Background	St. George's Gardens (prev. 'Wakefield Gardens')	**40**	36	36	31	34	27	25
LBI – Diffusion Tubes									
BIS005/02	Roadside	Roseberry Avenue	**57**	**58**	**62**	**62**	**54**	**51**	-
BIS005/04	Urban Background	Percy Circus	38	**40**	**45**	**46**	**40**	35	-
BIS005/05	Urban Background	Myddleton Square	37	39	39	38	39	35	-
Objective			**40**						

[a] Exceedances of the objectives are shown in bold.

Table 5: Number of Hours With NO_2 Concentrations Above 200 µg/m³

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018	2019
B0	Urban Background	London Bloomsbury	0	0	0	0	0	0	0
CD9	Roadside	Euston Road	**404**	**221**	**54**	**39**	**25**	**18**	7
Objective			**18**						

[a] Exceedances of the objectives are shown in bold.

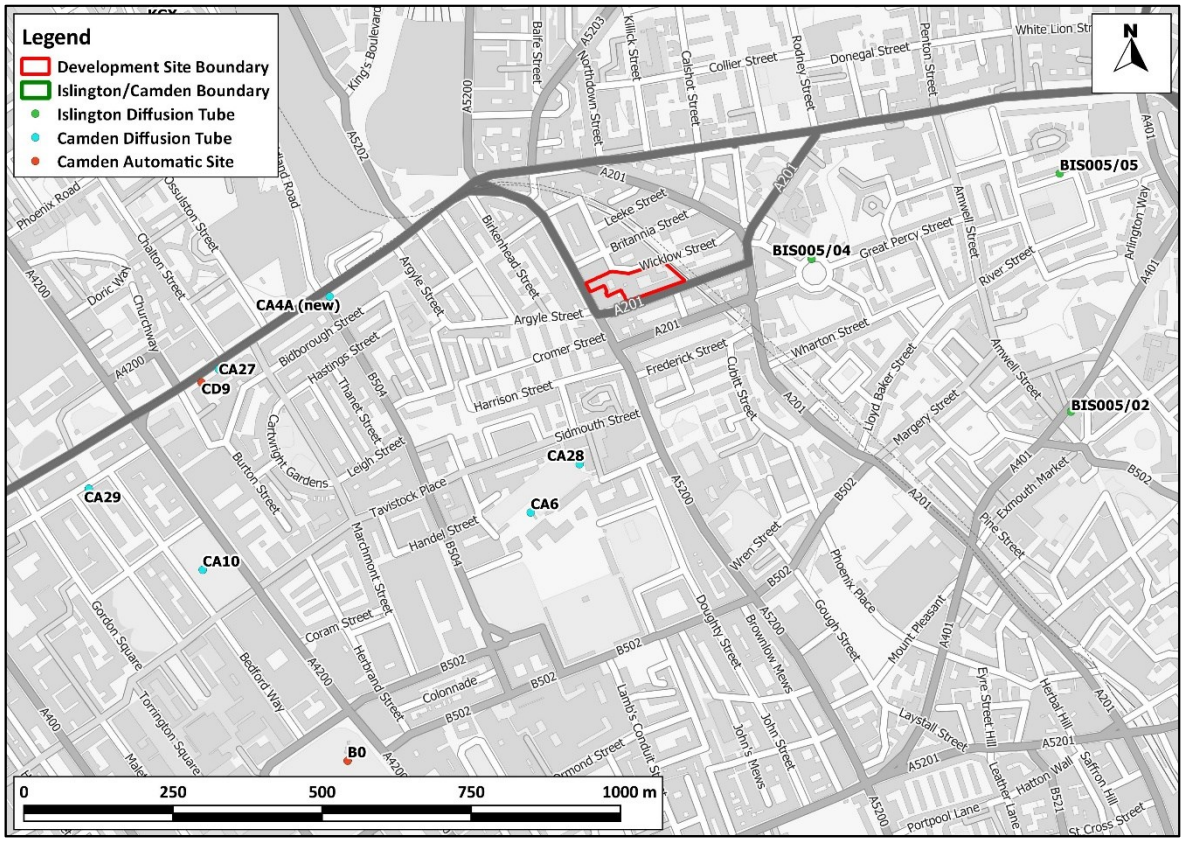

Figure 4: Local Authority Monitoring Locations

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5.8 There have been consistent exceedances of the annual mean NO_2 objective, at all roadside and kerbside monitors since 2013. However, concentrations at all background sites in the study area are below the objective in the most recent recorded year. As none of the above monitoring sites are believed to be representative of air quality conditions at the Site, a site specific monitoring survey was conducted.

5.9 From the monitoring sites that have been in operation since 2013, there is evidence to suggest a strong downward trend in concentrations over time at roadside and urban background monitoring sites.

5.10 The London Bloomsbury and Euston Road automatic monitoring stations also measure PM_{10} and $PM_{2.5}$. Annual mean results for the years 2013 to 2018 are summarised in Table 6, while results relating to the daily mean objective are summarised in Table 7. Exceedances of the objectives are shown in bold.

Table 6: Summary of Annual Mean PM_{10} and $PM_{2.5}$ Monitoring (2013-2019) (µg/m³)

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018	2019
PM_{10}									
B0	Urban Background	London Bloomsbury	18	20	22	20	19	17	18
CD9	Roadside	Euston Road	-	29	18	24	20	21	22
Objective			**40**						
$PM_{2.5}$									
B0	Urban Background	London Bloomsbury	-	-	11	12	16	10	11
CD9	Roadside	Euston Road	-	-	17	17	14	15	14
Objective			**25 [a]**						

[a] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Table 7: Number of Days With PM_{10} Concentrations Above 50 µg/m³

Site No.	Site Type	Location	2013	2014	2015	2016	2017	2018	2019
B0	Urban Background	London Bloomsbury	4	11	6	9	6	1	9
CD9	Roadside	Euston Road	-	5	5	10	3	2	8
Objective			**35 [a]**						

Site Specific Monitoring Survey

5.11 Nitrogen dioxide monitoring has also been carried out using diffusion tubes deployed at seven locations in the vicinity of the Site by Air Quality Consultants Ltd. The locations of the seven monitoring sites are described in Table 8 and shown in Figure 5.

5.12 The diffusion tube survey was designed in accordance with the Diffusion Tubes for Ambient NO_2 Monitoring Practical Guidance (AEA Energy & Environment, 2008) published on Defra's air quality website. Diffusion tubes were supplied and analysed by Gradko International Ltd (using the 50% TEA in acetone preparation method).

5.13 6-months of monitoring was carried out between 3rd July 2019 to 8th January 2020. In order for the short-term monitoring study to represent annual mean concentrations, the data have been annualised to a 2019 calendar year.

5.14 The data have also been corrected for systematic diffusion tube bias using a Defra's national diffusion tube bias adjustment factor spreadsheet (Defra, 2020d). Full details of the annualisation and bias adjustment procedures applied are presented in Appendix A9.

Table 8: Diffusion Tube Monitoring Locations and Annual Mean NO_2 Concentrations [a]

Site No.	Location	Annual Mean NO_2 ($\mu g/m^3$) [b]	%Data Capture [c]
GR1	1st floor office window on Gray's Inn Road	**46.4**	100
GR2 [d]	Lampost on Gray's Inn Road	**49.6**	83
GR4 [d]	1st floor office window on Swinton Street	**49.2**	83
GR5 [d]	Lamppost on Swinton Street	**51.6**	100
GR6 [d]	Roof of Building on Wicklow Street	34.8	100
GR7 [d]	Wicklow Street	38.0	83
Objective		**40.0**	

[a] Results for monitoring site GR3 have not been presented due to low data capture.

[b] Results have been annualised and bias adjusted (see Appendix A9).

[c] 100% data capture corresponds to 6 months of data.

[d] Triplicate diffusion tubes.

5.15 The results show that at ground and 1st-floor on Gray's Inn Road and Swinton Street measured concentrations are above the air quality objectives, indicating existing air quality is poor. However, at roof level and on Wicklow Street concentrations meet the air quality objectives.

5.16 As the air quality monitoring survey was conducted in 2019, before the spread of COVID-19 in 2020 resulted in a decline in road traffic, the report has not been influenced in any way by these unusual changes.

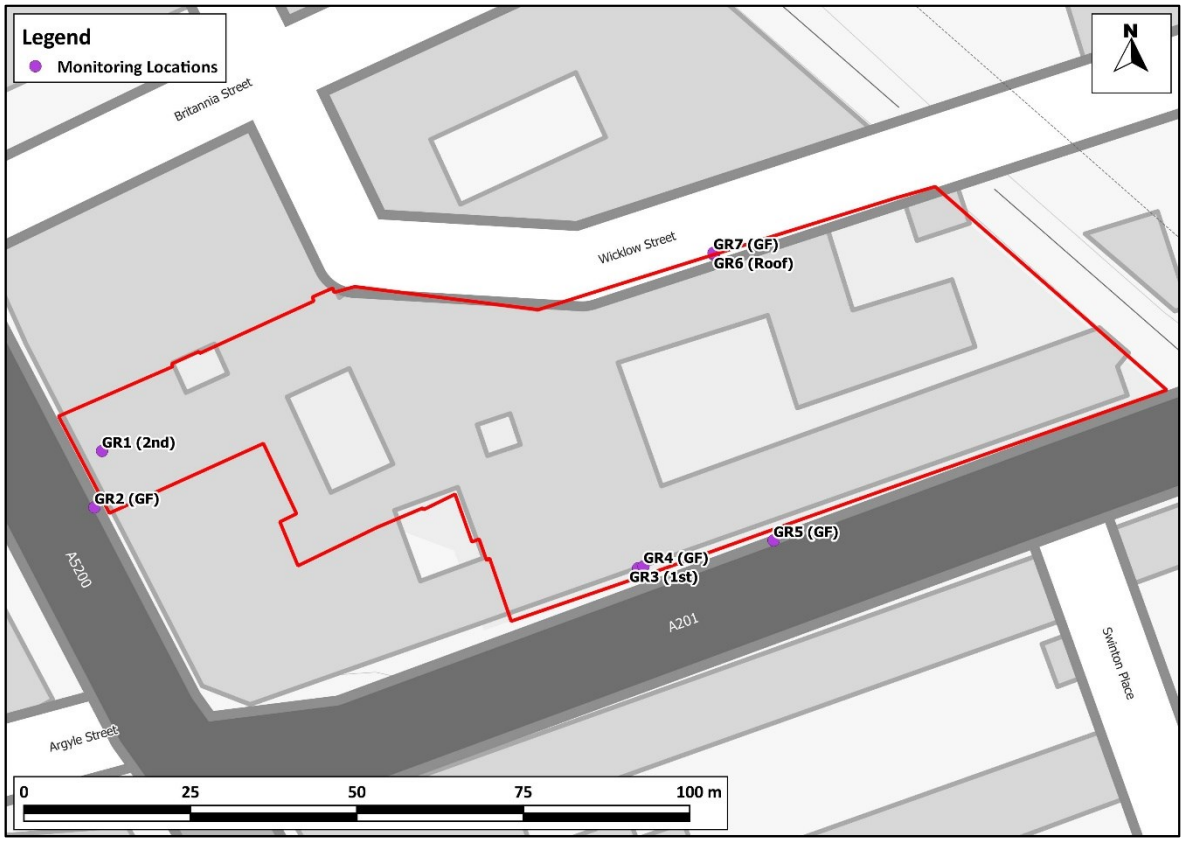

Figure 5: Site Specific Monitoring Survey Locations

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Exceedances of EU Limit Value

5.17 There are several AURN monitoring sites within the Greater London Urban Area that have measured exceedances of the annual mean nitrogen dioxide limit value. Furthermore, Defra's roadside annual mean nitrogen dioxide concentrations (Defra, 2020c), which are used to report exceedances of the limit value to the EU, identify exceedances of this limit value in 2019 along many roads in London, including Gray's Inn Road, adjacent to the Site. The Greater London Urban Area has thus been reported to the EU as exceeding the limit value for annual mean nitrogen dioxide concentrations. Defra's predicted concentrations for 2023 (Defra, 2020e) do not identify any exceedances adjacent to the Site. As such, there is considered to be no risk of a limit value exceedance in the vicinity of the Site by the time that it is operational.

5.18 Defra's Air Quality Plan requires the GLA to prepare an action plan that will *"deliver compliance in the shortest time possible"*, and the 2015 Plan assumed that a CAZ was required. The GLA has already implemented an LEZ and a ULEZ, thus the authority has effectively already implemented the required CAZ. These have been implemented as part of a package of measures including 12

Low Emission Bus Zones, Low Emission Neighbourhoods, the phasing out of diesel buses and taxis and other measures within the Mayor's Transport Strategy.

Background Concentrations

5.19 Estimated background concentrations at the Site are set out in Table 9 and are below the objectives. Results are provided for context, as the measured on-site background concentration from GR6 of 34.7µg/m^3 has been used in the modelling for the assessment. This is judged to be most representative of background concentrations at the Site.

Table 9: Estimated Annual Mean Background Pollutant Concentrations in 2019 and 2023 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2019	37.8	19.3	12.8
2023	32.7	18.4	12.1
Objectives	**40**	**40**	**25** [a]

[a] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

6 Construction Phase Impact Assessment

Construction Traffic

6.1 The construction works have the potential to generate traffic throughout the construction phase. It is not known at this stage how many vehicles will have access to the Site on any given day, however, given the scale of the Site, it is anticipated that as an annual average, movements to and from the Site will not exceed the screening threshold of 25 Heavy Duty Vehicles (HDVs) recommended for use within an AQMA in the EPUK/IAQM Guidance (Moorcroft and Barrowcliffe et al, 2017) (see Paragraph 3.8). Based on the above, and the fact that these movements will be temporary and will not have a lasting effect on local air quality, it is not considered necessary to assess the impacts of traffic emissions during the construction phase.

On-Site Exhaust Emissions

6.2 The IAQM guidance (IAQM, 2016) states:

"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur".

6.3 The proposed development is a not sufficiently large or unusual to require quantitative assessment of emissions from NRMM. Therefore, based on the above guidance, it is judged that there is no risk of significant effects at existing receptors as a result of on-site machinery emissions.

Construction Dust and Particulate Matter Emissions

6.4 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. Step 1 of the assessment procedure is to screen the need for a detailed assessment. There are receptors within the distances set out in the guidance (see Appendix A2), thus a detailed assessment is required. The following section sets out Step 2 of the assessment procedure.

Potential Dust Emission Magnitude

Demolition

6.5 There will be a requirement to demolish all existing buildings within the Site, with the exception of the westernmost hospital building at 330 Gray's Inn Road. This equates to a total volume of approximately 40,000 - 50,000 m^3 of building to be demolished. Demolition will occur up to 26 m above ground level and comprise potentially dusty construction material, such as concrete. Based

on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for demolition is considered to be *large.*

Earthworks

6.6 The characteristics of the soil at the Site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2020), as set out in Table 10. Overall, it is considered that, when dry, this soil has the potential to be moderately dusty.

Table 10: Summary of Soil Characteristics

Category	Record
Soil Layer Thickness	Deep
Soil Parent Material Grain Size	Argillaceous [a]
European Soil Bureau Description	Prequaternary Marine/Estuarine Sand and Silt
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Clayey Loam [b] to Silty Loam

[a] grain size < 0.06 mm.

[b] a loam is composed mostly of sand and silt.

6.7 The Site covers approximately 5,400 m^2 and most of this will be subject to earthworks, involving removal of the foundations of the demolished buildings and excavating the basement area. Dust will arise mainly from vehicles travelling over unpaved ground and from the handling of dusty materials (such as dry soil). Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for earthworks is considered to be *large*.

Construction

6.8 Construction will comprise two residential blocks, office building and a larger hotel block, with a total building volume of at least 100,000 m^3 constructed of brick and other materials. Dust will arise primarily from the handling and storage of dusty materials, and from the cutting of concrete. Based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for construction is considered to be *large*.

Trackout

6.9 The number of heavy vehicles accessing the Site, which may track out dust and dirt, is currently unknown, but given the size of the Site it is unlikely to be more than a maximum of 10-50 outward heavy vehicle movements per day. During the majority of the construction period vehicles are unlikely to have travelled over unpaved ground In order to be conservative, based on the example definitions set out in Table A2.1 in Appendix A2, the dust emission class for trackout is judged to be *medium*.

6.10 Table 11 summarises the dust emission magnitude for the proposed development.

Table 11: Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude
Demolition	Large
Earthworks	Large
Construction	Large
Trackout	Medium

Sensitivity of the Area

6.11 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the Site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

6.12 The IAQM guidance, upon which the GLA's guidance is based, explains that residential properties and student dwellings are 'high' sensitivity receptors to dust soiling, while places of work are 'medium' sensitivity receptors (Table A2.2 in Appendix A2). Residential properties and places of work are also classified as being of 'high' and 'medium' sensitivity respectively to human health effects. There are at least 100 dwellings within 20 m of the Site (see Figure 6), situated primarily within the Depot Point student accommodation block adjacent to Wicklow Street and along Swinton Street. However, it should be noted that a significant proportion of these dwellings is temporary accommodation, with little amenity space which could be impacted by dust soiling.

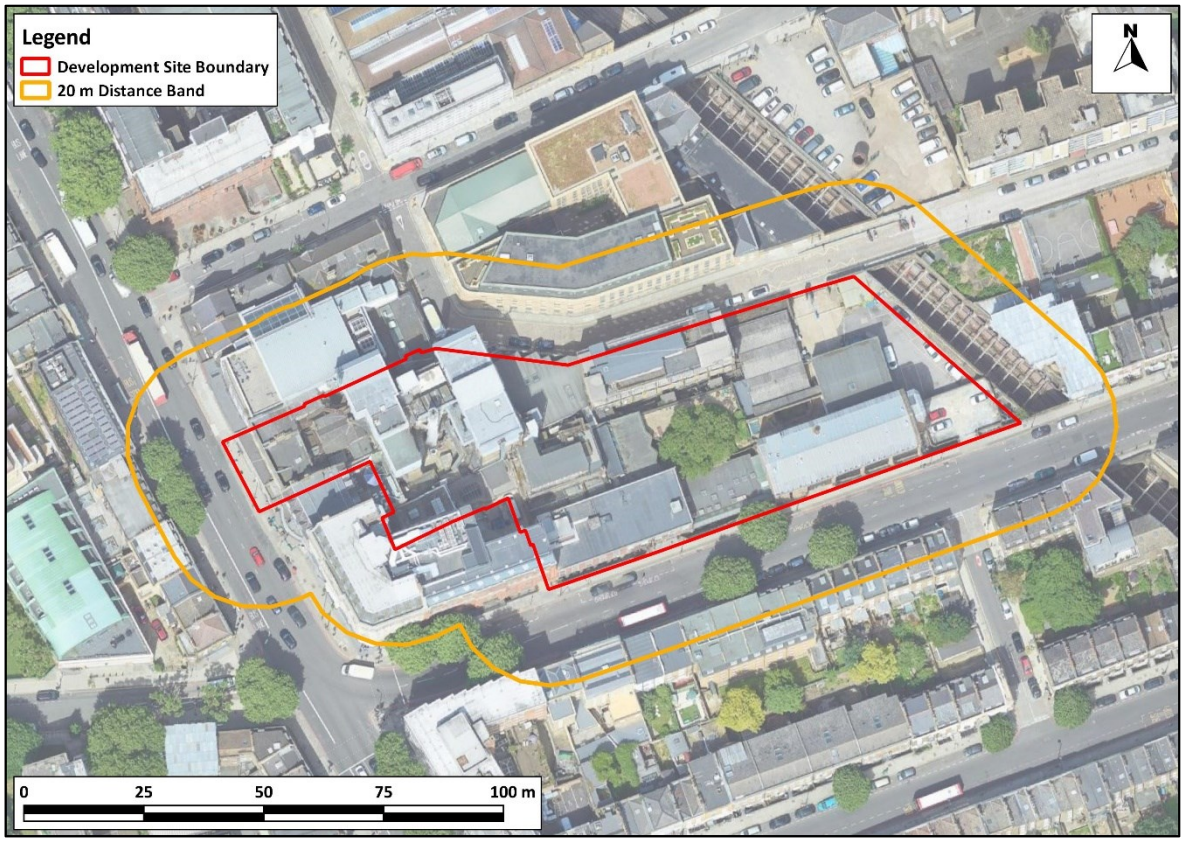

Figure 6: 20 m Distance Band around Site Boundary

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infotera Ltd & Bluesky, Maxar Technologies, The GeoInformation Group.

6.13 Table 11 shows that the dust emission magnitude for trackout is *medium* and Table A2.3 in Appendix A2 thus explains that there is a risk of material being tracked 200 m from the Site exit. Since it is not known which roads construction vehicles will use, it has been assumed that all possible routes could be affected. There are well over 100 residential dwellings within 20 m of the roads along which material could be tracked (see Figure 7).

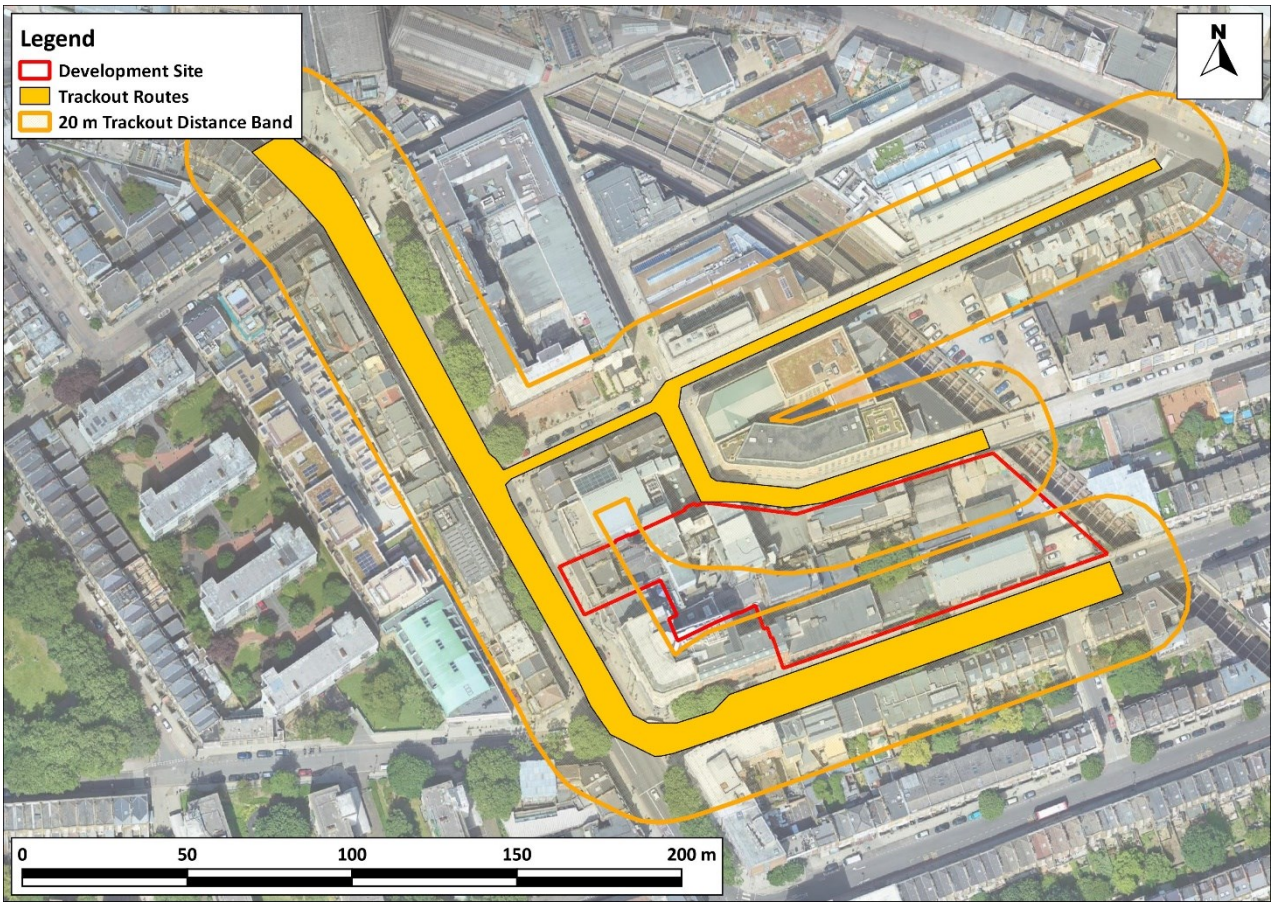

Figure 7: 20 m Distance Band around Possible Roads Used by Construction Traffic Within 200 m of the Site

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infotera Ltd & Bluesky, Maxar Technologies, The GeoInformation Group.

Sensitivity of the Area to Effects from Dust Soiling

6.14 Using the information set out in Paragraph 6.12 and Figure 6 alongside the matrix set out in Table A2.3 in Appendix A2, the area surrounding the onsite works is of 'high' sensitivity to dust soiling. Using the information set out in Paragraph 6.13 and Figure 7 alongside the same matrix, the area is also of 'high' sensitivity to dust soiling due to trackout.

Sensitivity of the Area to any Human Health Effects

6.15 The matrix in Table A2.4 in Appendix A2 requires information on the baseline annual mean PM_{10} concentration in the area. The properties nearest the Site are situated on Swinton Street, along which PM_{10} concentrations have been modelled (receptors 1-5). The maximum predicted baseline PM_{10} concentration at these receptors is 22.4 $\mu g/m^3$ at basement level. This prediction is made using the same worst-case assumptions as specified in paragraph 4.18. Using the information set out in Paragraph 6.12 and Figure 6 alongside the matrix in Table A2.4 in Appendix A2, the area surrounding the onsite works is of 'medium' sensitivity to human health effects. Using the information

set out in Paragraph 6.13 and Figure 7 alongside the same matrix, the area surrounding roads along which material may be tracked from the Site is also of 'medium' sensitivity.

Sensitivity of the Area to any Ecological Effects

6.16 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of the Site boundary or those roads along which material may be tracked, thus ecological impacts will not be considered further.

Summary of the Area Sensitivity

6.17 Table 12 summarises the sensitivity of the area around the proposed construction works.

Table 12: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	High Sensitivity	High Sensitivity
Human Health	Medium Sensitivity	Medium Sensitivity

Risk and Significance

6.18 The dust emission magnitudes in Table 11 have been combined with the sensitivities of the area in Table 12 using the matrix in Table A2.6 in Appendix A2, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 13. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 9 (step 3 of the assessment procedure).

Table 13: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition	High Risk	High Risk
Earthworks	High Risk	Medium Risk
Construction	High Risk	Medium Risk
Trackout	Medium Risk	Low Risk

6.19 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant' (IAQM, 2016).

7 Operational Phase Impact Assessment

Impacts at Existing Receptors

Assessment of Development-Generated Road Traffic Emissions

7.1 The proposed development is expected to generate a total of 175 daily light duty vehicle (LDV) movements and 21 HDVs per day. However, until recently the hospital generated a number of vehicle movements and overall there is anticipated to be a net reduction in vehicle movements associated with the Site compared with this recent use. The recent LDV trip generation attributed to the hospital is 251 per day, so there is anticipated to be a net decrease of 76 movements. Therefore, in this regard, the development will result in an improvement in existing air quality.

7.2 The development-generated Heavy Duty Vehicle (HDV) trip generation is 21 per day, which is below the screen threshold of 25 HDVs recommended for use within an AQMA in the EPUK/IAQM guidance (Moorcroft and Barrowcliffe et al, 2017). The hospital currently generates 9 trips per day, so the net increase is 12 movements per day which is also below the screening criteria.

7.3 As such, it is judged that the development will result in a minimal change in traffic flows and there is no requirement for a detailed assessment of road traffic impacts at existing receptors; it can be concluded that the proposed development will not have a significant impact on local roadside air quality.

Assessment of Energy Plant Emissions

7.4 The proposed development will include a backup diesel generator. The generator will only be used under two conditions; while testing on-load and in the event of an electrical blackout. Testing will occur monthly, for half an hour, with generators on-load, meaning they will only temporarily increase local pollutant concentrations once a month. As pollutant concentrations will only be raised for a small number of short periods, there will be a negligible impact on annual mean pollutant concentrations and this need not be considered.

7.5 The short-term objectives set out in Table 1 state that a nitrogen dioxide concentration of 200 $\mu g/m^3$ is not to be exceeded more than 18 hours a year. Regardless of whether or not the generators being tested will cause an exceedance of this objective at all, if generators are tested monthly (i.e. 12 times a year) for a maximum of 30 minutes, then there is no risk of exceeding this objective for a total of 18 hours. In addition, the location of any impacts will vary depending on the wind direction during the test, and thus it is unlikely that the same location would be affected during all twelve of the monthly tests in a year. Therefore, aligning with the testing schedule, there is no risk of the proposed generator causing a breach of either short or long term objectives.

Impacts of Existing Sources on Future Residents and Users of the Development

Assessment of Emissions from the Local Road Network on Future Residents

7.6 Predicted air quality conditions for future residents of the proposed development, taking account of emissions from the adjacent road network, are set out in Table 14 for Receptors 1 to 14 (see Table 2 and Figure 3 for receptor locations). Concentrations have been predicted at all floors, but results are presented only for the lowest floors and those close to, or in exceedance of, the objective. The results show that nitrogen dioxide concentrations may marginally exceed the annual mean objective at some receptors along Swinton Street on the basement and ground floor. At the third floor, nitrogen dioxide concentrations are below the more precautionary threshold specified by the LBC SPD on air quality as well. At the remainder of the residential receptors throughout the the Site, concentrations are below their respective objectives. Air quality for future residents and users of the development, without mitigation, will thus be acceptable in all locations, except for the lower floors of the residential building façade fronting Swinton Street. Consequently, mitigation measures will be implemented for these properties to ensure that air quality is acceptable for all residents and users (See Section 9 for mitigation measures and 10 for residual impacts).

7.7 Predicted air quality conditions for users of the hotel portion of the development are set out in Table 15 for Receptors 15 to 20. As discussed in paragraph 4.5, the proxy concentration of 60 µg/m^3 has been used to determine whether air quality is acceptable within the hotel. The results show that concentrations are below the objective at all worst-case locations within the building and that air quality will thus be acceptable at for all future users of the hotel. This is also the case, based on the worst-case model results presented in Appendix A6

Table 14: Predicted Annual Mean Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2023 for New Residential Receptors in the Proposed Development (µg/m^3)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
Basement			
1	**40.6**	19.6	12.7
2	39.8	19.5	12.7
3	39.9	19.6	12.7
4	35.8	18.3	12.0
5	39.6	19.5	12.7
6	32.4	17.3	11.4
7	32.0	17.2	11.3
8	32.0	17.2	11.3
9	31.9	17.1	11.3

Receptor	NO_2	PM_{10}	$PM_{2.5}$
10	31.9	17.1	11.3
11	31.9	17.1	11.3
Ground			
1	**40.5**	19.5	12.7
2	39.7	19.5	12.7
3	39.8	19.5	12.7
4	35.7	18.3	12.0
5	39.6	19.5	12.6
12	31.6	17.1	11.3
13	31.6	17.1	11.3
14	31.6	17.0	11.3
1st Floor			
1	39.4	19.2	12.5
2	38.7	19.2	12.5
3	38.7	19.2	12.5
4	34.8	18.0	11.8
5	37.9	18.9	12.3
3rd Floor			
1	37.1	18.6	12.1
2	36.8	18.6	12.1
3	36.8	18.6	12.1
4	33.5	17.6	11.6
5	36.0	18.4	12.0
Objective / Criterion	**40**	**32** [a]	**25** [b]

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Table 15: Predicted Annual Mean Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2023 for Hotel Receptors in the Proposed Development (µg/m^3)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
Ground			
15	43.0	20.1	13.0
16	41.9	20.0	13.0
17	41.9	20.0	13.0
1st Floor			
18	40.3	19.5	12.7
19	40.4	19.6	12.7
20	41.4	19.6	12.7
Objective / Criterion	**60**	**32** [a]	**25** [b]

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Significance of Operational Air Quality Effects

7.8 The operational air quality effects without mitigation, with regard to the impact of the development on existing air quality, are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A3, and takes account of the assessment that:

- The change in construction and development related traffic as a result of the proposed development is below the screening criteria and therefore is not anticipated to result in any significant change to local air quality; and
- the impact of the backup diesel generators on local air quality will not cause an exceedance of the objectives.

7.9 Without mitigation, there is potential for future residents at a number of lower floor receptors fronting Swinton Street to experience significant impacts from existing air quality, as the assessment has demonstrated that pollutant concentrations within the Site will be above the objectives. Mitigation measures for these dwellings are therefore set out in Section 9. At residential receptors at facades other than on Swinton Street, concentrations are predicted to be below the objective, and therefore air quality at these receptors is judged to be acceptable and mitigation measures are not necessary.

8 'Air Quality Neutral'

8.1 The purpose of the London Plan's requirement that development proposals be 'air quality neutral' is to prevent the gradual deterioration of air quality throughout Greater London. The 'air quality neutrality' of a proposed development, as assessed in this section, does not directly indicate the potential of the proposed development to have significant impacts on human health (this has been assessed separately in the previous section).

Building Emissions

8.2 The proposed development will be provided with heat and hot water by air source heat pumps, which do not have any associated on-site emissions. Backup diesel generators will be used for under 12 hours per year and thus will have minimal emissions. Therefore, building emissions have not been considered further.

Road Transport Emissions

8.3 The Transport Emissions Benchmarks (TEBs) are based on the number of car trips generated by different land-use classes, together with the associated trip lengths and vehicle emission rates. However, the guidance (AQC, 2014) only provides trip lengths and emission rates for A1, B1 and C3 uses, thus a TEB cannot be calculated for the Hotel (C1) and Assembly and Leisure (Gym; D2) elements of the proposed development. The guidance does provide an alternative methodology, based on trip rates only, and this has been followed in considering the air quality neutrality of the proposed development in terms of transport emissions.

8.4 Steer Group has advised that the proposed development is expected to generate a total of 175 LDV movements per day, which equates to 63,875 per year.

8.5 Table A8.6 in Appendix A8 provides default trip rates for different development categories. This information has been used to calculate a benchmark trip rate for the proposed development in Table 16. This has then been compared with the actual total trip rate of the development.

Table 16: Calculation of Trip Rate Benchmarks for the Development [a]

Description	Value
Residential (C3)	
Number of Dwellings	76
Benchmark Trip Rate (trips/dwelling/annum)	407
Residential Benchmark Trip Rate (trips /annum)	30,932
Office (B1)	
Gross Internal Floor Area of Office (m^2)	13,273
Benchmark Trip Rate (trips/dwelling/annum)	4
Residential Benchmark Trip Rate (trips /annum)	53,092
Hotel (C1)	
Gross Internal Floor Area of Hotel (m^2)	9,425
Benchmark Trip Rate (trips/dwelling/annum)	5
Residential Benchmark Trip Rate (trips /annum)	47,125
Gym (D2)	
Gross Internal Floor Area of Gym (m^2)	1,476
Benchmark Trip Rate (trips/m^2/annum)	22.5
Café TEBs (trips/annum)	32,210
Entire Development	
Total Benchmark Trip Rate (trips /annum)	163,359

8.6 The total development transport trip rate is less than the total trip rate benchmarks. The proposed development is thus better than air quality neutral in terms of transport emissions.

Summary

8.7 The trip rate associated with the proposed development is below the relevant benchmark. The proposed development therefore complies with the requirement that all new developments in London should be at least air quality neutral.

9 Mitigation

Good Design and Best Practice

9.1 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures, which have been accounted for in the assessment as far as is possible:

- adoption of a Dust Management Plan (DMP) or Construction Environmental Management Plan (CEMP) to minimise the environmental impacts of the construction works;
- within the Site Travel Plan:
    - encouraging walking and cycling via provision of cycle parking in accordance with the Draft London Plan (GLA, 2019a) and London Cycling Design (TfL, 2014) standards, providing pedestrian links in the wider area, including LBC's Route 1, and establishing a regular meeting to discuss cycle issues;
    - encouraging the use of public transport by providing real-time passenger information at key locations;
    - only providing accessible car parking at 3% of the total residential units with no further eligibility to apply for permits at any controlled parking zone outside of the Site;
    - provision of access to car clubs within the Site and any initiatives agreed with the car club operator;
    - promotion of smarter working and living practices by highlighting proximity to transport links and allowing for internet connection to prommot online grocery shopping;
- within the Site Framework Travel Plan:
    - encouraging walking and cycling via provision of cycle parking in accordance with the Draft London Plan (GLA, 2019a) standards, providing pedestrian links in the wider area, organising cycle training and maintenance for employees and provision of forum bike user group forum to raise issues with relevant stakeholders;
    - encouraging the use of public transport by providing real-time passenger information at key locations;
    - encouraging best use of cars and servicing vehicles by limiting car parking for non-residential uses, provision of car club operator for each all business, recommendation of suitable car sharing website;

- promotion of smarter working and living practices by promoting teleconferencing in place of face-to-face meetings and consideration of flexible jpirs, with shift hours co-ordinated to public transport operating times;

- use of air source heat pumps for heating, which have zero associated emissions; and
- collaboration with the adjacent landlord and occupier's professional consultant team in positioning neighbouring flues to minimise building emission impacts on future residents and users of the development.

Recommended Mitigation

Construction Impacts

9.2 Measures to mitigate dust emissions will be required during the construction phase of the development in order to minimise effects upon nearby sensitive receptors.

9.3 The Site has been identified as a *High* Risk site during demolition, earthworks and construction and *Medium* Risk for trackout, as set out in Table 13. The GLA's SPG on *The Control of Dust and Emissions During Construction and Demolition* (GLA, 2014b) describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on what monitoring should be undertaken during the construction phase. This reflects best practice experience and has been used, together with the professional experience of the consultant who has undertaken the dust impact assessment and the findings of the assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A10.

9.4 The mitigation measures should be written into a dust management plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring. The GLA's guidance suggests that, for a High Risk site, automatic monitoring of particulate matter (as PM_{10}) will be required. It also states that, on certain sites, it may be appropriate to determine the existing (baseline) pollution levels before work begins. However, the guidance is clear that the Local Authority should advise as to the appropriate air quality monitoring procedure and timescale on a case-by-case basis.

9.5 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

Road Traffic Impacts

9.6 The assessment has demonstrated that the development-generated traffic will not cause any significant impacts on air quality. It is, therefore, not considered appropriate to include further mitigation measures in this regard.

9.7 The assessment has demonstrated that future residents of the ground and basement apartments at the Swinton Street façade of the proposed development will be exposed to annual mean nitrogen dioxide concentrations above the objective in the year of opening. At all other residential facades not on Swinton Street, concentrations are predicted to be below the objective, and therefore mitigation measures are not deemed necessary.

9.8 However, the unrealistically worst-case results requested by LBC (Appendix A6) have indicated that future residents of the apartments up to the fifth floor of the Swinton Street façade of the proposed development could be exposed to annual mean nitrogen dioxide concentrations above the objective in the year of opening. As with the results set out in Table 14 and Table 15, concentrations at all other receptors not on Swinton Street, are predicted to be below the objective, and therefore mitigation measures are not deemed necessary.

9.9 In order to comply with LBC's approach, a mechanical ventilation system will be installed, which will provide adequate air to all habitable rooms fronting Swinton Street without recourse to opening the windows. With this mitigation in place all future residents of the proposed development will experience acceptable air quality. This approach will more than offset any uncertainty associated with the assessment and thus the installation of mitigation for all of these properties is extremely precautionary.

9.10 The designed mechanical ventilation strategy comprises MVHR with air intakes at the courtyard on the opposite side of the building to Swinton Street, where air has been demonstrated to be acceptable (see receptors 7 to 11, Table 14 and Table A6.1). The development will also be provided with comfort cooling so that there is no residual reliance on natural ventilation.

9.11 Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which is written into UK law). The local air quality plan that the GLA is required to produce in order to address limit value exceedances in its area will also help to improve air quality; the proposed implementation of a CAZ can reasonably be expected to lead to significant improvements. The Council Local Transport Plan also details policies and actions which will improve local air quality, including encouraging the use of electric vehicles within the borough. The Council's Air Quality Action Plan will also be helping to deliver improved air quality.

Energy Plant Impacts

9.12 The assessment has demonstrated that the emissions from the backup generators within the proposed development will have an insignificant impact on air quality. As such, there is no requirement for mitigation. The energy plant installed within the Site will, however, be located on the roof and be tested for no more than eighteen hours per year; if the installed plant were not to conform to these specifications, additional assessment and/or mitigation would be required.

Air Quality Neutral

9.13 The road traffic movements predicted for the proposed development are below the benchmark derived for an average development of this nature in inner London. Therefore no further mitigation is recommended in this regard.

10 Residual Impacts and Effects

Construction

10.1 The IAQM guidance, on which the GLA's guidance is based, is clear that, with appropriate mitigation in place, the residual effects will normally be 'not significant'. The mitigation measures set out in Section 9 and Appendix A10 are based on the GLA guidance. With these measures in place and effectively implemented the residual effects are judged to be 'not significant'.

10.2 The IAQM guidance does, however, recognise that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be 'not significant'.

Energy Plant Impacts

10.3 The residual impacts will be the same as those identified in Section 7. The overall effects of the proposed development will be 'not significant'.

Road Traffic Impacts

10.4 Without mitigation, some residents will be exposed to nitrogen dioxide concentrations close to, or in exceedance of, the annual mean objective. A mechanical ventilation system with air intake from the rear of the building, will significantly improve air quality at these units, with concentrations as shown for receptors 7 to 11 as presented in Table 14.

11 Conclusions

11.1 The assessment has considered the impacts of the proposed development on local air quality in terms of dust and particulate matter emissions during construction, emissions from road traffic generated by the completed and occupied development, and emissions from the backup diesel generators. It has also identified the air quality conditions that future residents and users will experience and whether or not the proposed development is air quality neutral (as required by the London Plan).

Construction Impacts

11.2 The construction works have the potential to create dust. During construction, it will therefore be necessary to apply a package of mitigation measures to minimise dust emissions. Appropriate measures have been recommended and, with these measures in place, it is expected that any residual effects will be 'not significant'.

Operational Impacts

Impacts without Mitigation

11.3 Air quality conditions for future residents of the proposed development have been shown to be acceptable, with concentrations below the relevant air quality objectives at all locations within the Site, with the exception of basement and ground floors of the Swinton Street façade.

11.4 The assessment has demonstrated that the emissions from the additional traffic generated by the proposed development, and backup diesel generators, will have a negligible impact on air quality conditions at all existing receptors.

Impacts with Mitigation

11.5 Mitigation will be applied in the form of mechanical ventilation drawing air from the courtyard, which will reduce pollutant concentrations to well below the objectives at all dwellings fronting Swinton Street. With this mitigation in place it is concluded that road traffic emissions do not provide any constraints to the proposed development.

Significance

11.6 The overall operational air quality effects of the proposed development are judged to be 'not significant'. This conclusion is based on the concentrations for future residents and users of the development being below the relevant objectives, with the proposed mitigation in place, and the impact of development-generated traffic and generators being negligible.

Air Quality Neutral

11.7 The vehicle trip-rate associated with the proposed development is below the relevant benchmark and there would be no on-site emissions associated with heating and hot water plant. The proposed development therefore complies with the requirement that all new developments in London should be at least air quality neutral.

Policy Implications

11.8 Taking into account these conclusions, it is judged that the proposed development is consistent with Paragraph 180 of the NPPF, being appropriate for its location both in terms of its effects on the local air quality environment and the air quality conditions for future residents. It is also consistent with Paragraph 181, as it will not affect compliance with relevant limit values or national objectives. The proposed development is also consistent with Policies A1 of LBC's Local Plan, as development generated traffic will not will not have a significant detrimental effect on air quality, and hence the amenity. It is also consistent with Policy CC4, as the development does not increase exposure to poor air quality, impacts during construction have been assessed and mitigation has been proposed. The development is also in compliance with the Air Quality Camden Planning Guidance, because, as discussed in paragraph 10.4, even when worst-case assumptions are taken into account, the development does not introduce any receptors which will be exposed to concentrations beyond the nitrogen dioxide threshold of 38 $\mu g/m^3$. The proposed development is better than air quality neutral and is thus compliant with Policy 7.14 of the London Plan.

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13 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
ADMS-5	Atmospheric Dispersion Modelling System model for point sources
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
BEB	Building Emissions Benchmark
CAFS	Cleaner Air for Scotland
CAZ	Clean Air Zone
CEMP	Construction Environmental Management Plan
CHP	Combined Heat and Power
CROW	Countryside and Rights of Way Act
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
EU	European Union
EV	Electric Vehicle
Focus Area	Location that not only exceeds the EU annual mean limit value for NO_2 but also has a high level of human exposure
GIA	Gross Internal Floor Area
GLA	Greater London Authority
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle

IAQM	Institute of Air Quality Management
ICCT	International Council on Clean Transportation
JAQU	Joint Air Quality Unit
kph	Kilometres Per hour
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LB	London Borough
LBC	London Borough of Camden
LBI	London Borough of Islington
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
LGV	Light Goods Vehicle
µg/m^3	Microgrammes per cubic metre
MCPD	Medium Combustion Plant Directive
MW$_{th}$	Megawatts Thermal
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
NRMM	Non-road Mobile Machinery
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
OLEV	Office for Low Emission Vehicles
PHV	Private Hire Vehicle
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
PPG	Planning Practice Guidance

RDE	Real Driving Emissions
SCR	Selective Catalytic Reduction
SPG	Supplementary Planning Guidance
SPD	Supplementary Planning Document
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEB	Transport Emissions Benchmark
TEMPro	Trip End Model Presentation Program
TfL	Transport for London
TRAVL	Trip Rate Assessment Valid for London
ULEZ	Ultra Low Emission Zone
WHO	World Health Organisation
ZEC	Zero Emission Capable

14 Appendices

A1 London-Specific Policies and Measures

London Plan

A1.1 The London Plan sets out the following points in relation to planning decisions:

"Development proposals should:

a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs or where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3);

b) promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils "The control, of dust and emissions form construction and demolition";

c) be at least "air quality neutral" and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs));

d) ensure that where provision needs to made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches;

e) where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."

London Environment Strategy

A1.2 The air quality chapter of the London Environment Strategy sets out three main objectives, each of which is supported by sub-policies and proposals. The Objectives and their sub-policies are set out below:

"Objective 4.1: Support and empower London and its communities, particularly the most disadvantaged and those in priority locations, to reduce their exposure to poor air quality.

- *Policy 4.1.1 Make sure that London and its communities, particularly the most disadvantaged and those in priority locations, are empowered to reduce their exposure to poor air quality*
- *Policy 4.1.2 Improve the understanding of air quality health impacts to better target policies and action*

Objective 4.2: Achieve legal compliance with UK and EU limits as soon as possible, including by mobilising action from London Boroughs, government and other partners

- *Policy 4.2.1 Reduce emissions from London's road transport network by phasing out fossil fuelled vehicles, prioritising action on diesel, and enabling Londoners to switch to more sustainable forms of transport*
- *Policy 4.2.2 Reduce emissions from non-road transport sources, including by phasing out fossil fuels*
- *Policy 4.2.3 Reduce emissions from non-transport sources, including by phasing out fossil fuels*
- *Policy 4.2.4 The Mayor will work with the government, the London boroughs and other partners to accelerate the achievement of legal limits in Greater London and improve air quality*
- *Policy 4.2.5 The Mayor will work with other cities (here and internationally), global city and industry networks to share best practice, lead action and support evidence based steps to improve air quality*

Objective 4.3: Establish and achieve new, tighter air quality targets for a cleaner London by transitioning to a zero emission London by 2050, meeting world health organization health-based guidelines for air quality

- *Policy 4.3.1 The Mayor will establish new targets for $PM_{2.5}$ and other pollutants where needed. The Mayor will seek to meet these targets as soon as possible, working with government and other partners*
- *Policy 4.3.2 The Mayor will encourage the take up of ultra low and zero emission technologies to make sure London's entire transport system is zero emission by 2050 to further reduce levels of pollution and achieve WHO air quality guidelines*
- *Policy 4.3.3 Phase out the use of fossil fuels to heat, cool and maintain London's buildings, homes and urban spaces, and reduce the impact of building emissions on air quality*
- *Policy 4.3.4 Work to reduce exposure to indoor air pollutants in the home, schools, workplace and other enclosed spaces"*

A1.3 While the policies targeting transport sources are significant, there are less obvious ones that will also require significant change. In particular, the aim to phase out fossil-fuels from building heating and cooling and from NRMM will demand a dramatic transition.

Low Emission Zone (LEZ)

A1.4 The LEZ was implemented as a key measure to improve air quality in Greater London. It entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects older, diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. The LEZ was introduced on 4 February 2008, and was phased in through to January 2012. From January 2012 a standard of Euro IV was implemented for lorries and other specialist diesel vehicles over 3.5 tonnes, and buses and coaches over 5 tonnes. Cars and lighter Light Goods Vehicles (LGVs) are excluded. The third phase of the LEZ, which applies to larger vans, minibuses and other specialist diesel vehicles, was also implemented in January 2012. A NOx emissions standard (Euro IV) is included in the LEZ for HGVs, buses and coaches, from 2015.

A1.5 The Mayor of London confirmed in June 2018 that the LEZ will be amended such that a Euro VI standard will apply for heavy vehicles from 26 October 2020. Requirements relating to larger vans, minibuses and other specialist diesel vehicles will not change.

Ultra Low Emission Zone (ULEZ)

A1.6 London's ULEZ was introduced on 8 April 2019. The ULEZ currently operates 24 hours a day, 7 days a week in the same area as the current Congestion Charging zone. All cars, motorcycles, vans, minibuses and Heavy Goods Vehicles will need to meet exhaust emission standards (ULEZ standards) or pay an additional daily charge to travel within the zone. The ULEZ standards are Euro 3 for motorcycles; Euro 4 for petrol cars, vans and minibuses; Euro 6 for diesel cars, vans and minibuses; and Euro VI for HGVs, buses and coaches.

A1.7 The Mayor of London confirmed in June 2018 that, from 25 October 2021, the ULEZ will cover the entire area within the North and South Circular roads, applying the emissions standards set out in Paragraph A1.6 for light vehicles. The ULEZ will not include any requirements relating to heavy vehicle emissions beyond 26 October 2020, as these will be addressed by the amendments to the LEZ described in Paragraph A1.5.

Other Measures

A1.8 From 2018 all taxis presented for licencing for the first time must be zero emission capable (ZEC). This means they must be able to travel a certain distance in a mode which produces no air pollutants. From 2018 all private hire vehicles (PHVs) presented for licensing for the first time must meet Euro 6 emissions standards. From 1 January 2020, all newly manufactured PHVs presented for licensing for the first time must be ZEC (with a minimum zero emission range of 10 miles). The Mayor's aim is that the entire taxi and PHV fleet will be made up of ZEC vehicles by 2033.

A1.9 The Mayor has also proposed to make sure that TfL leads by example by cleaning up its bus fleet, implementing the following measures:

- TfL will procure only hybrid or zero emission double-decker buses from 2018;
- a commitment to providing 3,100 double decker hybrid buses by 2019 and 300 zero emission single-deck buses in central London by 2020;
- introducing 12 Low Emission Bus Zones by 2020;
- investing £50m in Bus Priority Schemes across London to reduce engine idling; and
- retrofitting older buses to reduce emissions (selective catalytic reduction (SCR) technology has already been fitted to 1,800 buses, cutting their NOx emissions by around 88%).

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM (2016), upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will be 'not significant'. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM guidance explains that this classification should be based on professional judgement, but provides the examples in Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

Class	Examples
Demolition	
Large	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on site crushing and screening, demolition activities >20 m above ground level
Medium	Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level
Small	Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10 m above ground, demolition during wetter months
Earthworks	
Large	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes
Small	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonnes, earthworks during wetter months
Construction	
Large	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Small	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Trackout [a]	
Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

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

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM guidance recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM guidance provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM guidance provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided in the IAQM guidance has been used as the basis for the requirements set out in Appendix A10.

STEP 4: Determine Significant Effects

A2.12 The IAQM guidance does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally be 'not significant'.

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will be 'not significant'.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Dust Soiling Effects on People and Property [3]

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

[3] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from sites with a *large* dust emission magnitude for trackout, 200 m from sites with a *medium* dust emission magnitude and 50 m from sites with a *small* dust emission magnitude, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.4: Sensitivity of the Area to Human Health Effects [3]

Receptor Sensitivity	Annual Mean PM_{10}	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32 µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A2.5: Sensitivity of the Area to Ecological Effects [3]

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

Table A2.6: Defining the Risk of Dust Impacts

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

A3 EPUK & IAQM Planning for Air Quality Guidance

A3.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

"Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations".*

Recommended Best Practice

A3.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

"The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions".

A3.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m^2 of commercial floorspace;
- are carried out on land of 1 ha or more.

A3.4 The good practice principles are that:

- New developments should not contravene the Council's Air Quality Action Plan, or render any of the measures unworkable;
- Wherever possible, new developments should not create a new "street canyon", as this inhibits pollution dispersion;

- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNOx/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
    - Spark ignition engine: 250 mgNOx/Nm^3;
    - Compression ignition engine: 400 mgNOx/Nm^3;
    - Gas turbine: 50 mgNOx/Nm^3.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNOx/Nm^3 and 25 mgPM/Nm^3.

A3.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

"It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the "damage cost approach" used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential".

A3.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

"There may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Impacts of the Development on the Local Area

A3.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

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

A3.8 Coupled with any of the following:

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

A3.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere; and
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor.

A3.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A3.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

"Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at <95mg/Nm^3.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable".

A3.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

"The criteria provided are precautionary and should be treated as indicative. They are intended to function as a sensitive 'trigger' for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A3.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

"The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer".

A3.14 The guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Assessment of Significance

A3.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

A3.16 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either 'significant' or 'not significant'. In drawing this conclusion, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts and, in such circumstances, several impacts that are described as '*slight*' individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a '*moderate*' or '*substantial*' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A3.17 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A3.18 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

A4 Professional Experience

Penny Wilson, BSc (Hons) CSci MIEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than 19 years' relevant experience in the field of air quality. She has been responsible for numerous assessments for a range of infrastructure developments including power stations, road schemes, ports, airports and residential/commercial developments. The assessments have covered operational and construction impacts, including odours. She also provides services to local authorities in support of their LAQM duties, including the preparation of Review and Assessment and Action Plan reports, as well as audits of Air Quality Assessments submitted with planning applications. She has provided expert evidence to a number of Public Inquiries, and is a Member of the Institute of Air Quality Management and a Chartered Scientist.

Lucy Hodgins, BSc (Hons) MIEnvSc MIAQM

Miss Hodgins is a Senior Consultant with AQC, with over ten years' experience in the field of air quality. She has extensive experience in the assessment of air quality impacts for a range of industrial, commercial and residential projects, using qualitative and quantitative methods to assess road traffic and point source emissions utilising a variety of models, including ADMS-Roads, Breeze Roads, ADMS-5 and Breeze Aermod. She has prepared assessments for energy from waste, anaerobic digestion and waste biomass facilities for a range of air pollutants, along with nuisance dust and odour assessments. Lucy has also been involved in air quality management and assessment work for local authorities, including air quality modelling for Clean Air Zones as well as microsimulation modelling for junction improvement schemes. She has also undertaken numerous operational dust assessments for mineral and waste facilities, as well as assessments of construction dust emissions. She is a Member of the Institute of Air Quality Management and the Institution of Environmental Sciences.

Jamie Dennis, MSci (Hons), AMIEnvSc, AMIAQM

Mr Dennis is an Assistant Consultant with AQC, having joined the company in December 2019. Prior to joining, he completed an MSci degree in Chemistry at the University of Bristol, specialising in the regional modelling of trace gases. He has undertaken numerous air quality assessments, including road traffic and plant emissions modelling, as well as odour and construction dust risk assessments. He is an Associate Member of both the Institute of Air Quality Management and Institution of Environmental Sciences.

A5 Modelling Methodology

Road Traffic

Model Inputs

A5.1 Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon width, street canyon height and porosity, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 9.0) published by Defra (2020b). Model input parameters are summarised in Table A5.1 and, where considered necessary, discussed further below.

Table A5.1: Summary of Model Inputs

Model Parameter	Value Used
Terrain Effects Modelled?	No
Variable Surface Roughness File Used?	No
Urban Canopy Flow Used?	No
Advanced Street Canyons Modelled?	Yes
Noise Barriers Modelled?	No
Meteorological Monitoring Site	London City
Meteorological Data Year	2019
Dispersion Site Surface Roughness Length (m)	1
Dispersion Site Minimum MO Length (m)	50
Met Site Surface Roughness Length (m)	0.5
Met Site Surface Minimum MO Length (m)	30
Gradients?	No

A5.2 AADT flows, and the proportions of HDVs, for the model extent have been determined from the interactive web-based map provided by DfT (2020). The 2018 AADT flows have been factored forwards to the base (2019) and assessment (2023) years using growth factors derived using the TEMPro System v7.2 (DfT, 2017). Traffic speeds have been based on those presented in the London Atmospheric Emissions Inventory (LAEI) (GLA, 2019b), with some having been adjusted based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A5.2. Diurnal and monthly flow profiles for the traffic have been derived from the national profiles published by DfT (2019).

A5.3 As with the air quality monitoring survey, the baseline traffic data used in the modelling for this assessment is from well before the spread of COVID-19 in 2020 impacted on traffic flows, and the report has therefore not been influenced in any way by these unusual changes.

Table A5.2: Summary of Traffic Data used in the Assessment [a]

Road Link	2019		2023	
	AADT	%HDV	AADT	%HDV
A501 Euston Road (A4200 - A5202)	57,558	3.6	60,574	3.6
A501 Grays Inn Road (N)	57,558	3.6	60,574	3.6
A501 (York Way - Caledonian Road)	20,632	4.7	21,713	4.7
A5200 Grays Inn Road (N)	12,579	2.5	13,238	2.5
A501 Acton Street	8,870	2.8	9,335	2.8
A5200 Grays Inn Road (S)	12,579	2.5	13,238	2.5
A501 Swinton Street	11,795	3.3	12,413	3.3
A501 Penton Rise	25,909	4.9	27,267	4.9
A201 Kings Cross Road North	15,527	10.4	16,340	10.4
A201 Kings Cross Road South	12,825	6.2	13,497	6.2
A501 Grays Inn Road (S)	23,519	7.0	24,751	7.0

[a] This is just a summary of the data entered into the model, which have been input as hourly average flows and HDV proportions, as well as diurnal and monthly flow profiles for these vehicles.

A5.4 Figure A5.1 shows the road network included within the model, along with the speed at which each link was modelled, and shows which sections of road have been modelled as canyons.

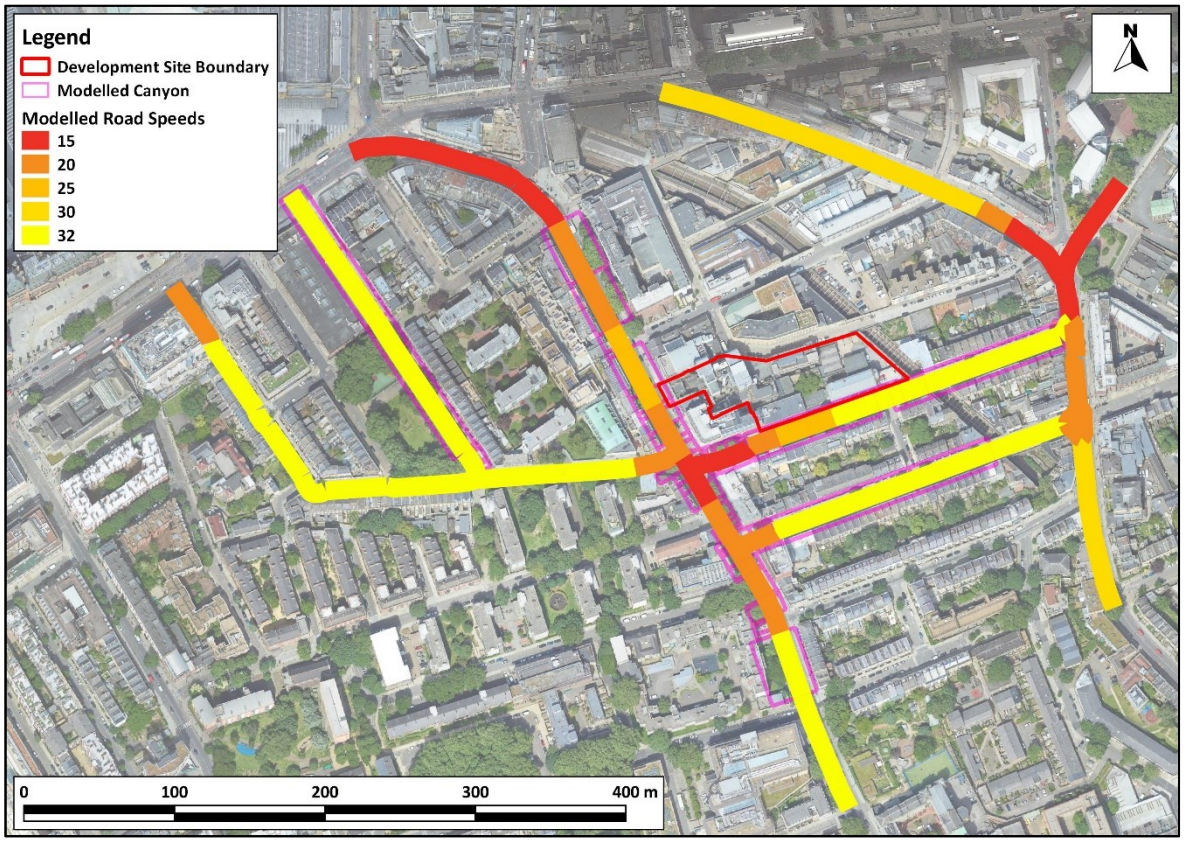

Figure A5.1: Modelled Road Network & Speed

Imagery ©2020 Bluesky, CNES / Airbus, Getmapping plc, Infotera Ltd & Bluesky, Maxar Technologies, The GeoInformation Group.

A5.5 For the purposes of modelling, it has been assumed that the Swinton Street and Gray's Inn Road façades of the proposed development are within a street canyon formed by the buildings of each road. This road has a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. Swinton Street and Gray's Inn Road, as well as Acton Street and Argyle Square, have therefore been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from plans, on-site measurements, local mapping and photographs. The modelled canyons are shown in Figure A5.1.

Model Verification

A5.6 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The model has been run to predict the annual mean concentrations during 2019 at the GR1, GR4 and GR5 diffusion tube monitoring sites. Site GR3 was omitted due to low data capture and GR2 and GR7 were omitted due to unexpectedly low concentrations, likely to be a result of localised conditions directly adjacent to the monitoring sites.

As a result of these omissions, the verification factor is greater. Therefore, the resulting concentrations predicted by the model may be considered worst-case.

A5.7 There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor calculated for road NOx.

A5.8 Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2).

A5.9 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 7.1) available on the Defra LAQM Support website (Defra, 2020b).

A5.10 The unadjusted model has under predicted the road-NOx contribution; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure A5.2). The calculated adjustment factor of 2.249 has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

A5.11 The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure A5.3 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

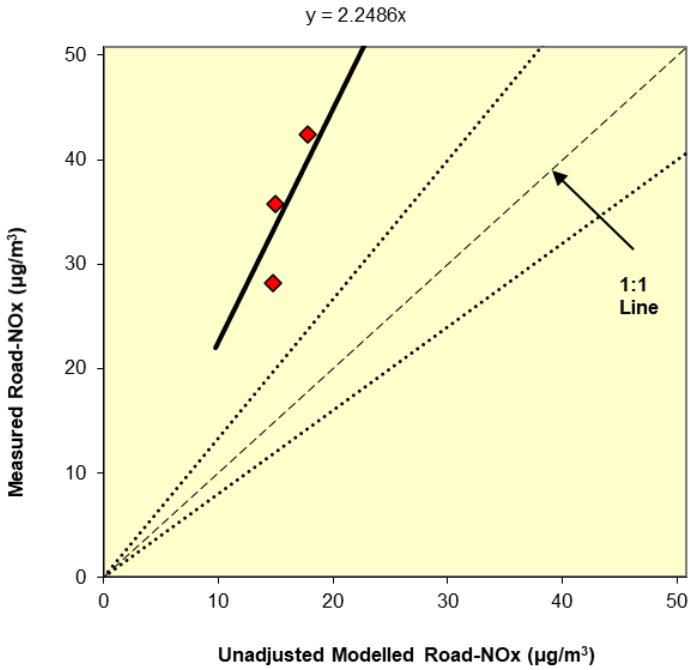

Figure A5.2: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

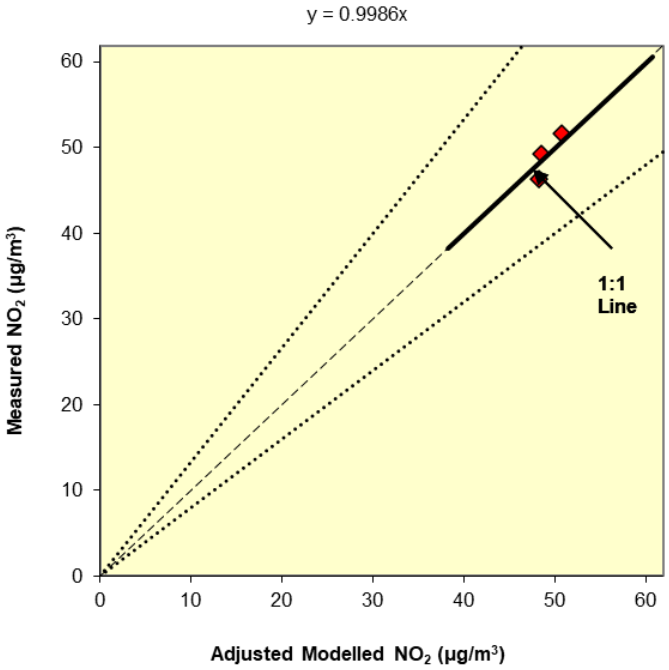

Figure A5.3: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Table A5.3: Statistical Model Performance

Statistical Parameter	Model-Specific Value	'Ideal' Value
Correlation Coefficient [a]	0.88	**1**
Root Mean Square Error (RMSE) [b]	1.27	**0**
Fractional Bias [c]	0.00	**0**

[a] Used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.

[b] Used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared (i.e. µg/m^3). TG16 (Defra, 2018b) outlines that, ideally, a RMSE value within 10% of the air quality objective (4µg/m^3) would be derived. If RMSE values are higher than 25% of the objective (10 µg/m^3) it is recommended that the model is revisited.

[c] Used to identify if the model shows a systematic tendency to over or under predict. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.

Post-processing

A5.12 The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2020b). The traffic mix within the calculator has been set to "All London traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

A6 Modelling Results Following LBC Methodology

A6.1 The following section provides modelling results based on the unrealistically worst-case methodology suggested by LBC, specified in paragraph 4.18.

Table A6.1: Predicted Annual Mean Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ for New Residential Receptors in the Proposed Development (µg/m^3) (assuming no future reduction in concentrations)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
Basement			
1	**51.2**	22.6	14.8
2	**49.1**	22.4	14.6
3	**49.2**	22.4	14.7
4	**43.4**	21.0	13.8
5	**48.9**	22.3	14.6
6	**38.3**	19.9	13.2
7	37.8	19.8	13.1
8	37.7	19.8	13.1
9	37.5	19.8	13.1
10	37.5	19.7	13.1
11	37.5	19.7	13.1
Ground			
12	37.1	19.7	13.0
13	37.1	19.7	13.0
14	37.1	19.7	13.0
4th Floor			
1	**43.4**	20.9	13.8
2	**41.7**	20.7	13.6
3	**41.8**	20.7	13.6
4	**39.5**	20.2	13.3
5	**40.9**	20.5	13.5

Receptor	NO_2	PM_{10}	$PM_{2.5}$
5th Floor			
1	**42.3**	20.7	13.6
2	37.7	19.8	13.1
3	37.9	19.9	13.1
4	37.6	19.8	13.1
5	37.2	19.7	13.0
Objective / Criterion	**40**	**32** [a]	**25** [b]

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Table A6.2: Predicted Annual Mean Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ for Hotel Receptors in the Proposed Development (µg/m^3) (assuming no future reduction in concentrations)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
Ground			
15	54.9	23.0	15.1
16	53.1	22.9	15.0
17	53.1	22.9	15.0
1st Floor			
18	50.7	22.4	14.7
19	50.8	22.4	14.7
20	52.6	22.5	14.8
Objective / Criterion	**60**	**32** [a]	**25** [b]

[a] While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} objective is possible, as outlined in LAQM.TG16 (Defra, 2018b). A value of 32 µg/m^3 is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

[b] The $PM_{2.5}$ objective, which was to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

A7 London Vehicle Fleet Projections

A7.1 TfL has published an Integrated Impact Assessment (Jacobs, 2017) setting out the impacts of the changes to the LEZ and ULEZ described in Paragraphs A1.5 and A1.7. The assessment predicts that the changes will reduce overall NOx emissions from vehicles in London by 28% in 2021 (32% in Inner London and 27% in Outer London) and by 21% in 2025 (24% in Inner London and 21% in Outer London). The percentage reduction reduces with time due to the natural turnover of the fleet that would have occurred regardless of the introduction of the proposed changes. The proposed changes will not significantly affect emissions in Central London, where the ULEZ will already be implemented, but concentrations here will still reduce due to the lower emissions in surrounding areas.

A7.2 The report projects that the changes will reduce exposure to exceedances of the annual mean nitrogen dioxide objective by 40% and 21% in Central London in 2021 and 2025, respectively; by 4% and 0% in Inner London in 2021 and 2025, respectively; and by 23% and 27% in Outer London in 2021 and 2025, respectively, when compared to the baseline scenario.

A7.3 The changes are not projected to have a significant effect on PM_{10} and $PM_{2.5}$ concentrations, although a small reduction is predicted.

A7.4 AQC's report on the performance of Defra's EFT (AQC, 2020) also highlighted that the EFT's assumptions regarding future fleet composition in London and across the UK may be over-pessimistic in terms of NOx emissions. The future fleet projection derived from the EFT for Outer London, for example, shows a very small reduction in the proportion of diesel cars between 2016 and 2030, and a very limited uptake of electric cars. The AQC report highlights that this contrasts with the expectations of many observers, as well as the most recent trends publicised by the media. When considered alongside the future requirements of the LEZ and ULEZ, these future fleet projections seem all the more unrealistic (i.e. worst-case in terms of emissions), as the changes to the LEZ and ULEZ would reasonably be expected to significantly increase the uptake of lower emissions vehicles in London.

A7.5 As outlined in Paragraph 4.17, the changes to the LEZ and ULEZ announced by the Mayor of London in June 2018 are not reflected in Defra's latest EFT and thus have not been considered in this assessment. The potentially over-pessimistic fleet projections built in to the EFT have not been addressed in this report either. Paragraphs A7.1 and A7.2 highlight that the changes to the LEZ and ULEZ will result in significant reductions in vehicle nitrogen oxides emissions and resultant nitrogen dioxide concentrations. The changes might reasonably also be expected to expedite the uptake of cleaner vehicles well beyond that projected in the EFT's fleet projections for London. As such, while the results presented in this report represent a reasonably conservative reflection of likely concentrations and impacts in the absence of the changes to the LEZ and ULEZ, they almost

certainly represent an unrealistically worst-case assessment of likely concentrations and impacts bearing in mind the implementation of these changes.

A8 'Air Quality Neutral'

A8.1 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a), and its accompanying Air Quality Neutral methodology report (AQC, 2014), provide an approach to assessing whether a development is air quality neutral. The approach is to compare the expected emissions from the building energy use and the car use associated with the proposed development against defined emissions benchmarks for buildings and transport in London.

A8.2 The benchmarks for heating and energy plant (termed 'Building Emissions Benchmarks' or 'BEBs') are set out in Table A8.1, while the 'Transport Emissions Benchmarks' ('TEBs') are set out in Table A8.2. In order to assess against the TEBs, it is necessary to combine the expected trip generation from the development with estimates of average trip length and average emission per vehicle. So as to ensure a consistent methodology, the report which accompanies the SPG (AQC, 2014) recommends that the information in Table A8.3 and Table A8.4 (upon which the TEBs are based) is used. Similarly, the information in Table A8.5 may be used if site-specific information are not available (AQC, 2014). For use classes other than A1, B1 and C3, trip lengths and average emissions per vehicle are not provided, thus the trip rates in Table A8.6 alone may be used to consider the air quality neutrality of a development. These have been derived from the Trip Rate Assessment Valid for London (TRAVL) database.

Table A8.1: Building Emissions Benchmarks (g/m^2 of Gross Internal Floor Area)

Land Use Class	NOx	PM_{10}
Class A1	22.6	1.29
Class A3 - A5	75.2	4.32
Class A2 and Class B1	30.8	1.77
Class B2 - B7	36.6	2.95
Class B8	23.6	1.90
Class C1	70.9	4.07
Class C2	68.5	5.97
Class C3	26.2	2.28
D1 (a)	43.0	2.47
D1 (b)	75.0	4.30
Class D1 (c -h)	31.0	1.78
Class D2 (a-d)	90.3	5.18
Class D2 (e)	284	16.3

Table A8.2: Transport Emissions Benchmarks

Land use	CAZ [a]	Inner [b]	Outer [b]
NOx (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

[a] Central Activity Zone.

[b] Inner London and Outer London as defined in the LAEI (GLA, 2019b).

Table A8.3: Average Distance Travelled by Car per Trip

Land use	Distance (km)		
	CAZ	Inner	Outer
Retail (A1)	9.3	5.9	5.4
Office (B1)	3.0	7.7	10.8
Residential (C3)	4.3	3.7	11.4

Table A8.4: Average Road Traffic Emission Factors in London in 2010

Pollutant	g/vehicle-km		
	CAZ	Inner	Outer
NOx	0.4224	0.370	0.353
PM_{10}	0.0733	0.0665	0.0606

Table A8.5: Average Emissions from Heating and Cooling Plant in Buildings in London in 2010

	Gas (kg/kWh)		Oil (kg/kWh)	
	NOx	PM_{10}	NOx	PM_{10}
Domestic	0.0000785	0.00000181	0.000369	0.000080
Industrial/Commercial	0.000194	0.00000314	0.000369	0.000080

Table A8.6: Average Number of Trips per Annum for Different Development Categories

Land use	Number of Trips (trips/m^2/annum)		
	CAZ	Inner	Outer
A1	43	100	131
A3	153	137	170
A4	2.0	8.0	-
A5	-	32.4	590
B1	1	4	18
B2	-	15.6	18.3
B8	-	5.5	6.5
C1	1.9	5.0	6.9
C2	-	3.8	19.5
D1	0.07	65.1	46.1
D2	5.0	22.5	49.0
Number of Trips (trips/dwelling/annum)			
C3	129	407	386

A9 Adjustment of Short-Term Data to Annual Mean

14.1 The monitoring results for the period July 2019 to January 2020 have been annualised to represent a full calendar year. The data have been annualised to a 2019 annual mean equivalent based on the ratio between concentrations for the short-term monitoring period and the 2019 calendar year using three background sites operated as part of the Automatic Urban and Rural Network (AURN). This follows the guidance set out in Box 7.10 of LAQM.TG16 (Defra, 2018b).

14.2 The annual mean and period mean nitrogen dioxide concentrations for the three automatic monitoring sites for each diffusion tube site are presented. The adjustment factors for each automatic monitor and calculated average factor for each diffusion tube site are presented in Table A9.1.

Table A9.1: Data used to Adjust Short-term Monitoring Data to 2019 Annual Mean Equivalent

Automatic Monitor	Parameter	Automatic Monitor Annual Mean (A_m) 2019 ($\mu g/m^3$)	Exposure Period Average [a]						
			GR1	GR2	GR3	GR4 [c]	GR5	GR6	GR7
London Bloomsbury	Period Mean (P_m) ($\mu g/m^3$) July 2019-December 2020 [b]	31.6	28.7	30.9	19.8	29.0	28.6	28.6	30.9
	Ratio A_m/P_m		1.1	1.02	1.6	1.09	1.10	1.10	1.02
London Haringey Priory Park South	Period Mean ($\mu g/m^3$) July 2019-December 2020 [b]	21.9	20.9	22.6	14.1	21.1	20.9	20.9	22.5
	Ratio A_m/P_m		1.05	0.97	1.56	1.04	1.05	1.05	0.97
London North Kensington	Period Mean ($\mu g/m^3$) July 2019-December 2020 [b]	27.2	25.4	27.5	18.1	24.8	25.4	25.4	25.6
	Ratio A_m/P_m		1.07	0.99	1.5	1.09	1.07	1.07	1.06
Average Annualisation Factor			**1.07**	**0.99**	**1.55**	**1.07**	**1.07**	**1.07**	**1.02**

[a] Due to loss of diffusion tubes and access to the building, the exposure periods differ for each of the monitoring sites.

[b] Period mean calculated for each month separately, for the months with monitoring results available. Average of all the available months for annual and period mean are presented. Where a tube forming part of a triplicate was lost the average is percentage, however, all tubes have been annualised separately, then averaged at the end.

A10 Site Specific Monitoring Location Photos

A10.1 Photographs of the diffusion tube monitoring sites are shown below.

Figure A10.1: Diffusion Tube Monitoring Location for GR1 on Gray's Inn Road (outside window)

Figure A10.2: Diffusion Tube Monitoring Location for GR2 on Gray's Inn Road

Figure A10.3: Diffusion Tube Monitoring Location for GR3 on Swinton Street (on window ledge)

Figure A10.4: Diffusion Tube Monitoring Location for GR4 on Swinton Street

Figure A10.5: Diffusion Tube Monitoring Location for GR5 on Swinton Street

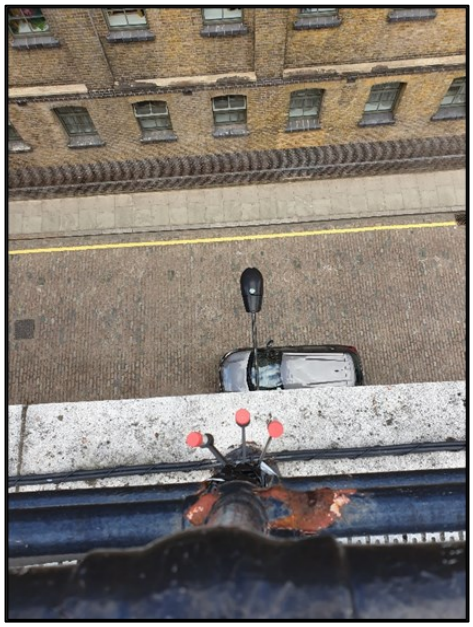

Figure A10.6: Diffusion Tube Monitoring Location for GR6 on Roof on Wicklow Street

Figure A10.7: Diffusion Tube Monitoring Location for GR7 on Wicklow Street

A11 Construction Mitigation

A11.1 Table A11.1 presents a set of best-practice measures from the GLA guidance (GLA, 2014b) that should be incorporated into the specification for the works. These measures should be written into a Dust Management Plan. Some of the measures may only be necessary during specific phases of work, or during activities with a high potential to produce dust, and the list should be refined and expanded upon in liaison with the construction contractor when producing the Dust Management Plan.

Table A11.1: Best-Practice Mitigation Measures Recommended for the Works

Measure	Desirable	Highly Recommended
Site Management		
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site		✓
Develop a Dust Management Plan (DMP)		✓
Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary		✓
Display the head or regional office contact information		✓
Record and respond to all dust and air quality pollutant emissions complaints		✓
Make a complaints log available to the local authority when asked		✓
Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the Local Authority when asked		✓
Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions are being carried out and during prolonged dry or windy conditions		✓
Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and ensure that the action taken to resolve the situation is recorded in the log book		✓
Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes		✓
Preparing and Maintaining the Site		
Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible		✓
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site		✓
Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period		✓

Install green walls, screens or other green infrastructure to minimise the impact of dust and pollution	✓	
Avoid site runoff of water or mud		✓
Keep site fencing, barriers and scaffolding clean using wet methods		✓
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below		✓
Cover, seed, or fence stockpiles to prevent wind whipping		✓
Carry out regular dust soiling checks of buildings within 100 m of site boundary and provide cleaning if necessary		✓
Provide showers and ensure a change of shoes and clothes are required before going off-site to reduce transport of dust	✓	
Put in place real-time dust and air quality pollutant monitors across the site and ensure they are checked regularly		✓
Agree monitoring locations with the Local Authority		✓
Where possible, commence baseline monitoring at least three months before work begins		✓
Operating Vehicle/Machinery and Sustainable Travel		
Ensure all on-road vehicles comply with the requirements of the London LEZ (and ULEZ)		✓
Ensure all Non-road Mobile Machinery (NRMM) comply with the standards set within the GLA's Control of Dust and Emissions During Construction and Demolition SPG. This outlines that, from 1 September 2015, all NRMM of net power 37 kW to 560 kW used on the site of a major development in Greater London must meet Stage IIIA of EU Directive 97/68/EC (The European Parliament and the Council of the European Union, 1997) and its subsequent amendments as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum. From 1 September 2020 NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum, while NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum;		✓
Ensure all vehicles switch off engines when stationary – no idling vehicles		✓
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable		✓
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials		✓
Implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing)		✓
Operations		
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems		✓
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate		✓

Use enclosed chutes, conveyors and covered skips		✓
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate		✓
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods		✓
Waste Management		
Reuse and recycle waste to reduce dust from waste materials		✓
Avoid bonfires and burning of waste materials		✓
Measures Specific to Demolition		
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)		✓
Ensure water suppression is used during demolition operations.		✓
Avoid explosive blasting, using appropriate manual or mechanical alternatives		✓
Bag and remove any biological debris or damp down such material before demolition		✓
Measures Specific to Earthworks		
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable		✓
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable		✓
Only remove the cover from small areas during work, not all at once		✓
Measures Specific to Construction		
Avoid scabbling (roughening of concrete surfaces), if possible		✓
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place		✓
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery		✓
For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust	✓	
Measures Specific to Trackout		
Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site		✓
Avoid dry sweeping of large areas		✓
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport		✓
Access gates should be located at least 10 m from receptors, where possible		✓

Apply dust suppressants to locations where a large volume of vehicles enter and exit the construction site	✓	