# AIR QUALITY ASSESSMENT

551 – 557 Finchley Road

Proposed Residential-led Development

Produced by XCO2 for Hampstead Properties Ltd. c/o Delta Properties

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# EXECUTIVE SUMMARY

An assessment has been undertaken to quantify the potential impacts on local air quality associated with the construction and operation of the proposed development. Based on the results of the assessment, it is considered that redevelopment of the site would not cause a significant impact on local air quality.

An assessment of potential air quality impacts arising from the construction and operation of the proposed development at 551 - 557 Finchley Road in the London Borough of Camden has been undertaken.

During the construction phase, the site has the potential to generate dust nuisance beyond the application boundary. However, through the implementation of best practice mitigation measures, the impacts will be effectively minimised and are unlikely to be significant.

Emissions from operational traffic associated with the proposed development are not anticipated to significantly affect local air quality, however detailed dispersion modelling was undertaken to assess whether future occupants of the proposed development will be exposed to poor air quality. The modelling indicates that the development falls within the London Council's Planning Guidance APEC-A exposure category and the site is therefore considered suitable for residential and commercial development, as proposed.

The proposed development has been assessed as Air Quality Neutral with respect to both transport and building-related emissions.

# INTRODUCTION

This report presents an assessment of the potential impact on local air quality of the construction and operation of the proposed development at 551 – 557 Finchley Road, in the London Borough of Camden.

The proposed development comprises a part change of use from Use Class E and F1 and remodelling of the existing building to provide 15 residential apartments (C3) along with flexible commercial (Class E)/pub/wine bar/drinking establishments/pub with expanded food provision (Sui Generis) uses, alterations including partial demolition and extensions at the rear at lower ground, ground and first floor levels, extension to provide an additional storey at roof level, levelling of the lower ground floor level, remodelling and restoration of front façade, amenity space, cycle parking and all associated works (Site does not include 1st to 3rd floor of 551 Finchley Road).

The location of the proposed development site is presented in Figure 1. The site falls within the London Borough of Camden Air Quality Management Area (AQMA), which is a borough-wide designation due to measured and modelled exceedances of the air quality objectives for nitrogen dioxide ($NO_2$) and particulate matter (as $PM_{10}$). The primary source of $NO_2$ in the Borough is road traffic.

The proposed development has potential to introduce the following air quality impacts:

- Suspended and re suspended fugitive dust emissions from demolition / construction activities;
- Emissions from construction traffic, including re suspended dust from HGV movements; and
- Emissions from operational traffic.

An assessment has been undertaken to determine the potential impact on local air quality during both the construction and operational phases of the development, with recommendations made for mitigation where appropriate.

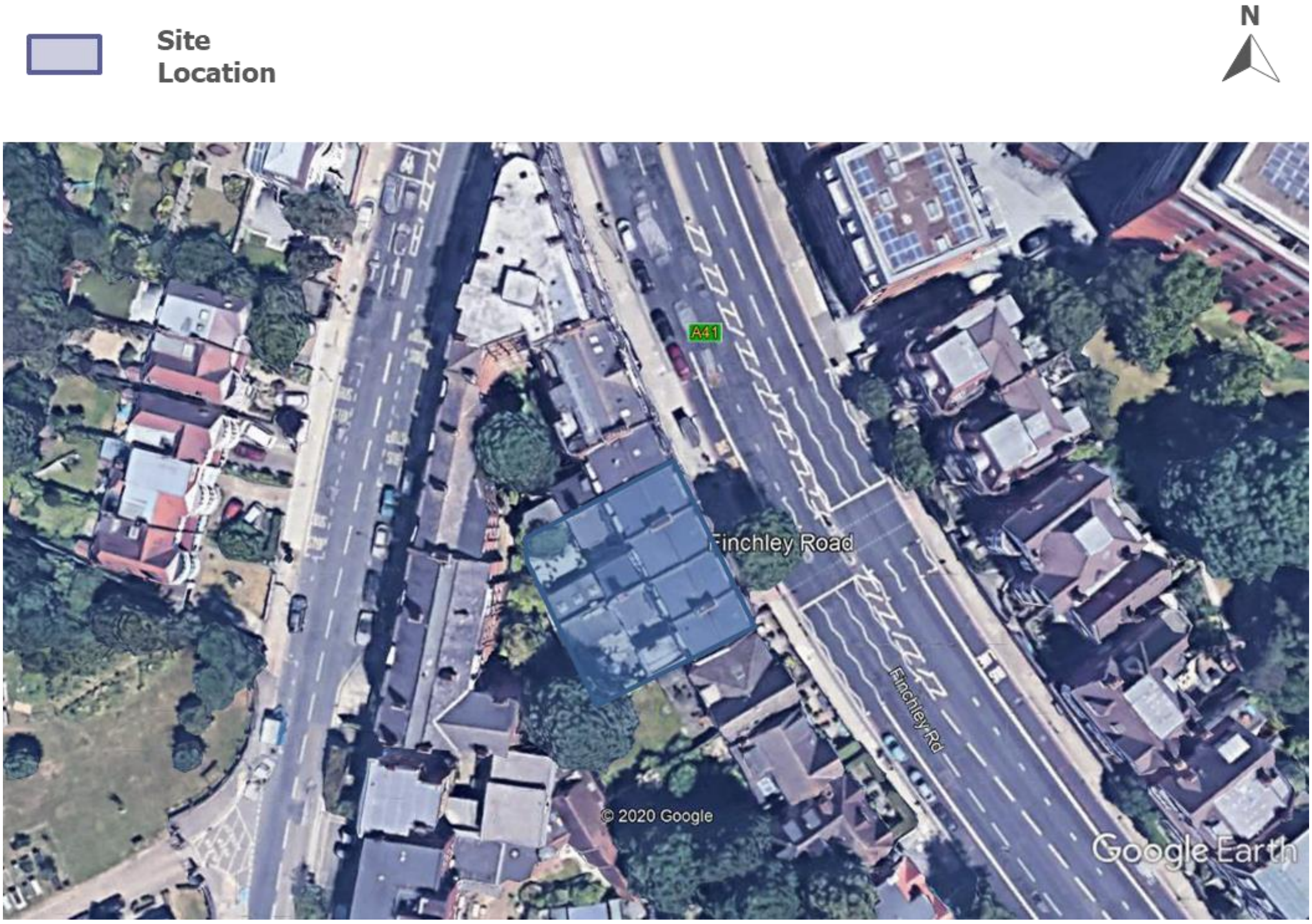


Figure 1: Site Location

# POLICY CONTEXT

An overview of the relevant policy drivers for the assessment is provided in the following section.

## EUROPEAN LEGISLATION

Within the European Union, ambient air quality is currently regulated through the Ambient Air Quality Directive 2008/50/EC[1] and the Fourth Daughter Directive 2004/107/EC[2]. These directives set limit values and target values for ambient pollutant concentrations. The limit values are legally binding and must not be exceeded, whereas the target values are to be attained where it is cost effective to do so.

The Ambient Air Quality Directive provides limit values for sulphur dioxide ($SO_2$), nitrogen dioxide ($NO_2$), benzene ($C_6H_6$), carbon monoxide (CO), lead (Pb) and particulate matter ($PM_{10}$ and $PM_{2.5}$)[3]. The Fourth Daughter Directive provides target values for arsenic (As), cadmium (Cd), nickel (Ni), benzo(a)pyrene (B(a)P), mercury (Hg) and polycyclic aromatic hydrocarbons (PAH)[4].

The EU limit values have been adopted into UK law via the Air Quality Standards Regulations 2010[5].

In the context of the proposed development, the primary pollutants of concern are $NO_2$, $PM_{10}$ and $PM_{2.5}$ from traffic on roads close to the site. A summary of the European limit values for the protection of human health for these pollutants is presented in Table 1.

Table 1: European Limit Values for the Protection of Human Heath

| Pollutant | Averaging Period | Limit Value ($\mu g/m^3$) | Comments |
|---|---|---|---|
| $NO_2$ | 1-hour | 200 | Not to be exceeded more than 18 times per calendar year (equivalent to the 99.8th percentile of 1-hour means) |
| | Calendar year | 40 | - |
| $PM_{10}$ | 24-hour | 50 | Not to be exceeded more than 35 times per year (equivalent to the 90.4th percentile of 24-hour means) |
| | Calendar Year | 40 | - |
| $PM_{2.5}$ | Calendar Year | 25 | Stage 1 LV (to be met by 01/01/15) |
| | Calendar Year | 20 | Stage 2 LV (to be met by 01/01/20) |

1 Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.
2 Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.
3 Particulate matter with an aerodynamic diameter below 10 µm and below 2.5 µm.
4 Polycyclic aromatic hydrocarbons other than benzo(a)pyrene.
5 The Air Quality Standards Regulations 2010, Statutory Instrument 2010 No. 1001, Environmental Protection.

## NATIONAL LEGISLATION

### *THE AIR QUALITY STRATEGY FOR ENGLAND, SCOTLAND, WALES AND NORTHERN IRELAND*

The Air Quality Strategy for England, Wales and Northern Ireland[6] was published in 2007 and sets out policy targets (objectives) for $SO_2$, $NO_2$, $C_6H_6$, CO, Pb, $PM_{10}$, $PM_{2.5}$, 1,3-butadiene ($C_4H_6$) and PAH. These objectives are generally in line with those set by the European Directives, although more stringent particulate and benzene objectives apply in Scotland (and in Northern Ireland for benzene).

The Air Quality Objectives (AQO) for $NO_2$, $PM_{10}$ and $PM_{2.5}$ in England do not differ from those presented in Table 1.

In January 2019, the UK government published a Clean Air Strategy[7], which outlines measures to reduce emissions from a wide range of sources including transport, farming and industry. The Strategy proposes new local powers to implement Clean Air Zones in problem areas, backed up by clear enforcement mechanisms. Whilst the UK has already adopted legally binding international targets to reduce emissions of key pollutants such as nitrogen oxides and particulate matter (as $PM_{10}$), the Strategy aims to reduce fine particulate emissions ($PM_{2.5}$) to ensure that public exposure to concentrations above the more stringent WHO annual mean guideline value of 10 $\mu g/m^3$ is halved by 2025.

### *LOCAL AIR QUALITY MANAGEMENT*

The framework for Local Air Quality Management (LAQM) in the UK was introduced by the Environment Act 1995[8]. Local Authorities are required to regularly review and assess air quality to establish whether there are any locations where pollutant concentrations exceed the relevant air quality objectives or EU limit values. Where an exceedance is identified the local authority is obliged to declare an Air Quality Management Area (AQMA) and prepare an Action Plan setting out measures to improve air quality and achieve compliance with the objective(s).

### *THE NATIONAL PLANNING POLICY FRAMEWORK*

The National Planning Policy Framework (NPPF)[9] sets out the Government's policies for planning and how these should be applied. With regard to air quality, the NPPF states that local "Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should "ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

The revised NPPF[10] was published in July 2018 (updated February 2019) and states that "planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas". It outlines the principles upon which the planning process can take account

6 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007.
7 Clean Air Strategy 2019, Defra, January 2019
8 Part IV of the Environment Act 1995
9 National Planning Policy Framework, Department for Communities and Local Government, March 2012.
10 Department for Communities and Local Government, National Planning Policy Framework, February 2019

of air quality impacts associated with new developments. It outlines the role of Local Plans in promoting sustainability and providing limitations on development in areas of poor air quality. An emphasis is placed on consultation with the planning authority to determine whether there are any local issues with the potential to affect the scope of an air quality assessment. Typical air quality mitigation measures are outlined highlighting the use of planning conditions and funding obligations to off-set any significant impacts.

## REGIONAL POLICY

### *THE LONDON PLAN (2016)*

Policy 7.14 of the London Plan[11] sets out the Mayor of London's commitment to improving air quality and public health. It states that development proposals should 'minimise increased exposure to poor air quality' by:

- Promoting sustainable transport;
- Promoting sustainable design and construction;
- Being air quality neutral, particularly in AQMAs;
- Ensuring that where a potential impact on air quality is identified, appropriate mitigation measures are proposed which demonstrate a clear benefit to local air quality; and
- Providing detailed air quality assessments for non-transport sources such as on-site biomass boilers and combined heat and power (CHP) plants to assess the potential impact of emissions on air quality.

A draft New London Plan[12] was published in November 2017 and includes Policy SI1 (Improving Air Quality). The latest version (Intend to Publish, December 2019) states:

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

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

*1. Development proposals should not:*

*a) lead to further deterioration of existing poor air quality*
*b) 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*
*c) create unacceptable risk of high levels of exposure to poor air quality.*

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

*a) Development proposals must be at least air quality neutral*
*b) Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures*
*c) Major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1*

11 The London Plan, The Spatial Development Strategy for London Consolidated with Alterations Since 2011, March 2016
12 The Draft London Plan- consolidated changes version, July 2019

*d) Development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people, which do not demonstrate that design measures have been used to minimise exposure should be refused.*

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

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

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

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

### *LONDON ENVIRONMENT STRATEGY (2018)*

Chapter 4 of the London Environment Strategy[13] outlines the Mayor's commitment to improving air quality in London. The strategy aims plan to significantly reduce $NO_2$ and particulate ($PM_{10}$, $PM_{2.5}$ and black carbon) concentrations through a number of key objectives and policies:

*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

[13] London Environment Strategy, The Mayor of London, May 2018

*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

## LOCAL POLICY

### *THE LONDON BOROUGH OF CAMDEN LOCAL AIR QUALITY MANAGEMENT*

The London Borough of Camden carries out frequent assessments of air quality within the area and produces annual reports in accordance with the requirements of Defra.

Historically, routine monitoring has identified widespread exceedances of the air quality objectives for $NO_2$ and $PM_{10}$. As a consequence, in 2002, the Council declared a Borough-wide AQMA for these pollutants. More recent monitoring indicates that the $NO_2$ objectives are still widely exceeded at roadside locations within the Borough, but $PM_{10}$ concentrations are now generally within the objective.

### *CAMDEN LOCAL PLAN*

Policy CC4 'Air Quality' of Camden's Local Plan[14] 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 (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that a development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.*

*Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.*'

[14] Camden Local Plan (Adopted July 2017)

### CAMDEN'S CLEAN AIR ACTION PLAN 2019 - 2022

Camden's Clean Air Action Plan[15] outlines the Councils commitment to improving air quality in the Borough between 2019 and 2022. The key objectives of the plan are to reduce $PM_{10}$, $PM_{2.5}$ and $NO_2$ concentrations by:

- Reducing construction emissions
- Reducing building emissions (encouraging the use of clean fuels and technologies)
- Reducing transport emissions
- Supporting communities and schools
- Reducing emissions from delivery, servicing and freight
- Continuing public health and awareness raising
- Lobbying

The Action Plan is supported by The Camden Plan[16] and Camden's Environmental Sustainability Plan[17] drawing on European and National legislation in conjunction with national, regional and local policy to manage and improve air quality across the Borough.

[15] London Borough of Camden, Camden's Clean Air Action Plan 2019-2022.
[16] The Camden Plan 2012 - 2017
[17] Green Action for Change 2010 – 2020.

# METHODOLOGY

This section outlines the assessment methodology, taking into account all relevant national and local policies and technical guidance relating to air quality.

## CONSTRUCTION DUST

The potential impact of dust generated during site enabling, earthworks and construction works at the proposed development has been undertaken in accordance with the Mayor of London's SPG for the control of dust and emissions during construction and demolition[18], which is closely aligned with the Institute of Air Quality Management (IAQM) construction dust guidance[19] . A full description of the construction dust methodology is provided in Appendix A – IAQM Construction Dust Methodology.

A detailed assessment of dust impacts is required where there are human or ecological receptors within:

- 50m of the site boundary; or
- 50m of the route(s) used by construction vehicles on public roads, up to 500m from the site entrance(s).

The IAQM/ SPG methodology allows the potential risk of dust soiling and human health effects to be determined, based primarily on the sensitivity of nearby receptors (human and ecological) and the anticipated magnitude of the dust emission due to:

- Demolition;
- Earthworks;
- Construction; and
- Track-out (re-suspended dust from vehicle movements).

The assessment of dust risk is also based on professional judgement taking into account factors such as the prevailing wind direction, the proposed construction phasing, the likely duration of dust raising activities, local topography and existing air quality.

A range of best practice mitigation measures are provided within the guidance, which are dependent on the level of dust risk attributed to the site. It is recommended that these measures are incorporated into the Construction Environmental Management Plan (CEMP) for the proposed development.

The significance of the residual impacts following appropriate mitigation is determined by professional judgement.

## CONSTRUCTION TRAFFIC

The Environmental Protection UK (EPUK)/ IAQM planning guidance[20] , states that for developments within or near an AQMA, a detailed assessment of traffic-related impacts is required where:

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[18] The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, The Mayor of London, July 2014
[19] Guidance on the assessment of dust from demolition and construction, IAQM, v1.1, June 2016
[20] Land-use Planning and Development Control: Planning for Air Quality, Guidance from Environmental Protection UK and the Institute of Air Quality Management for the consideration of air quality within the land use planning and development control process, January 2017.

- There is a change in the annual average daily traffic (AADT) flow of light goods vehicles (LGV) of more than 100 vehicles; and/or
- There is a change in the AADT flow of heavy goods vehicles (HGV) of more than 25 vehicles; and/or
- There is a change in the road re-alignment by more than 5m; and/or
- A new junction is introduced, which will significantly alter vehicle speeds.

In the context of these criteria, LGV refers to cars and other motorised vehicles below 3.5 tonnes and HGV refers to vehicles above 3.5 tonnes.

Construction traffic will contribute to existing traffic levels on the surrounding road network, However, based on the minor construction works which are proposed for the site, the temporary increase in traffic is considered unlikely to be significant in terms of total flow or construction duration.

All non-road mobile machinery (NRMM) will comply with the emission standards specified in the Mayor of London's Control of Dust and Emissions during Construction and Demolition SPG.

The impact of vehicular emissions of $NO_2$ and $PM_{10}$ from construction traffic and on-site machinery on local air quality is considered to be negligible.

## OPERATIONAL TRAFFIC

The proposed development will have no allocated parking and trip generation will be limited to deliveries, taxi movements and on-street disabled parking. The maximum trip generation associated with the site, assuming the commercial units are used for retail or food and drink purposes is expected to be 57 AADT (10% HGV). Of these trips, only 5 are anticipated to be associated with the residential uses. In the event that the commercial units are used for office purposes, the total trip generation is anticipated to be 10 AADT (5 AADT residential, 5 AADT office). The impact of operational traffic on local air quality is therefore anticipated to be negligible.

## EXPOSURE ASSESSMENT

Detailed dispersion modelling of emissions from traffic on the local road network has been undertaken using the ADMS-Roads dispersion model, to predict pollutant concentrations at the proposed development and determine whether on-site mitigation will be required to protect future occupants from poor air quality.

A summary of the model input parameters is presented in Appendix B. The traffic flows used in the assessment have been projected to 2021 (the proposed opening year) using TEMPro v7.2[21].

### *EMISSION FACTORS*

Concentrations of NOx, $PM_{10}$ and $PM_{2.5}$ have been predicted using vehicle emission factors from the latest version of the Emissions Factor Toolkit (10.0) [22]. The predicted NOx concentrations have been converted to $NO_2$ using version 8.1 of the NOx to $NO_2$ calculator, available from the Defra air quality website[23].

[21] https://www.gov.uk/government/publications/tempro-downloads
[22] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[23] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc

### METEOROLOGICAL DATA

Hourly sequential meteorological data from London City Airport (approximately 11 km southeast of the proposed development) for 2018 has been used in the dispersion modelling.

### SENSITIVE RECEPTORS

Concentrations of $NO_2$, $PM_{10}$ and $PM_{2.5}$ have been predicted using a Cartesian grid of 5 m resolution over the full extent of the development site at an elevation of 1.5m above road-level (representing public exposure at the ground-floor on the front façade of the building).

### VERIFICATION

There is an inherent level of uncertainty associated with any assessment process; however, the methodology presented has been developed to minimise errors where possible. Potential errors in predicted concentrations due to uncertainties in the assessment source activity data (e.g. traffic flows and emission factors) and the estimated background concentration are minimised by the verification of modelled concentrations using local monitoring data.

The 2016 Local Air Quality Management Technical Guidance (LAQM.TG16) [24] recommends that modelled concentrations should be within 25% of monitored concentrations, ideally within 10%. Where there is a large discrepancy between modelled and measured concentrations, it is considered necessary to adjust the model results to reflect local air quality more accurately.

The modelled concentrations have been verified using 2018 data from the Swiss Cottage automatic monitoring site. Full details of the model verification process are presented in Appendix C.

### EXPOSURE CRITERIA

The London Councils Air Quality Planning Guidance[25] provides criteria for determining the significance of exposure to air pollution and level of mitigation required. The Air Pollution Exposure Criteria (APEC) are presented in Table 2. The applicable ranges assume a downward trend in pollutant concentrations has been established, which is anticipated due to the uptake of electric vehicles and the implementation of the Ultra-Low Emission Zone.

Table 2: Air Pollution Exposure Criteria

| | Applicable Range $NO_2$ Annual Mean | Applicable Range $PM_{10}$ | Recommendation |
|---|---|---|---|
| **APEC - A** | > 5% below national objective | **Annual Mean:**<br>> 5% below national objective<br>**24 hr Mean:**<br>> 1-day less than national objective | No air quality grounds for refusal; however, mitigation of any emissions should be considered. |

24 Local Air Quality Management Technical Guidance (LAQM.TG16), Defra, February 2018
25 London Councils Air Quality and Planning Guidance, January 2007

| | | | |
|---|---|---|---|
| **APEC - B** | Between 5% below or above national objective | **Annual Mean:** Between 5% above or below national objective **24 hr Mean:** Between 1-day above or below national objective. | May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., Maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered, and internal pollutant emissions minimised. |
| **APEC - C** | > 5% above national objective | **Annual Mean:** > 5% above national objective **24 hr Mean:** > 1-day more than national objective. | Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures. |

## BUILDING-RELATED EMISSIONS

Heat and water will be supplied to the proposed development by a combination of Air Source Heat Pumps (ASHP) and individual gas boilers. The boilers will be compliant with the NOx emission limit of 40 mg/kWh, specified in the Sustainable Design and Construction SPG.

An air quality neutral assessment based on the anticipated gas usage for the development has been undertaken in accordance with the London Plan.

# BASELINE AIR QUALITY

Through an analysis of local monitoring data, a description of existing air quality near the proposed development is provided and appropriate baseline pollutant concentrations are determined for use in the assessment.

## *AUTOMATIC MONITORING DATA*

The nearest automatic air quality monitoring site to the proposed development is at Swiss Cottage, approximately 2km to the southeast. The site is affiliated to the London Air Quality Network (LAQN); therefore, the measured data are subject to high levels of quality assurance (QA) and quality control (QC).

The nearest automatic monitoring sites that measure urban background concentrations are at Haringey Priory Park South, Islington Arsenal and Camden Bloomsbury. Details of all four monitoring sites are presented in Table 3.

Table 3: Automatic Monitoring Sites

| Site Name | Type | Easting | Northing | Pollutants Monitored | Approximate Location Relative to Proposed Development |
|---|---|---|---|---|---|
| Swiss Cottage (Camden) | Kerbside | 526629 | 184391 | $NO_2$, $PM_{10}$, $PM_{2.5}$ | 2 km southeast |
| Priory Park South (Haringey) | Urban background | 531325 | 186032 | $NO_2$ | 5.7 km northeast |
| Bloomsbury (Camden) | Urban background | 530123 | 182014 | $NO_2$, $PM_{10}$, $PM_{2.5}$ | 6.2 km southeast |
| Arsenal (Islington) | Urban background | 531325 | 186032 | $NO_2$, $PM_{10}$ | 6.1 km east |

Annual mean $NO_2$ and particulate ($PM_{10}$ and $PM_{2.5}$) concentrations measured at these locations are summarised in Table 4, together with the number of measured exceedances of the short-term AQOs. The data have been obtained from LBC's 2018 Air Quality Annual Status Report[26] and the London Air Quality Network[27].

The data show that the annual mean AQO for $NO_2$ of 40 µg/m$^3$ is routinely exceeded at Swiss Cottage. In 2016, the number of measured hourly means above 200 µg/m$^3$ was more than double the 18 allowable per annum.

With the exception of Bloomsbury in 2015 and 2016, $NO_2$ concentrations measured at the urban background automatic monitoring sites nearest the proposed development were below the relevant air quality objectives. There is significant variation in annual mean $NO_2$ concentrations across the three sites, with the highest concentrations measured in Bloomsbury and the lowest in Priory Park South. This is likely to be due to the gradually less built-up nature of the environment as you move away from the centre of the city, where large tower blocks trap pollutants closer to the ground. The Arsenal monitoring site is similar distance from the centre of the city as the proposed development, with a similar built environment. Urban background concentrations measured at this location are therefore considered most representative of background concentrations at the proposed development site. Over the past five years annual mean $NO_2$ concentrations at this location have ranged between 25 and 33 µg/m$^3$.

The data from all four automatic monitoring sites indicate a declining trend in annual mean $NO_2$ concentrations since 2016.

[26] London Borough of Camden Air Quality Annual Status Report for 2018, July 2019
[27] www.londonair.org.uk

Concentrations of $PM_{10}$ and $PM_{2.5}$ measured at Swiss Cottage and the three urban background monitoring sites are well within the short and long-term objectives. The data indicate that even at roadside locations, annual mean $PM_{10}$ concentrations are unlikely to exceed 60% of the air quality objective. The measured $PM_{2.5}$ concentrations at all four sites exceed the WHO guideline value of 10 µg/m$^3$, however this level is routinely exceeded across London and there is currently no statutory obligation for compliance. There data indicate that particulate concentrations at both roadside and background locations in the area, are relatively stable.

Table 4: Automatically Measured Pollutant Concentrations

| Site Name | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|
| **Swiss Cottage** | | | | | | |
| Annual Mean NOx (µg/m$^3$) | 177.1 | 158.6 | 178.9 | 140.0 | 126.8 | 96.7 |
| Annual Mean $NO_2$ (µg/m$^3$) | **66** | **61** | **66** | **53** | **54** | **43** |
| Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m$^3$ | 13 | 11 | **37** | 1 | 2 | 1 |
| Annual Mean $PM_{10}$ (µg/m$^3$) | 22 | 20 | 21 | 20 | 21 | 19 |
| Number of Predicted Exceedances of the 24-Hour Mean $PM_{10}$ AQO of 50 µg/m$^3$ | 11 | 8 | 7 | 8 | 4 | 8 |
| Annual Mean $PM_{2.5}$ (µg/m$^3$) | - | 17 | 17 | 14 | 15.6 | 11 |
| **Priory Park South** | | | | | | |
| Annual Mean NOx (µg/m$^3$) | 34.2 | 31.9 | 43.5 | 38.1 | 31.7 | 32.2 |
| Annual Mean $NO_2$ (µg/m$^3$) | n/a | 24 | 26 | 24 | 23 | 22 |
| Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m$^3$ | n/a | 0 | 0 | 0 | 0 | 0 |
| **Bloomsbury** | | | | | | |
| Annual Mean NOx (µg/m$^3$) | 72.1 | 74.4 | 75.0 | 61.4 | 54.4 | 46.3 |
| Annual Mean $NO_2$ (µg/m$^3$) | n/a | **48** | **42** | 38 | 36 | 32 |
| Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m$^3$ | n/a | 0 | 0 | 0 | 0 | 0 |
| Annual Mean $PM_{10}$ (µg/m$^3$) | 20 | n/a | 20 | 19 | 17 (a) | 18 |
| Number of Predicted Exceedances of the 24-Hour Mean $PM_{10}$ AQO of 50 µg/m$^3$ | 10 | n/a | 9 | 6 | 1 | 9 |
| Annual Mean $PM_{2.5}$ (µg/m$^3$) | n/a | 11 | 12 | 13 | 10 | 11 |
| **Arsenal** | | | | | | |
| Annual Mean NOx (µg/m$^3$) | 52.2 | 40.0 | 55.0 | 48.3 | 39.3 | 36.8 |
| Annual Mean $NO_2$ (µg/m$^3$) | n/a | 29 | 33 | 31 | 27 | 25 |
| Number of Predicted Exceedances of the 1-Hour Mean AQO of 200 µg/m$^3$ | n/a | 0 | 0 | 1 | 0 | 0 |
| Annual Mean $PM_{10}$ (µg/m$^3$) | n/a | 18 | 18 | 18 | 19 | 19 |
| Number of Predicted Exceedances of the 24-Hour Mean $PM_{10}$ AQO of 50 µg/m$^3$ | n/a | 1 | 3 | 3 | 1 | 9 |
| (a) 88% data capture | | | | | | |

## *NON-AUTOMATIC MONITORING DATA*

Monitoring of ambient $NO_2$ concentrations is also undertaken by LBC at a number of locations using passive diffusion tubes. A summary of the diffusion tube monitoring locations considered relevant to the assessment is presented in Table 5. The locations of the diffusion tubes are presented in Figure 2.

A summary of the bias adjusted annual mean $NO_2$ concentrations measured between 2014 and 2019 is presented in Table 6.

Table 5: Diffusion Tube Monitoring Locations

| Site ID | Location | Type | Distance from kerb (m) | Easting | Northing |
|---|---|---|---|---|---|
| 7 | Frognal Way | Urban Background | 30.0 | 526213 | 185519 |
| 25 | Emmanuel Primary (a) | Roadside | 1.0 | 525325 | 185255 |
| (a) Moved to new location (525362,185255) in 2019. | | | | | |

The annual mean $NO_2$ concentrations measured at the Frognal Way background diffusion tube site are well within the air quality objective of 40 µg/m$^3$. The annual mean concentrations measured at the Emmanuel Primary roadside location are somewhat higher and consistently exceed the air quality objective, although the concentrations are lower than those measured on Finchley Road at Swiss Cottage.

The Frognal Way monitoring site is 1km east-southeast of the proposed development and due to its proximity is considered to provide a better indication of background NO2 concentrations at the site, than the three background automatic monitoring sites, which are between 5.7 and 6.2 km from the site. The concentrations measured at Frognal Way have ranged between 22.1 and 28.6 µg/m$^3$ since 2014 (not taking into account 2017 where data capture was poor). These data are in reasonable agreement with the concentrations measured at Islington Arsenal, which of the three urban background automatic monitoring locations, was considered the most likely to be representative of the proposed development.

Table 6: Annual Mean $NO_2$ Concentrations Measured by Diffusion Tube (µg/m$^3$)

| Location | Type | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|
| Frognal Way | Urban Background | 28.6 | 27.8 | 27.9 | 29.6 (a) | 22.1 | 22.8 |
| Emmanuel Primary | Roadside | **48.4** | **47.7** | **52.2** | **50.7 (a)** | **39.8** | **37.9** |
| (a) Annualised due to poor data capture. | | | | | | | |

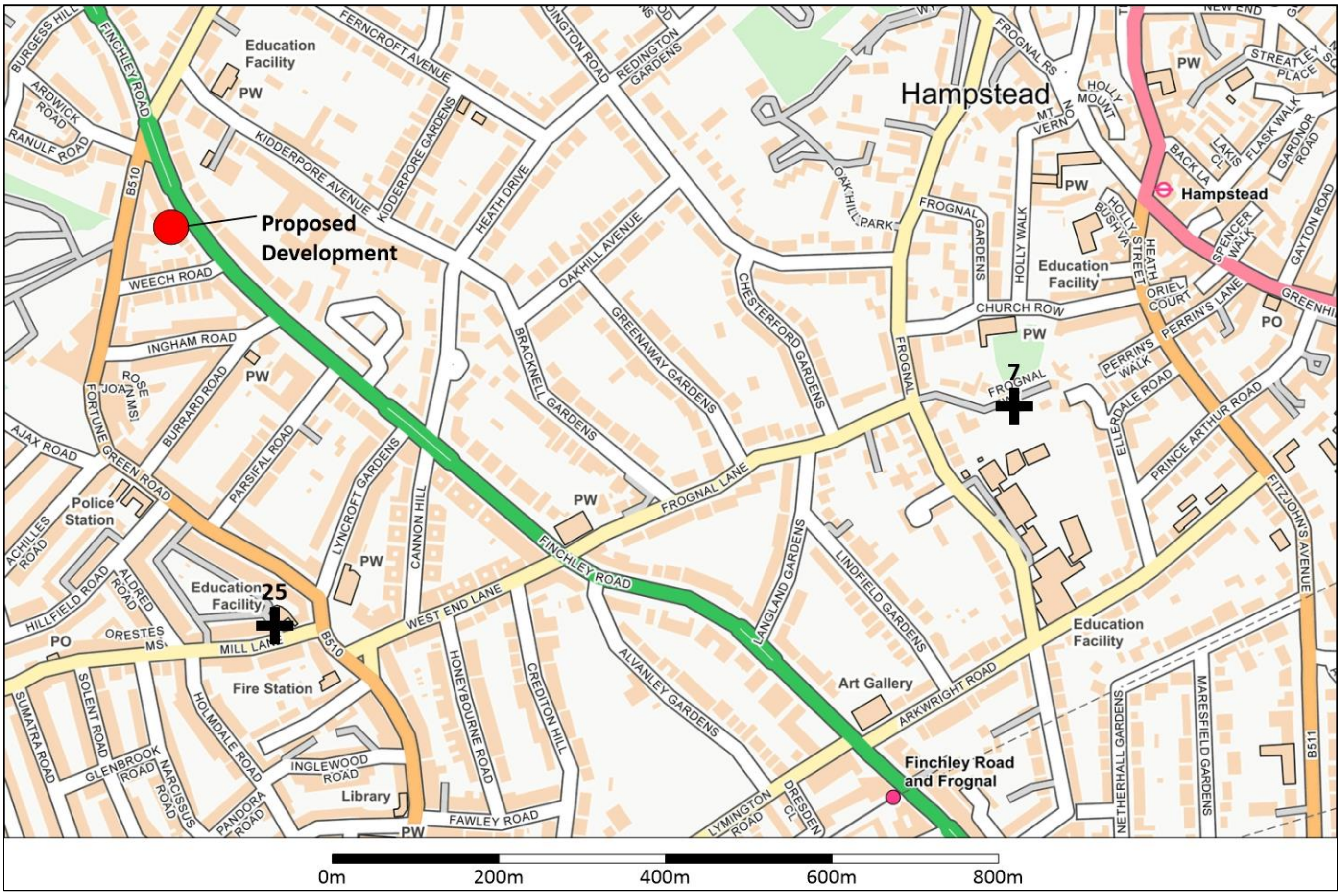

Figure 2: Location of Diffusion Tubes (Contains Ordnance Survey data © Crown copyright and database right 2020)

## MAPPED AND ASSESSMENT BACKGROUND CONCENTRATIONS

For comparison with the measured data, annual mean concentrations for the proposed development site have been obtained from the Defra UK Background Air Pollution maps[28]. These 1km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The latest background maps were issued in August 2020 and are based on 2018 monitoring data, with projections for future years.

The maximum 2018[29] annual mean $NO_2$, $PM_{10}$ and $PM_{2.5}$ concentrations for the proposed development and the Swiss Cottage AQMS have been determined from contour plots of the mapped data and are presented in Table 7. The concentrations are well within the relevant air quality standards.

[28] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html
[29] For consistency with verification year, met data and emission factors used in the assessment.

Table 7: Mapped 2018 Annual Mean Background Pollutant Concentrations (µg/m$^3$)

| Pollutant | Proposed Development | Swiss Cottage AQMS | Air Quality Standard |
|---|---|---|---|
| $NO_2$ | 26.3 | 31.8 | 40 |
| NOx | 40.4 | 52.2 | n/a |
| $PM_{10}$ | 18.6 | 19.6 | 40 |
| $PM_{2.5}$ | 12.1 | 12.5 | 25 |

The mapped $NO_2$ concentration at the proposed development is lower than the concentration measured at Frognal Way in all years, except 2018 and 2019. For the purposes of the assessment, the maximum concentration measured at Frognal Way between 2014 and 2019 of 28.6 µg/m$^3$ (excluding 2017, which had poor data capture) has been used to predict concentrations at the proposed development site in 2021 (opening year). This is considered to provide a conservative estimate of the potential exposure of future occupants to poor air quality.

There are no background particulate monitoring sites in the vicinity of the proposed development. The 2018 annual mean $PM_{10}$ concentration measured at Islington Arsenal was 19 µg/m$^3$, which is in good agreement with the background concentrations measured at London Bloomsbury, but higher than the mapped concentration at the proposed development. The measured concentration at Arsenal is therefore assumed to be acceptably representative of the existing and future (2021) background $PM_{10}$ concentration at the Site.

For $PM_{2.5}$, the nearest background monitoring site is Bloomsbury, however the concentration measured in 2018 was somewhat lower than those measured in other years. On this basis the mapped $PM_{2.5}$ concentration is considered to provide a more conservative estimate of the background $PM_{2.5}$ concentration at the site.

The nearest background monitoring location to the Swiss Cottage verification site is the London Bloomsbury automatic monitoring station. The 2018 measured concentrations at London Bloomsbury are higher than the mapped concentrations at Swiss Cottage and therefore the Bloomsbury data have been used for model verification (see Appendix C). It should be noted that whilst the data capture for $PM_{10}$ at London Bloomsbury in 2018, was below 90%, using a lower background concentration for verification results in a higher adjustment factor for the modelled $PM_{10}$ concentrations at the proposed development site and therefore a more conservative assessment of the potential exposure of future occupants to poor air quality.

A summary of the annual mean background pollutant concentrations used for model verification purposes and to predict concentrations at the proposed development site in 2021 are presented in Table 8.

Table 8: Background Concentrations used in the Assessment

| Pollutant | 2021 Exposure Assessment | 2018 Verification | Air Quality Standard |
|---|---|---|---|
| $NO_2$ | 28.6 | 36.0 | 40 |
| NOx | - | 54.4 | n/a |
| $PM_{10}$ | 19.0 | 17.0 | 40 |
| $PM_{2.5}$ | 12.1 | 10.0 | 25 |

# POTENTIAL IMPACTS

The potential impacts and significance of these impacts on air quality during the construction and operational phases of the development are identified in this section. Suggested mitigation measures are outlined in a subsequent section of the report.

## CONSTRUCTION DUST

### *SENSITIVITY OF THE AREA TO DUST IMPACTS*

The assessment of dust impacts is dependent on the proximity of the most sensitive receptors to the site boundary. A summary of the receptor and area sensitivity to health and dust soiling impacts is presented in Table 9.

Table 9: Sensitivity of Receptors and the Local Area to Dust Impacts

<table>
<tr><th rowspan="2">Receptor</th><th rowspan="2">Distance from Site Boundary</th><th rowspan="2">Number of Receptors</th><th colspan="2">Sensitivity to Health Impacts (a)</th><th colspan="2">Sensitivity to Dust Soiling Impacts</th></tr>
<tr><th>Receptor</th><th>Area</th><th>Receptor</th><th>Area</th></tr>
<tr><td rowspan="3">Residential Properties</td><td><20 m</td><td>10 - 100</td><td rowspan="3">High</td><td>Low</td><td rowspan="3">High</td><td>High</td></tr>
<tr><td><50 m</td><td>10 - 100</td><td>Low</td><td>Medium</td></tr>
<tr><td><100 m</td><td>>100</td><td>Low</td><td>Medium</td></tr>
<tr><td>Hampstead School of Art</td><td>~60 m</td><td>10 - 100</td><td>High</td><td>Low</td><td>High</td><td>Medium</td></tr>
<tr><td>St Luke's Primary School</td><td>~140 m</td><td>>100</td><td>High</td><td>Low</td><td>Medium</td><td>Low</td></tr>
<tr><td colspan="3">Overall Sensitivity of the Area</td><td colspan="2">Low</td><td colspan="2">High</td></tr>
<tr><td colspan="7">(a) Existing annual mean $PM_{10}$ concentration < 24µg/m$^3$</td></tr>
</table>

The precise behaviour of the dust, its residence time in the atmosphere and the distance it may travel before being deposited, will depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

Wind roses for London City Airport are presented in Appendix D, which show that the prevailing wind is from the southwest, therefore receptors to the northeast of the site are most likely to experience dust impacts during the construction phase.

There are no dust sensitive habitat sites within 50m of the Site; therefore, impacts on ecology have not been considered in the assessment.

### *DUST EMISSION MAGNITUDE*

The magnitude of the likely dust emission from demolition, earthworks, construction and trackout, has been evaluated using the criteria in Table A5 of Appendix A and is presented in Table 10.

Table 10: Evaluation of Dust Emission Magnitude

| Dust Source | IAQM Criteria | Proposed Development | Dust Emission Magnitude |
|---|---|---|---|
| **Demolition** | Total building volume ($m^3$) | Approx. 215 $m^3$ | Small |
| | Potentially dusty material? | Brick | Medium |
| | On-site crushing and screening? | No | Small |
| | Maximum height of demolition activities above ground-level (m) | <3m (single-storey) | Small |
| | Demolition during wetter months? | Depends on planning process timescales | Small to Medium |
| **Overall Dust Emission Magnitude From Demolition** | | | **Small** |
| Justification: Based on the very minor scale of the proposed works (215 $m^3$), the magnitude of the dust emission due to demolition is anticipated to be 'small'. | | | |
| **Earthworks** | Total site area ($m^2$) | < 650 $m^2$ | Small |
| | Soil type? | Silty Loam | Medium |
| | Number of heavy earth moving vehicles active at any one time | 1-2 | Small |
| | Maximum bund height (m) | <4m | Small |
| | Total material moved (tonnes) | < 20,000 tonnes. | Small |
| | Earthworks during wetter months? | Cannot be guaranteed. | Medium |
| **Overall Dust Emission Magnitude From Earthworks** | | | **Small** |
| Justification: With the exception of the rear extension, the existing building on site will be retained. The scale of the earthworks is small, and with limited access to the rear of the site, is likely to be undertaken by mini earth moving equipment. The magnitude of the emission due to earthworks is therefore considered to be 'small'. | | | |
| **Construction** | Total building volume ($m^3$) | 612 $m^3$ | Small |
| | Potentially dusty construction material? | Brick, concrete | Medium |
| | On-site concrete batching? | No | Small |
| | Sandblasting? | No | Small |
| **Overall Dust Emission Magnitude From Construction** | | | **Small** |
| Justification: Whilst brick and concrete will be used on site, the proposed extension is very minor in scale and therefore the magnitude of the emissions is considered to be 'small'. | | | |
| **Trackout** | Number of outward HGV movements in any one day | <5 | Small |
| | Dusty surface material? | Silty loam | Medium |
| | Unpaved road length (m) | n/a | Small |
| **Overall Dust Emission Magnitude From Trackout** | | | **Small** |
| Justification: There will be no vehicular access to the rear of the site, where the proposed extension will be constructed and therefore there is unlikely to be any significant trackout of material from the site. | | | |

## Assessment of Dust Risk Prior to Mitigation

A summary of the potential risk of dust impacts prior to mitigation, based on the low sensitivity of the area to human health impacts and high sensitivity to dust soiling impacts is presented in Table 11.

Whilst the dust emission magnitude from the demolition works has been assessed as 'small', it is our professional judgement that a dust risk of 'low' is more appropriate, since the scale of the works are very small (just 215 $m^3$), low level (<3m) and will be undertaken over a very short-time period. The site is also bound to the rear by a brick wall, which will provide an effective barrier to dust generated during demolition.

Table 11: Risk of Dust Impacts Prior to Mitigation

| Dust Source | Emission Magnitude | Human Health Risk | Dust Soiling Risk | Overall Risk |
|---|---|---|---|---|
| Demolition | Small | Negligible | Low | **Low** |
| Earthworks | Small | Negligible | Low | **Low** |
| Construction | Small | Negligible | Low | **Low** |
| Trackout | Small | Negligible | Low | **Low** |

# EXPOSURE ASSESSMENT

## *NITROGEN DIOXIDE*

Predicted ground-floor and first-floor annual mean $NO_2$ concentrations across the proposed development site are presented as contour plots in Figure 3 and Figure 4, respectively.

At ground-floor level the maximum predicted annual mean $NO_2$ concentration at the roadside façade is just under 44 µg/m$^3$. The front half of the proposed development at ground-floor level will be used for commercial purposes and therefore there will be no long-term public exposure. Measurements across the UK[30] have shown that there is a risk of an exceedance of the 1-hour mean AQO for $NO_2$ where the annual mean concentration is greater than 60 µg/m$^3$. The predicted annual mean $NO_2$ concentrations at the façade of the proposed development are well below this threshold and therefore the risk of a short-term exceedance is considered to be negligible. Two residential apartments are proposed for the back half of the ground-floor, with windows on the rear façade. Figure 3 indicates that the maximum annual mean $NO_2$ concentration will be less than 95% of the annual mean air quality objective of 40 µg/m$^3$, therefore falling within exposure level **APEC-A**.

The second, third and fourth floors of the proposed development will be 100% residential use. The maximum predicted concentration at the first-floor level roadside façade is less than 37 µg/m$^3$ with concentrations falling to approximately 35 µg/m$^3$ at the rear façade. The exposure level at the first-floor is therefore also **APEC-A**. Since pollutant concentrations decline rapidly with height from road-level, the concentrations at second, third and fourth level would be expected to be lower than at first-floor level and therefore all of the proposed residential dwellings fall within exposure level **APEC-A**.

[30] D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites, July 2003.


Figure 3: Predicted Ground-Floor Level Annual Mean $NO_2$ Concentrations (µg/m$^3$)

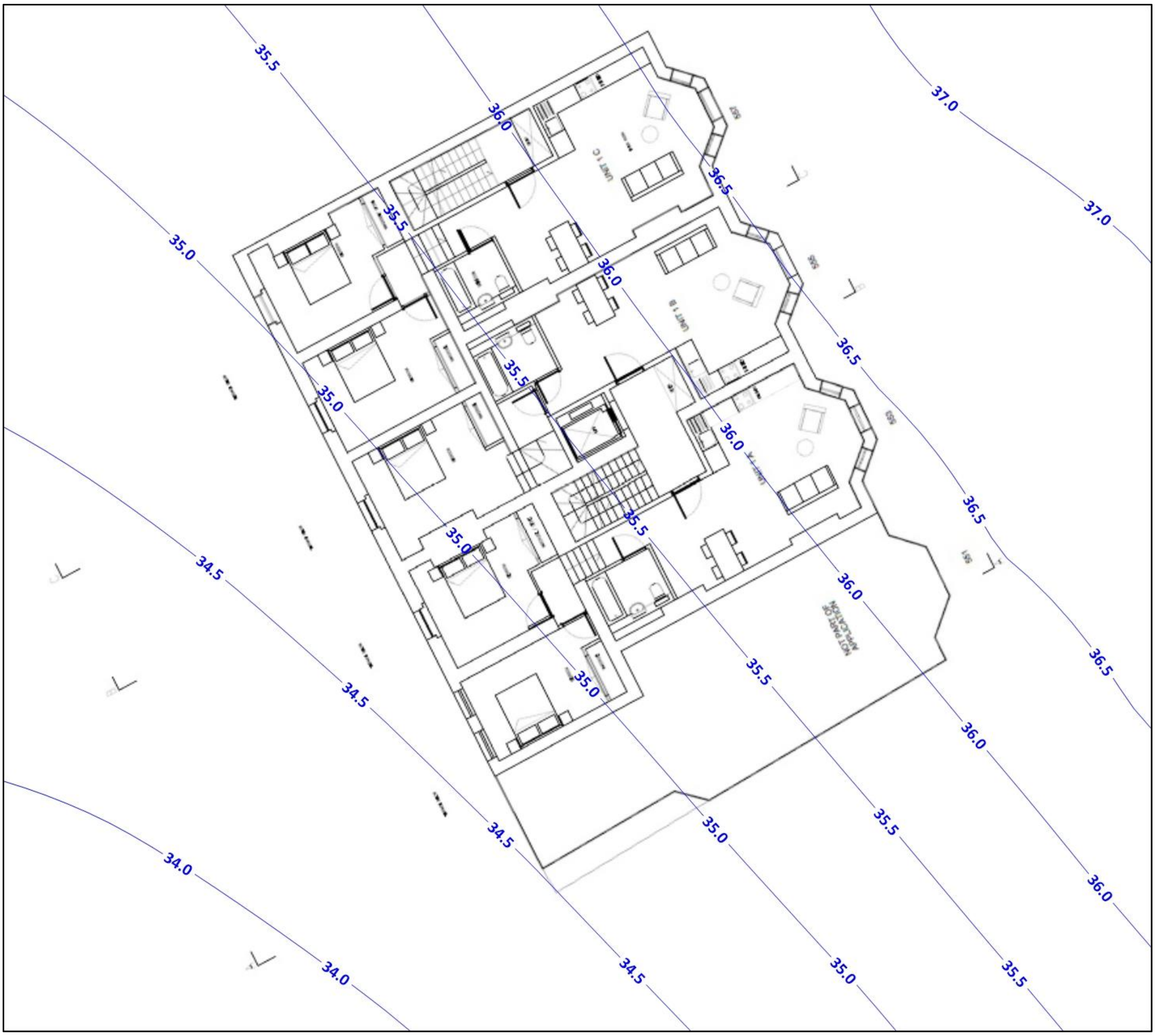


Figure 4: Predicted First-Floor Level Annual Mean $NO_2$ Concentrations (µg/m$^3$)

## *PARTICULATE MATTER*

Ground-floor level annual mean $PM_{10}$ and $PM_{2.5}$ concentrations at the proposed development site are presented as contour plots in Figure 6 and Figure 6, respectively. The predicted concentrations at the façade of the proposed development are well below the air quality standards and therefore the proposed development falls within exposure category **APEC-A**, with respect to particulate matter.

LAQM.TG(16) provides a relationship between predicted annual mean $PM_{10}$ concentrations and the likely number of exceedances of the short-term (24-hour mean) $PM_{10}$ objective of 50 µg/m$^3$. The objective allows 35 exceedances per year, which is equivalent to an annual mean of 32 μg/m³. On this basis, the dispersion modelling indicates that compliance with the short-term $PM_{10}$ objective is also likely to be achieved at all locations on site.


Figure 5: Predicted Ground Level Annual Mean $PM_{10}$ Concentrations (μg/m³)


Figure 6 Predicted Ground Level Annual Mean $PM_{2.5}$ Concentrations (µg/m³)

# MITIGATION

The following mitigation measures will be required during the construction and operational phases in order to minimise the air quality impacts arising from the development.

## CONSTRUCTION PHASE

London Best Practice Guidance for dust control will be implemented, as appropriate, during the construction phase through the CEMP for the proposed development.

The risk of dust soiling and human health impacts from the site has been assessed as 'low'.

In accordance with the IAQM and Mayor of London guidance, it is therefore recommended that the 'highly recommended' measures detailed in Table 12 are incorporated into the CEMP. The 'desirable' measures detailed in Table 13 should also be considered for inclusion.

The significance of dust impacts on nearby receptors following the implementation of appropriate and best practice mitigation is considered to be negligible.

Table 12: Highly Recommended Mitigation Measures

| Description | Mitigation Measure |
|---|---|
| Site management | - Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site Manager.<br>- Display the head or regional office contact information.<br>- Record and respond to all dust and air quality pollutant emissions complaints.<br>- Make the complaints log available to the local authority when asked.<br>- Carry out regular site inspections to monitor compliance with the CEMP, record inspection results, and make an inspection log available to the local authority when asked.<br>- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.<br>- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook. |
| Preparing and maintaining the site | - Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.<br>- Erect solid screens or barriers around dusty activities or at the site boundary that are at least as high as any stockpiles on site.<br>- Avoid site runoff of water or mud. |
| Operating vehicle/machinery and sustainable travel | - Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable.<br>- Ensure all vehicles switch off engines when stationary - no idling vehicles.<br>- Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.<br>- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing). |

| | |
|---|---|
| Operations | - Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.<br>- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.<br>- Use enclosed chutes and conveyors and covered skips.<br>- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate. |
| Waste management | - Reuse and recycle waste to reduce dust from waste materials<br>- Avoid bonfires and burning of waste materials |
| Demolition | - Ensure water suppression is used during demolition operations.<br>- Avoid explosive blasting, using appropriate manual or mechanical alternatives.<br>- Bag and remove any biological debris or damp down such material before demolition. |

Table 13: Desirable Mitigation Measures

| Description | Mitigation Measure |
|---|---|
| Preparing and maintaining the 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.<br>- Keep site fencing, barriers and scaffolding clean using wet methods.<br>- Remove materials from site as soon as possible. |
| 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). |
| Construction | - Avoid scabbling (roughening of concrete surfaces) if possible.<br>- 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. |
| 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.<br>- Avoid dry sweeping of large areas.<br>- Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport.<br>- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). |

## OPERATIONAL PHASE

Dispersion modelling of traffic on the local road network indicates that the proposed development falls within the London Planning Guidance APEC-A exposure category and therefore mitigation is not required during the operational phase.

The proposed development will include cycle spaces to encourage sustainable transport.

# AIR QUALITY NEUTRAL ASSESSMENT

This section presents an air quality neutral assessment in accordance with The London Plan. It is found that the proposed development will be Air Quality Neutral with respect to transport and building-related emissions.

## BUILDING EMISSIONS

The air quality neutral assessment compares the building-related emissions with benchmarked emissions based on the floor space and land-use as specified in the Air Quality Neutral Planning Support Document (PSD). The proposed commercial space is Class E. The guidance has not been updated for the recent revisions to land-use classes and therefore, the benchmarks for the pre-September 2020 land-use classes have been used to determine whether the traffic-related emissions will be air quality neutral. In order to present a worst-case assessment, the lowest BEB across the Class E equivalent sectors (A1) has been used.

The Building Emission Benchmarks (BEBs) and benchmarked emissions for the proposed development are presented in Table 14. The PSD states that '*it is not necessary for a developer to demonstrate compliance with the $PM_{10}$ benchmark where gas is the only fuel used on site*'. On this basis, the air quality neutral assessment has been undertaken for NOx emissions only.

Table 14: Benchmarked Building Emissions

| Land Use Class | GIA ($m^2$) | BEB (g NOx/$m^2$/annum) | Benchmarked Emissions (kg NOx/annum) |
|---|---|---|---|
| Residential (C3) | 1290.5 | 26.2 | 33.9 |
| Commercial (assumed A1) | 236.1 | 22.6 | 5.3 |
| **Total Benchmarked NOx Emission** | | | **39.2** |

Building-related emissions for the proposed development are presented in Table 15 and have been derived from the anticipated energy usage (gas) for the site and the London Atmospheric Emissions Inventory (LAEI) default NOx emission factor for domestic and commercial land-uses, as specified in the PSD.

The development emissions are lower than the benchmarked emissions and therefore the proposed development is Air Quality Neutral with respect to building-related emissions.

Table 15: Development Building Emissions

| Land Use Class | Energy Usage (kWh/annum) | Emission Factor (kg NOx/kWh) | Building Emissions (kg NOx/annum) |
|---|---|---|---|
| Commercial | 10,000 | 0.000194 | 1.9 |
| Domestic | 70,000 | 0.0000785 | 5.5 |
| **Total Building-Related NOx Emission** | | | **7.4** |

## TRANSPORT EMISSIONS

The air quality neutral assessment for transport-related emissions compares the emissions from traffic generated by the site with benchmarked emissions based on land-use as specified in the Air Quality Neutral PSD. Whilst the proposed development is car-free, taxis, deliveries and blue badge parking are expected to generate a maximum of

57 vehicle movements per day if the commercial units are used for retail or food and drink purposes. If the commercial units are used for office purposes the total trip generation is anticipated to be just 10 AADT.

The Transport Emission Benchmarks (TEBs) for inner London and benchmarked emissions for NOx and $PM_{10}$ are presented in Table 16 and Table 17 for a combination of residential and retail, and residential and office uses, respectively.

Table 16: Benchmarked Transport Emissions (Residential and Retail)

| Pollutant/ Land-Use | NIA ($m^2$) or Number of dwellings | TEB (g /$m^2$ or dwelling /annum) | Benchmarked Emissions (kg/annum) |
|---|---|---|---|
| **NOx** | | | |
| Residential (C3) | 15 | 558 | 8.3 |
| Commercial | 236.1 | 219 | 51.7 |
| **Total Benchmarked NOx** | | | **60.0** |
| **$PM_{10}$** | | | |
| Residential (C3) | 15 | 100 | 1.5 |
| Commercial | 236.1 | 39.1 | 9.2 |
| **Total Benchmarked $PM_{10}$** | | | **10.7** |

Table 17: Benchmarked Transport Emissions (Residential and Office)

| Pollutant/ Land-Use | NIA ($m^2$) or Number of dwellings | TEB (g /$m^2$ or dwelling /annum) | Benchmarked Emissions (kg/annum) |
|---|---|---|---|
| **NOx** | | | |
| Residential (C3) | 15 | 558 | 8.3 |
| Commercial | 236.1 | 11.4 | 2.7 |
| **Total Benchmarked NOx** | | | **11.0** |
| **$PM_{10}$** | | | |
| Residential (C3) | 15 | 100 | 1.5 |
| Commercial | 236.1 | 2.05 | 0.5 (9.2) |
| **Total Benchmarked $PM_{10}$** | | | **2.0** |

Transport-related emissions associated with the proposed development are presented in Table 18 and have been calculated using the anticipated trip generation for the site, trip lengths and emission factors for Inner London.

Table 18: Development Transport Emissions

| Parameter | Residential | Retail | Office |
|---|---|---|---|
| Daily Trips | 5 | 52 | 5 |
| Annual trips | 1,825 | 18,980 | 1,825 |
| Average distance travelled per trip (km) | 3.7 | 5.9 | 7.7 |
| Annual distance (km) | 6,753 | 111,982 | 14,053 |
| NOx Emission Factor (g/km) | 0.370 | | |
| NOx Emission (kg/annum) | 2.5 | 41.4 | 5.2 |
| **Total NOx Emission Residential + Retail (kg/annum)** | **43.9** | | |
| **Total NOx Emission Residential + Office (kg/annum)** | **7.7** | | |
| $PM_{10}$ Emission Factor (g/km) | 0.0665 | | |
| $PM_{10}$ Emission (kg/annum) | 0.4 | 7.4 | 0.9 |
| **Total $PM_{10}$ Emission Residential + Retail (kg/annum)** | **7.8** | | |
| **Total $PM_{10}$ Emission Residential + Office (kg/annum)** | **1.3** | | |

The development transport emissions for $NO_2$ and $PM_{10}$ are below the benchmarked emissions for both the combination of ‘residential and retail’ and ‘residential and office’ uses. On this basis the proposed development is assessed as Air Quality Neutral with respect to transport-related emissions.

# SUMMARY AND CONCLUSIONS

An assessment has been undertaken to assess the potential impacts on local air quality associated with the construction and operation of the proposed development. Based on the results of the assessment, it is considered that redevelopment of the site would not cause a significant impact on local air quality.

An assessment of the potential impacts during the construction phase has been carried out in accordance with the latest Institute of Air Quality Management guidance; this has shown that releases of dust and $PM_{10}$ are likely to occur during site activities. The risk of dust soiling and health impacts at neighbouring properties has been assessed as 'low'. Through good site practice and the implementation of suitable mitigation measures, the impact of dust and $PM_{10}$ releases may be effectively mitigated and the resultant impacts are considered to be negligible.

The development will be car free and therefore operational traffic associated is not anticipated to significantly affect local air quality. Emissions from the small number of traffic movements generated by deliveries and taxis have been assessed as Air Quality Neutral.

Detailed dispersion modelling has been undertaken to predict pollutant concentrations at the proposed development. The proposed development is a mixed-use scheme with commercial units on the ground-floor façade. Residential dwellings are proposed for the rear of the ground-floor. The results of the assessment indicate that annual mean $NO_2$ concentrations at the roadside façade will be above the air quality objective of 40µg/m$^3$, however the risk of an exceedance of the short-term objective is considered to be negligible. The predicted concentrations at the rear (residential) façade fall within exposure category APEC-A. At first floor-level and above, the predicted $NO_2$ concentrations at both the roadside and rear facades are well within the air quality objective (APEC-A). The predicted concentrations of $PM_{10}$ and $PM_{2.5}$ are well within the relevant long and short-term air quality objectives (APEC-A).

A combination of individual gas boilers and ASHPs will be used to provide heat and hot water to the proposed development. The building-related emissions have been assessed as Air Quality Neutral.

# APPENDIX A – IAQM CONSTRUCTION DUST METHODOLOGY

Factors defining the sensitivity of a receptor to dust impacts are presented in Table A1.

Table A1: Receptor Sensitivity

| Receptor Sensitivity | Human Health | Dust Soiling | Ecological |
|---|---|---|---|
| High | - Locations where members of the public are exposed over a time period relevant to the air quality objectives for $PM_{10}$ (a)<br>- Examples include residential dwellings, hospitals, schools and residential care homes. | - Regular exposure<br>- High level of amenity expected.<br>- Appearance, aesthetics or value of the property would be affected by dust soiling.<br>- Examples include residential dwellings, museums, medium and long-term car parks and car showrooms. | - Nationally or Internationally designated site with dust sensitive features (b)<br>- Locations with vascular species (c) |
| Medium | - Locations where workers are exposed over a time period relevant to the air quality objectives for $PM_{10}$ (a)<br>- Examples include office and shop workers (d) | - Short-term exposure<br>- Moderate level of amenity expected<br>- Possible diminished appearance or aesthetics of property due to dust soiling<br>- Examples include parks and places of work | - Nationally designated site with dust sensitive features (b)<br>- Nationally designated site with a particularly important plant species where dust sensitivity is unknown |
| Low | - Transient human exposure<br>- Examples include public footpaths, playing fields, parks and shopping streets | - Transient exposure<br>- Enjoyment of amenity not expected.<br>- Appearance and aesthetics of property unaffected<br>- Examples include playing fields, farmland (e), footpaths, short-term car parks and roads | - Locally designated site with dust sensitive features (b) |

a) In the case of the 24-hour objective, a relevant location would be one where individuals may be exposed for eight hours or more in a day.
b) Ecosystems that are particularly sensitive to dust deposition include lichens and acid heathland (for alkaline dust, such as concrete).
c) Cheffing C. M. & Farrell L. (Editors) (2005), The Vascular Plant. Red Data List for Great Britain, Joint Nature Conservation Committee.
d) Does not include workers' exposure to $PM_{10}$ as protection is covered by Health and Safety at Work legislation.
e) Except commercially sensitive horticulture.

The sensitivity of the area as a whole is dependent on the number of receptors within each sensitivity class and their distance from the source. Human health impacts are also dependent on the existing $PM_{10}$ concentrations in the area.

Table A2 and Table A3 summarise the criteria for determining the overall sensitivity of the area to dust soiling and health impacts, respectively. The sensitivity of the area to ecological impacts is presented in Table A4.

Table A2: Sensitivity of the Area to Dust Soiling Effects on People and Property

| Receptor Sensitivity | Number of Receptors | Distance from the Source | | | |
|---|---|---|---|---|---|
| | | <20m | <50m | <100m | <350m |
| High | >100 | High | High | Medium | Low |
| | 10-100 | High | Medium | Low | Low |
| | 1-10 | Medium | Low | Low | Low |
| Medium | >1 | Medium | Low | Low | Low |
| Low | >1 | Low | Low | Low | Low |

Table A3: Sensitivity of the Area to Health Impacts from Dust

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

Table A4: Sensitivity of the Area to Ecological Impacts from Dust

| Receptor Sensitivity | Distance from the Source | |
|---|---|---|
| | <20m | <50m |
| High | High | Medium |
| Medium | Medium | Low |
| Low | Low | Low |

The magnitude of the dust impacts for demolition, earthworks, construction and trackout is classified as small, medium or large depending on the scale of the proposed works as detailed in Table A5.

Table A5: Dust Emission Magnitude

| Receptor Sensitivity | Large | Medium | Small |
|---|---|---|---|
| Demolition | - Total building volume >50,000m$^3$<br>- Potentially dusty material (e.g. concrete)<br>- Onsite crushing and screening<br>- Demolition activities >20m above ground level. | - Total building volume 20,000 - 50,000m$^3$<br>- Potentially dusty material<br>- Demolition activities 10 - 20m above ground level. | - Total building volume <20,000m$^3$<br>- Construction material with low potential for dust release<br>- Demolition activities <10m above ground level<br>- Demolition during wetter months |
| Earthworks | - Total site area >10,000m$^2$<br>- Potentially dusty soil type (e.g. clay)<br>- >10 heavy earth moving vehicles active at any one time<br>- Formation of bunds >8m in height<br>- Total material moved >100,000 tonnes | - Total site area 2,500 - 10,000m$^2$<br>- Moderately dusty soil type (e.g. silt)<br>- 10 heavy earth moving vehicles active at any one time<br>- Formation of bunds 4 - 8m in height<br>- Total material moved 20,000 - 100,000 tonnes | - Total site area <2,500m$^2$<br>- Soil type with large grain size (e.g. sand)<br>- <5 heavy earth moving vehicles active at any one time<br>- Formation of bunds <4m in height<br>- Total material moved <20,000 tonnes<br>- Earthworks during wetter months |
| Construction | - Total building volume >100,000m$^3$<br>- On site concrete batching<br>- Sandblasting | - Total building volume 25,000 - 100,000m$^3$<br>- Potentially dusty construction material (e.g. concrete)<br>- On site concrete batching | - Total building volume <25,000m$^3$<br>- Material with low potential for dust release (e.g. metal cladding or timber |
| Trackout | - >50 HGV movements in any one day (a)<br>- Potentially dusty surface material (e.g. high clay content)<br>- Unpaved road length >100m | - 10 - 50 HGV movements in any one day (a)<br>- Moderately dusty surface material (e.g. silt)<br>- Unpaved road length 50 - 100m | - <10 HGV movements in any one day (a)<br>- Surface material with low potential for dust release<br>- Unpaved road length <50m |

a) HGV movements refer to outward trips (leaving the site) by vehicles of over 3.5 tonnes

For each dust emission source, the worst-case area sensitivity is used in combination with the dust emission magnitude to determine the risk of dust impacts prior to mitigation as illustrated in Tables A6 and A7.

Table A6: Risk of Dust Impacts from Demolition, Earthworks and Construction

| Area Sensitivity | Emission Magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| High | High Risk | Medium Risk | Medium Risk |
| Medium | High Risk | Medium Risk | Low Risk |
| Low | Medium Risk | Low Risk | Negligible Risk |

Table A7: Risk of Dust Impacts from Trackout

| Area Sensitivity | Emission Magnitude | | |
|---|---|---|---|
| | Large | Medium | Small |
| High | High Risk | Medium Risk | Low Risk |
| Medium | Medium Risk | Low Risk | Negligible Risk |
| Low | Low Risk | Low Risk | Negligible Risk |

# APPENDIX B – ADMS-ROADS INPUT PARAMETERS

Table B1: Summary of ADMS-Roads Input Parameters for Model Verification

| Parameter | Value |
|---|---|
| ADMS-Roads Model Version | 5.0 |
| Vehicle Emission Factors | EFT v10.0 for 2018 |
| Meteorological Data | Hourly sequential data from London City Airport (2018) |
| Surface Roughness | 1.0m |
| Monin-Obukhov Length | 75m |

Table B2: Summary of ADMS-Roads Input Parameters for Prediction of Air Quality at the Proposed Development

| Parameter | Value |
|---|---|
| ADMS-Roads Model Version | 5.0 |
| Vehicle Emission Factors | EFT v10.0 for 2018 |
| Meteorological Data | Hourly sequential data from London City Airport (2018) |
| Surface Roughness | 1.0m |
| Monin-Obukhov Length | 75m |

Table B3: Summary of Traffic Data for Model Verification

| Road Link | 2018 AADT (a) | HGV(%) | Average Speed (kph) |
|---|---|---|---|
| Finchley Road North of Swiss Cottage | 49,822 | 8.7 | 10 |
| Finchley Road South of Swiss Cottage | 19,597 | 5.6 | 10 |
| Avenue Road | 48,979 | 7.2 | 10 |
| College Crescent | 20,922 | 3.1 | 10 |
| (a) AADT derived from 2016 London Atmospheric Emissions Inventory (LAQM) with TEMPro v7.2 growth factor for Camden applied to project flows to 2018. | | | |

Table B4: Summary of Traffic Data for the Prediction of Pollutant Concentrations at the Proposed Development

| Road Link | 2021 AADT (a) | HGV(%) | Average Speed (kph) |
|---|---|---|---|
| Finchley Road (south of Platt's Lane) | 51,239 | 6.7% | 10 |
| Fortune Green Road | 13,371 | 9.8% | 10 |
| Platt's Lane | 7,687 | 4.1% | 10 |
| Finchley Road (north of Platt's Lane) | 51,608 | 7.4% | 10 |
| (a) AADT derived from 2016 London Atmospheric Emissions Inventory (LAQM) with TEMPro v7.2 growth factor for Camden applied to project flows to 2021. | | | |

# APPENDIX C – MODEL VERIFICATION

Most nitrogen dioxide ($NO_2$) is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS-Roads model has followed the methodology presented in LAQM.TG16.

Predicted annual mean concentrations of NOx have been compared with the 2018 annual mean concentration measured by the LBC automatic air quality monitoring station located on the A41 at Swiss Cottage.

A Road-NOx (i.e. the component of total NOx coming from road traffic) concentration has been derived by subtracting the 2018 measured background NOx concentration from Bloomsbury from the NOx concentration measured at Swiss Cottage.

The ratio of the measured and modelled Road-NOx contributions provides an adjustment factor for the modelled Road-NOx concentrations. This factor is then applied to the modelled road NOx concentrations before they are converted to Road-$NO_2$ using the Defra NOx to $NO_2$ calculator and added to the background $NO_2$ concentration to produce a total adjusted modelled $NO_2$ concentration. The calculation of the adjustment factor for $NO_2$ is presented in Table C1.

Table C1: Verification Calculation for $NO_2$

| Parameter | Value |
|---|---|
| 2018 Measured $NO_2$ Concentration | 53.7 $\mu g/m^3$ |
| 2018 Measured NOx Concentration | 126.8 $\mu g/m^3$ |
| 2018 Background NOx Concentration | 54.4 $\mu g/m^3$ |
| Measured Road-NOx Concentration | 72.4 $\mu g/m^3$ |
| Modelled Road-NOx Concentration | 51.9 $\mu g/m^3$ |
| **Adjustment Factor** | **1.39** |

**Particulate Matter (as $PM_{10}$)**

Predicted annual mean concentrations of $PM_{10}$ have been compared with the 2018 annual mean concentration measured by the Swiss Cottage automatic air quality monitoring station. A measured Road-$PM_{10}$ (i.e. the component of total $PM_{10}$ coming from road traffic) concentration has been derived by subtracting the measured background concentration at Bloomsbury from the concentration measured at Swiss Cottage.

The ratio of the measured and modelled Road-$PM_{10}$ contributions provides an adjustment factor for the modelled Road-$PM_{10}$ concentrations. The calculation of the adjustment factor for $PM_{10}$ is presented in Table C2.

Table C2: Verification Calculation for $PM_{10}$

| Parameter | Value |
|---|---|
| 2018 Measured $PM_{10}$ Concentration | 21.0 µg/m$^3$ |
| 2018 Measured Background $PM_{10}$ Concentration | 17.0 µg/m$^3$ |
| Measured Road-$PM_{10}$ Concentration | 4.0 µg/m$^3$ |
| Modelled Road-$PM_{10}$ Concentration | 2.4 µg/m$^3$ |
| **Adjustment Factor** | **1.6** |

**Particulate Matter (as $PM_{2.5}$)**

Predicted annual mean concentrations of $PM_{2.5}$ have been compared with the 2018 annual mean concentration measured by the Swiss Cottage automatic air quality monitoring station. A measured Road-$PM_{2.5}$ (i.e. the component of total $PM_{2.5}$ coming from road traffic) concentration has been derived by subtracting the 2018 measured background concentration at Bloomsbury from the measured roadside $PM_{2.5}$ concentration.

The ratio of the measured and modelled Road-$PM_{2.5}$ contributions provides an adjustment factor for the modelled Road-$PM_{2.5}$ concentrations. The calculation of the adjustment factor for $PM_{2.5}$ is presented in Table C3.

Table C3: Verification Calculation for $PM_{2.5}$

| Parameter | Value |
|---|---|
| 2018 Measured $PM_{2.5}$ Concentration | 16.0 µg/m$^3$ |
| 2018 Measured Background $PM_{2.5}$ Concentration | 10.0 µg/m$^3$ |
| Measured Road-$PM_{2.5}$ Concentration | 6.0 µg/m$^3$ |
| Modelled Road-$PM_{2.5}$ Concentration | 1.6 µg/m$^3$ |
| **Adjustment Factor** | **3.8** |

# APPENDIX D – WIND ROSES

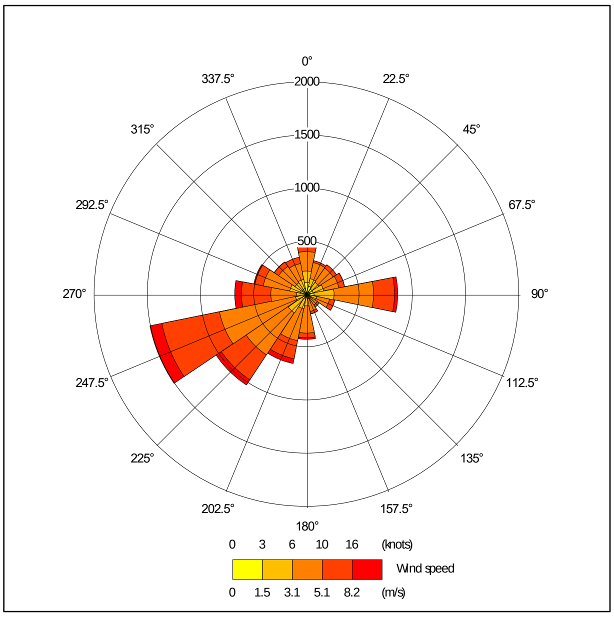


Figure D1: Wind Rose London City Airport 2016

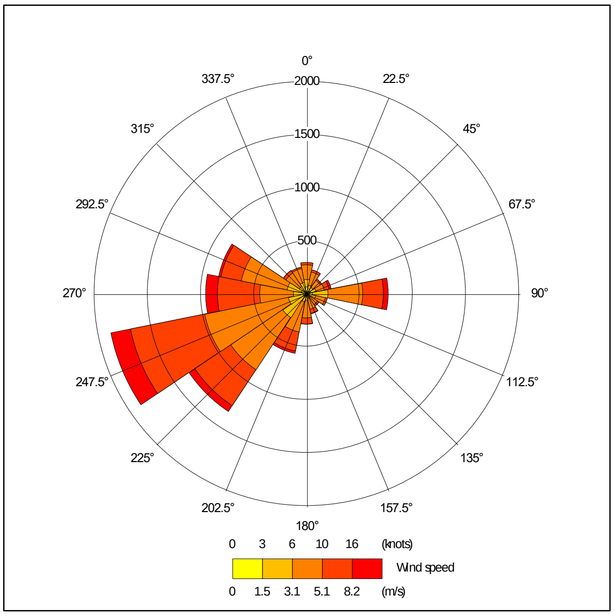


Figure D2: Wind Rose London City Airport 2017

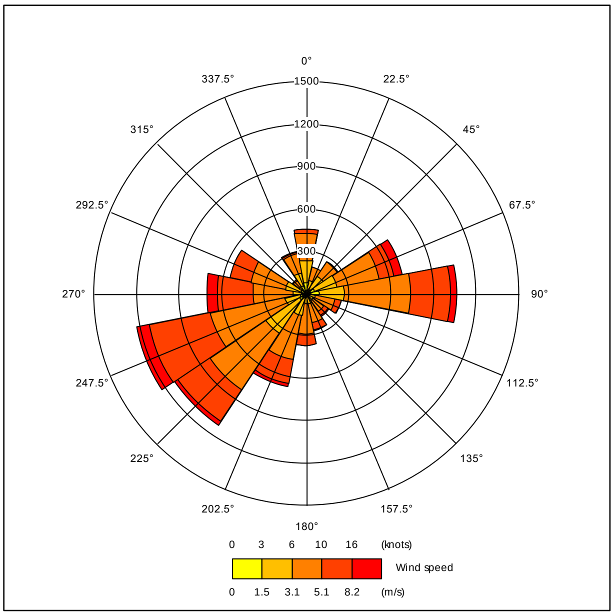


Figure D3: Wind Rose London City Airport 2018

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