PROPOSED MIXED RESIDENTIAL AND COMMERCIAL DEVELOPMENT

18-22 HAVERSTOCK HILL, CAMDEN, LONDON

Air Quality Impact Assessment

ITPENERGISED
Earth. Smart. Solutions

Quality Management

	Version 1	Version 2	Version 3	Version 4
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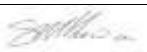
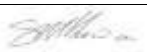
Signature				
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1 Introduction

1.1.1 ITPEnergised (ITPE) has been commissioned by PPR Haverstock Hill LLP (hereafter 'the client') to provide an air quality impact assessment for the redevelopment of an existing block of flats with two retail units into a mixed residential and commercial development (hereafter 'the Proposed Development').

1.1.2 The Proposed Development is located at 18-22 Haverstock Hill, London, within the administrative area of the London Borough of Camden (LBC). The Proposed Development site boundary and layout are shown on **Figure 1**.

1.1.3 The entire LBC is designated as an Air Quality Management Area (AQMA). While the Proposed Development generates negligible traffic flows and does not have an operational impact on existing receptors, the air quality impact assessment (AQIA) is required to assess the suitability of the site for future residential occupancy. The assessment includes a detailed dispersion modelling study to assess the air quality conditions at the future receptor locations of each floor of the Proposed Development.

1.1.4 The pollutants included in this assessment are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$).

2 Legislation and Policy

2.1.1 The UK's legislation and regulatory regime, along with national, regional and local planning policy play a key role in the prevention, control and minimisation of atmospheric emissions that are potentially harmful to human health and the environment. Air Quality Objectives (AQOs) are quality standards for clean air that are used as assessment criteria for determining the significance of any potential changes in local air quality resulting from development proposals.

2.1 European Legislation

2.1.1 The EU has published a Directive on Ambient Air Quality Assessment and Management which came into force in September 1996 (Directive 96/62/EC). This Directive is intended as a strategic framework for tackling air quality consistently, through setting European wide air quality limit values in a series of daughter directives, superseding and extending existing European legislation. The first four daughter directives were placed into national legislation. A new EU air quality directive (Directive 2008/50/EC) came into force in June 2008 and was transposed into The Air Quality Standards Regulations in England, Wales, Scotland and Northern Ireland in June 2010 (UK Government, 2010). The directive merged the four daughter directives and one Council decision into a single directive on air quality.

2.2 National Legislation and Strategy

2.2.1 The Environment Act 1995 (H.M. Government, 1995) required the preparation of a national air quality strategy setting air quality standards and objectives for specified pollutants and outlining measures to be taken by local authorities through the system of Local Air Quality Management (LAQM) and by others to work in pursuit of the achievement of these objectives. A National Air Quality Strategy (NAQS) was published in 1997 and subsequently reviewed and revised in 2000, and an addendum to the Strategy published in 2002. The current Strategy was published in July 2007; (The Air Quality Strategy for England, Scotland, Wales and Northern Ireland; DEFRA, 2007).

2.2.2 The air quality objectives are set for the purpose of protecting human health, vegetation and ecosystems from certain harmful atmospheric pollutants. The objectives applicable to this study are shown in **Table 1**.

Table 1 – Air quality Objectives for England applicable to this study

Pollutant	Concentration	Measured as
Human Receptors		
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate material (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Particulate material ($PM_{2.5}$)	Work towards reducing emissions/concentrations of fine particulate matter	Annual mean

2.2.3 The LAQM Technical Guidance, LAQM TG(16), (DEFRA, 2016) provides advice on where the AQOs for pollutants considered in this study apply. These are summarised in **Table 2**.

Table 2 – Examples of Where the AQOs Apply

Averaging Period	Objectives Should Apply to	Objectives Should Not Apply to
Annual Mean	All locations where members of the public might be reasonably exposed such as: building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access such as: hotels, unless people live there as a permanent residence; gardens of residential properties; kerbside sites (as opposed to locations at the building façade), or any other location where the public exposure is expected to be short-term.
8-hour and 24-hour Means	All locations where the annual mean objective would apply, together with hotels and gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1-hour Mean	All locations where the annual mean, 24-hour mean and 8-hour mean apply plus: kerbside sites of busy shopping streets; parts of car parks, bus and railway stations, etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more; Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.

2.3 National Policy

National Planning Policy Framework

2.3.1 The National Planning Policy Framework (NPPF) was published in March 2012 (UK Government, 2012). Paragraph 109 of the NPPF states that:

"The planning system should contribute to and enhance the natural and local environment by:

preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability…"

2.3.2 Annex 2 of the NPPF defines 'Pollution' as:

"Anything that affects the quality of land, air, water or soils, which might lead to an adverse impact on human health, the natural environment or general amenity. Pollution can arise from a range of emissions, including smoke, fumes, gases, dust, steam, odour, noise and light".

2.3.3 In relation to planning policies Paragraph 124 of the NPPF states that:

"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."

2.3.4 The different roles of a planning authority and a pollution control authority are addressed by the NPPF in paragraph 122:

2.3.5 *"... local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

National Planning Practice Guidance

2.3.6 The National Planning Practice Guidance (PPG) (UG Government, 2014) provides a web-based summary guidance on air quality issues within NPPF and notes that air quality assessments of Proposed Developments should include the following information:

- The existing air quality in the study area (existing baseline);
- The future air quality without the development in place (future baseline); and
- The future air quality with the development in place (with mitigation).

This assessment considers the current baseline air quality to determine site suitability only.

2.3.7 The guidance advises that a planning application can be determined with appropriate planning conditions or planning obligation, if the Proposed Development (including mitigation) would not lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or fail to comply with the requirements of the Conservation of Habitats and Species Regulations.

2.4 Regional Planning Policy

The London Plan – Spatial Development Strategy for London

2.4.1 The London Plan (Mayor of London, 2017) includes provision for the consideration of air pollution. The Plan includes specific policy measures (7.14) for improving air quality. In relation to planning decisions, it requires that:

"Development proposals should:

a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and 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 as 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 Greater London Area (GLA) and London Councils' 'The control of dust and emissions from 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 be made to reduce emissions from a development, this is usually 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".

The Mayor's Air Quality Strategy

2.4.2 The Mayor's 2010 Air Quality Strategy for London was published in December 2010 (Mayor of London, 2010), and identified that the main pollutants of concern in London are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$). The strategy sets out policies and proposals to address the full range of air quality issues, reducing emissions from transport, homes, business and industry and increasing awareness of air quality issues.

Sustainable Design and Construction – Supplementary Planning Guidance (2014)

2.4.3 In April 2014, the Mayor of London published a revised Sustainable Design and Construction – Supplementary Planning Guidance (SPG) (Mayor of London, 2014a). This document provides guidance to developers and local authorities on what measures can be included in their designs and operations in order to achieve sustainable development and the objectives set out in the London Plan.

2.4.4 Section 4.3 of the SPG concerns air quality, and sets-out the Mayor's Priorities:

- *Developers are to design their scheme so that they are at least 'air quality neutral'.*
- *Developments should be designed to minimise the generation of air pollution;*
- *Developments should be designed to minimise and mitigate against increased exposure to poor air quality;*
- *Developers should select plant that meets the standards for emissions from combined heat and power and biomass plants set out in Appendix 7; and*
- *Developers and contractors should follow the guidance set out in the Control of Dust and Emissions during Construction and Demolition SPG when constructing their development."*

The air quality neutral assessment was carried out using the Air Quality Neutral Planning Support Update (Air Quality Consultants, 2014).

The Control of Dust and Emissions during Construction and Demolition – Supplementary Guidance

2.4.5 In July 2014 the Mayor of London published a SPG for The Control of Dust and Emissions during Construction and Demolition (Mayor of London, 2014b). This document provides guidance to Councils, developers, consultants, etc. on the implementation of relevant policies contained in the London Plan and the Mayor's Air Quality Strategy in order to reduce emissions of dust and nitrogen oxides from demolition and construction activities in London.

2.4.6 Chapter 4 of the SPG sets out the methodology to undertake a dust risk assessment, and Chapter 5 presents dust and emissions control measures to apply in order to control/reduce emissions from construction sites.

2.4.7 The guidance specifies that it is based on the Institute of Air Quality Management (IAQM) 2014 Guidance on Assessment of Dust from Demolition and Construction and that therefore the latest version of the IAQM guidance should be used.

2.5 Local Planning Policy

Local Development Plan

2.5.1 The latest LBC Local Development Plan (LDP) was published in July 2017 (LBC, 2017). The LDP includes Policy CC4 – Air Quality, which refers directly to air quality, and states the following:

"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."

Camden Planning Guidance - Amenity

2.5.2 In 2011, LBC published a suite of Supplementary Planning Guidance documents to accompany its Local Development Framework. SPG 6 – Amenity (LBC, 2011) key objective is to "*to sustainably manage growth so that it avoids harmful effects on the amenity of existing and future occupiers and to nearby properties."*

2.5.3 Section 2 – Air Quality provides background regarding air quality within the borough and specifies the Council requirements in terms of air quality impact assessment:

"The Council's overarching aim is for new development is to be 'air quality neutral' and not lead to further deterioration of existing poor air quality.

You will be required to include mitigation and offsetting measures to deal with any negative air quality impacts associated with your development proposals. At the same time your development should be designed to minimise exposure of occupants to existing poor air quality.

To manage and prevent further deterioration of air quality in Camden, we will require an air quality assessment with planning applications for development that could have a significant negative impact in air quality. This impact can arise during both the construction and operational stages of a development as a result of increased NO_x and PM_{10} emissions."

2.6 Local Air Quality Management

2.6.1 The aforementioned AQOs (Table 1) have been set down in regulation solely for the purposes of local air quality management. The Environment Act 1995 requires that Local Authorities undertake a tiered appraisal of air quality within their area to establish compliance or non-compliance with the targets established in the UK National Air Quality Strategy, and, if it is unlikely that the objective values will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the governing local authority to define the geographical area that will be subject to the management measures defined in a subsequent AQAP. Consequently, it is not unusual for the boundary of an AQMA to include within it relevant locations where air quality is not at risk of exceeding an air quality objective.

2.6.2 To date, LBC has declared one AQMA, covering the whole borough. The AQMA was declared in 2002 due to the exceedance of the 24 hr-mean PM_{10} and Annual Mean NO_2 AQOs.

Camden's Clean Air Action Plan 2016 – 2018

2.6.3 In 2016; LBC published the Camden's Clean Air Action Plan (CAAP) 2016-2018 (LBC, 2016). This action plan is an update to the previous CAAP published in 2013 and provides a number of measures to help reduce the concentrations of key air pollutants within the borough; namely NO_2, PM_{10} and $PM_{2.5}$.

2.6.4 The CAAP is supported by the following strategies:

- The Camden Plan, the five year vision for Camden.
- The Local Plan, which sets out our strategy for managing growth and development in the borough.
- Camden's Environmental Sustainability Plan, Green Action for Change 2012 - 2020, which specifies the Council's policies and measures with regards to reducing carbon dioxide (CO_2) emissions, waste and other environmental impacts.
- Camden's Parking and Enforcement Plan, which sets out policies designed to reduce inter-borough and intra-borough car journeys and to encourage the take up of lower polluting vehicles.
- The Camden Transport Strategy 2011-2031, which outlines how the Council will deliver the borough's transport policies, programmes, and environmental objectives focused around reducing air pollution and CO_2 emissions, and fulfils Camden's statutory obligations related to the Mayor's Transport Strategy.
- Camden's Joint Strategic Needs Assessment emphasises the beneficial impact on public health of improving local air quality.

3 Scope and Methodology

3.1 Overview

3.1.1 This assessment has used version 4.1.1 of dispersion modelling software tool ADMS-Roads. This is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (CERC, 2009).

3.1.2 There is currently no statutory guidance on the method by which an air quality impact assessment should be undertaken; therefore, this assessment has been carried out using the following guidance:

- The Technical Guidance LAQM.TG(16) for Local Air Quality Management (DEFRA, 2016);

- The Environmental Protection UK (EPUK) Development Planning Control: Planning for Air Quality (EPUK, 2010);
- The EPUK and the Institute for Air Quality Management (IAQM) Land-Use Planning and Development Control for Air Quality (IAQM, 2017);
- The Air Quality Neutral Planning Support Update (Air Quality Consultants, 2014); and
- The IAQM Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2014).

3.2 Scope of Work

3.2.1 The scope of work for the AQIA includes the following:

- Correspondence with LBC to agree scope and methodology;
- Desktop review of baseline air quality in the locality;
- Qualitative assessment of construction phase dust emissions;
- Collection of baseline traffic data from the Department for Transport;
- Collection of development-generated traffic from the Transport Consultants (Transport Planning Associates);
- Screening assessment of development-generated road traffic and boiler emissions;
- Prediction of future baseline pollutant concentrations using ADMS-Roads 4.1.1 and comparison of predicted concentrations at sensitive receptors with relevant National Air Quality Strategy Objectives for site suitability;
- Completion of an Air Quality Neutral Assessment;
- Summary of embedded mitigation measures to minimise exposure to poor air quality; and
- Identification of additional mitigation measures if required.

3.3 Effects Scoped Out

Construction Phase

Road Traffic Emissions

3.3.1 The construction phase of the application site is likely to lead to a small increase in the number of vehicles, including cars and heavy goods vehicles (HGVs), on the local highway network for the duration of the construction works only. Environmental Protection UK (EPUK) (EPUK, 2010) sets out criteria to establish the need for an air quality assessment for the construction phase of a development as being:

"Large, long-term construction sites that would generate large HGV flows (>200 per day) over a period of a year or more."

3.3.2 The number of daily HGV construction vehicle movements will not exceed the EPUK criteria. The additional number of vehicle movements is not considered to be high enough to have the potential to cause a significant adverse effect at any local air quality sensitive receptor. A Construction Phase Traffic Management Plan (CPTMP) will be produced by the appointed Contractor. The effect on local air quality sensitive receptors will be not significant and construction phase road traffic emissions are therefore not considered further in this assessment.

Operational Phase

Pollutants not included in the Assessment

3.3.3 The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene, 1,3-butadiene and sulphur dioxide (SO_2), carbon monoxide (CO), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, given the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and fuel will oxidise to form NO_x, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2 is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

3.3.4 Although SO_2, CO, benzene and 1,3-butadiene are present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this proposal as current road traffic emissions of these substances do not compromise the realisation of the relevant air quality objectives for the protection of human health. Emissions of SO_2, CO, benzene and 1,3-butadiene from road traffic are therefore not considered further within this assessment.

Future Road Traffic and Point Source Emissions

3.3.5 The Proposed Development will include 29 flats and two retail units replacing the current 11 flats and two retail units. The traffic data provided by Transport Planning Associates confirms that the increase in Annual Average Daily Flows (AADF) due to the Proposed Development is 12.5 (5 of which are heavy goods vehicles (HGVs) associated with retail deliveries to the second unit. The Proposed Development does not include provision for residential parking spaces and parking is limited to two disabled bays on Haverstock Hill.

3.3.6 The Proposed Development has been assessed against the stage 1 & 2 criteria provided in the EPUK & IAQM guidance (IAQM, 2017) in order to determine the level of air quality assessment required. The screening assessment is provided in **Appendix B**.

Stage 1 Criteria

The Proposed Development includes more than 10 residential units and has a centralised combustion process to provide domestic heating, therefore the IAQM guidance Stage 1 assessment criteria is triggered.

Stage 2 Criteria

The traffic movements generated by the Proposed Development will be distributed equally north and south of the site and accordingly traffic movements will not result in an increase greater than the EPUK & IAQM guidance criteria of 100 Annual Average Daily Traffic (AADT) values for LDV and/or 25 AADT values for HGV within or adjacent to an AQMA. The Proposed Development does not trigger the IAQM guidance Stage 2 assessment criteria with respect to traffic impacts. The impacts of emissions from development-generated traffic emissions on existing sensitive receptors is therefore not considered further in this assessment.

3.3.7 The Proposed Development heating requirement will be served by large water content condensing gas-fired boilers with variable flow controls to promote low flow and consistently low return water temperatures around the system and within the primary boiler circuit.

3.3.8 The boiler emissions will be released via a flue from the roof level and in accordance with Mayor's Sustainable Design and Construction SPG (Mayor of London 2014a) and the Camden Planning Guidance CPG6 (London Borough of Camden (2011), will have a NO_x emission limit of <40mg/kWh with >90% efficiency and emission rate of <5mg/s. The point source emissions therefore do not require detailed modelling and the impacts of emissions from the heating system on local air quality

are not considered further in this assessment, other than in the Air Quality Neutral assessment discussed in Section 6 and **Appendix E**.

3.3.9 It was concluded that a simple air quality assessment was required to determine the likely levels of exposure to pollutants of future occupants of the Proposed Development and confirm the suitability of the site for its intended uses.

3.4 Emissions Sources

Construction Phase

Fugitive Emissions of Particulate Matter

3.4.1 Fugitive emissions of airborne particulate matter are readily produced through the action of abrasive forces on materials and therefore a wide range of site preparation and construction activities have the potential to generate this type of emissions. These include:

- earthworks, including the handling, working and storage of materials;
- construction activities; and
- the transfer of dust-making materials from the site onto the local road network.

3.4.2 The size fraction called 'PM_{10}' is composed of material with an aerodynamic diameter of less than 10µm and overlaps with the size fraction for dust. Air quality objectives (DEFRA, 2007) for PM_{10} have been set for the protection of human health. The short-term, 24-hour mean objective for airborne concentrations of PM_{10} is the appropriate air quality objective for assessing the potential impact on health of short-term fugitive emissions from demolition and construction sites.

3.4.3 The IAQM (IAQM, 2014) adopts a broad definition of dust that includes the potential for changes in airborne concentration, changes in deposition rates and the risk to human health and public amenity, when considering the significance of effects from emissions of fugitive particulate matter. In this assessment, specific reference is made to the impacts associated with specific size fractions (dust, PM_{10}) within the assessment narrative, before considering the overall effect on receptors using an approach that is consistent with the IAQM guidance.

3.4.4 The nature of the impact requiring assessment varies between different types of receptor. In general, receptors associated with higher baseline dust deposition rates are less sensitive to impacts, such as farms, light and heavy industry or outdoor storage facilities. In comparison some hi-technology industries or food processing plants operate under clean air conditions and increased airborne particulate matter concentrations may have an increased economic cost associated with the extraction of more material by the plants air filtration units.

3.4.5 During the construction phase of the Proposed Development, there is the potential for construction activities to generate fugitive emissions of particulate matter (dust and PM_{10}). There is a risk of such emissions giving rise to significant adverse effects on amenity or health at receptors near the sources of emissions (IAQM, 2014) unless appropriate mitigation measures are adopted. There are human receptors located within 350m of the application site boundary and within 50m of roads used by construction vehicles, up to 500m from the application site entrance, therefore an assessment of the significance of effects from fugitive emissions of dust and PM_{10} from the construction phase of the Proposed Development has been undertaken.

3.4.6 The assessment considers the significance of potential effects without mitigation in place and recommends any additional mitigation measures appropriate to the identified risks to receptors, to minimise the significance of any residual effects.

Operational Phase

Road Traffic Emissions

3.4.7 The Proposed Development is assumed to be completed by 2020 however, as aforementioned; the traffic associated with the Proposed Development will result in a negligible change in traffic flows and therefore baseline traffic flows (2018) are deemed representative of future operational traffic flows.

3.4.8 Pollutant concentrations of NO_2, PM_{10} and $PM_{2.5}$ have therefore been predicted for the baseline scenario (2018) at the Proposed Development site in order to predict the likely levels of exposure for future occupants. The assessment has been undertaken using the latest version of the atmospheric dispersion model ADMS-Roads (CERC, Version 4.1.1 – with built-in emissions factors equivalent to those within the emissions factors toolkit EFT 8.0 (2VC)) (DEFRA, 2017a).

3.4.9 Data used to inform the road traffic input to the model were extrapolated from traffic count data recorded by the Department for Transport (DfT) for Haverstock Hill up to 2016.

3.4.10 Traffic flows for 2018 were derived using the average increase in total traffic flows, and relative % of HGV, for the three years for which data were available at the time of writing (2013-2016). The hourly HGV and LGV flows were then calculated by dividing the derived 2018 AADT figure by 24. The assessment therefore assumes a constant hourly traffic flow throughout the day. The traffic data and average vehicle speeds used in the model are presented in **Appendix C.**

3.4.11 Details of input parameters specified in the dispersion model to represent local atmospheric and meteorological conditions, as well as the specified outputs requirements, are provided in **Table 3**.

Table 3 - General ADMS Model Conditions

Variables	ADMS Roads Model Input
Surface roughness at source	1m at the dispersion site and 0.5m at the meteorological station
Minimum Monin-Obukhov length for stable conditions	30m
Terrain types	Flat Terrain
Receptor location	x, y coordinates determined by GIS at 1.5m for ground floor and +3m per additional floors
Pollutants	NO_x, PM_{10}, $PM_{2.5}$
Traffic Emissions Factors	DEFRA EFT8.0 (2 VC) emission factor dataset for 2018
Meteorological data	One year (2016) hourly sequential data from Heathrow meteorological station
Emission profiles traffic	No diurnal profiles applied
Receptors	Proposed Development
Model output	Long-term annual mean NO_x concentrations Long-term annual mean PM_{10} concentrations Long-term annual mean $PM_{2.5}$ concentrations

3.5 Study Area and Air Quality Sensitive Receptors

Study Area

3.5.1 The study area for this AQIA include a buffer of approximately 500m around the Proposed Development site.

3.5.2 The study area and road links considered in this assessment are shown on **Figure 2**. The contributions from neighbouring roads are including in the modelled background concentration.

Sensitive Receptors

3.5.3 The air quality sensitive receptors used in this assessment are those which correspond to proposed future commercial and residential receptors where the short-term (hourly and daily means) and annual mean objectives are relevant. The receptors used in this assessment are summarised in **Table 4** and illustrated on **Figure 2**.

Table 4 – Sensitive Receptor Locations within model

Receptor ID	Description	Receptor Type	Grid Reference		
			X	Y	z
PD-1	Proposed Development - Commercial Units	Short-term	528155	184432	1.5
PD-2	Residential Receptor 1st to 4th floors	Short/Long Term	528155	184432	4.5-13.5
PD-3	Terrace on the 5th floor	Short-term	528157	184434	16.5
PD-4	Residential Receptor on the 5th floor	Short/Long Term	528163	184441	16.5

3.5.4 Each of the receptors chosen represents the maximum level of exposure that could be experienced at the Proposed Development site on the Haverstock Hill façade of the building.

3.6 Meteorological Data

3.6.1 Hourly sequential observation data for 2016 from Heathrow meteorological station has been used in this assessment. The station is located approximately 22.5km south-west of the Proposed Development and experiences meteorological conditions that are considered representative of those experienced at the application site. A wind rose is shown on **Figure 3**.

3.7 Background Air Quality Data

3.7.1 There are no background monitoring sites within the study area. Therefore, NO_2, PM_{10} and $PM_{2.5}$ background concentration data have been sourced from the DEFRA background maps (DEFRA, 2017b). This assessment uses the data for the 1km x 1km grid square centred on National Grid Reference, E528500 N184500 within which the Proposed Development is located.

3.7.2 The background maps include emissions from nearby sources such as local road networks and emissions from industrial and domestic sources. When explicitly modelled in the assessment, the contributions from motorway, trunk and primary roads within relevant squares are usually removed. This avoids "double-accounting" of road source contributions. However, for the purpose of this assessment only one road within the selected 1km grid square is modelled and to ensure a conservative assessment, modelled roads have not been removed from the background concentrations. Background concentrations used in this assessment are presented in **Table 5**.

Table 5 - Annual Mean Background NO_x, NO_2, PM_{10} and $PM_{2.5}$ Concentrations - 2018

1km Grid Square	Total Mapped NO_x	Total Mapped NO_2	Total Mapped PM_{10}	Total Mapped $PM_{2.5}$
528500 184500	45.2	28.9	18.6	11.6

Note: background concentrations sourced from DEFRA Background Maps. www.laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html. – 2015 updated maps

3.8 Analysis of Modelling Predictions

Model Verification

3.8.1 Model verification is used to check the performance of the model at a local level. The verification of the ADMS-Roads model is achieved by modelling concentrations at existing monitoring location(s) within the study area and comparing the modelled concentration(s) with the measured concentration(s).

3.8.2 At the time of writing, there are no LBC monitoring sites with data available suitable for model verification within the study area.

3.8.3 Where model verification is not possible, it is our experience that to ensure a conservative assessment, the roads NO_x contribution requires to be adjusted by a factor of 1.5-2 in urban environments.

3.8.4 Therefore, in order to provide a conservative assessment, a factor of 2 was applied to the modelled road contributions of all pollutants included in the study.

NO_x to NO_2 Conversion

3.8.5 To accompany the publication of the guidance document LAQM.TG(09) (DEFRA, 2009), a NO_x to NO_2 converter was made available as a tool to calculate the road source NO_2 contribution from modelled road source NO_x contributions which was last updated in 2017 (DEFRA, 2017a). The tool comes in the form of an MS Excel spreadsheet and uses local authority area specific data to calculate annual mean concentrations of NO_2 from dispersion model output values of annual mean concentrations of NO_x. This tool was used to calculate the total NO_2 concentrations at receptors from the modelled road NO_x contribution and associated background concentration. Due to the location of the Proposed Development, the 'All London Traffic' setting was selected.

Predicting the Number of Times per Year the NO_2 Hourly Mean Objective is Exceeded

3.8.6 Research projects completed on behalf of DEFRA and the Devolved Administrations (Laxen and Marner (2003) and AEAT (2008)) have concluded that the hourly mean NO_2 objective is unlikely to be exceeded if annual mean concentrations are predicted to be less the 60 µg/m^3.

3.8.7 In 2003, Laxen and Marner concluded:

"...local authorities could reliably base decisions on likely exceedances of the 1-hour objective for nitrogen dioxide alongside busy streets using an annual mean of 60 µg/m^3 and above."

3.8.8 The findings presented by Laxen and Marner (2003) are further supported by AEAT (2008) who revisited the investigation to complete an updated analysis including new monitoring results and additional monitoring sites. The recommendations of this report are:

"Local authorities should continue to use the threshold of 60 µg/m^3 NO_2 as the trigger for considering a likely exceedance of the hourly mean nitrogen dioxide objective."

3.8.9 Therefore, this assessment has evaluated the likelihood of exceeding the hourly mean NO_2 objective by comparing predicted annual mean NO_2 concentrations at all receptors to an annual mean equivalent threshold of 60 µg/m^3 NO_2. Where predicted concentrations were below this value, it has been concluded with confidence that the hourly mean NO_2 objective (200 µg/m^3 NO_2 exceeded not more than 18 times per year) will be achieved.

Predicting the Number of Times per Year the PM_{10} Daily Mean Objective is Exceeded

3.8.10 The LAQM.TG(16) (DEFRA 2016) document provides the following formula to estimate the number of daily mean PM_{10} exceedances per year:

$$No.\,24-hour\ mean\ exceedances = -18.5 + 0.000145 * Annual\ mean^3 + \frac{206}{Annual\ mean}$$

3.8.11 This formula was used with predicted annual mean concentrations to assess compliance with the 24-hour AQO for PM_{10}.

3.9 Method for Assessment of Significance

Construction Phase Emissions

Fugitive Emissions of Particulate Matter

3.9.1 The IAQM guidance on the assessment of dust from demolition and construction (IAQM, 2014) was used in this assessment to determine the significance of effect due to dust arising from the construction phase of the Proposed Development.

3.9.2 The application site was firstly allocated a risk category based on the following two factors:

- The scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large; and
- The sensitivity of the area to dust impacts, which is defined as low, medium or high sensitivity.

3.9.3 These two factors were then combined to determine the risk of dust impacts with no mitigation applied.

3.9.4 Experience in the UK (IAQM, 2014) is that good site practice is capable of mitigating the impact of fugitive emissions of particulate matter effectively. In all but the most exceptional circumstances, effects at receptors can be controlled to ensure effects are of negligible or minor adverse significance at worse, and are therefore not significant.

Operational Emissions

Assessment of Site Suitability for Proposed Residential and Commercial Use

3.9.5 The assessment considers the predicted concentrations at the proposed receptors within the Proposed Development site. Comparisons are made with the AQOs in **Table 1** and an assessment of the suitability of the Proposed Development site for future commercial and residential use is made.

Air Quality Neutral Assessment

3.9.6 The Mayor's Sustainable Design and Construction SPG (Mayor of London 2014a) was used to undertake an air quality neutral assessment using available information regarding the Proposed Development Energy Assessment (Silcock Dawson & Partners, 2018). The methodology and emission factors were taken from the Air Quality Neutral Planning Support (Air Quality Consultants, 2014), and assessed against relevant benchmarks for each land use classification and area of London.

4 Baseline Environment

4.1 Dust Conditions

4.1.1 A background level of dust exists in all urban and rural locations in the UK. Dust can be generated on a local scale from vehicle movements and from the action of wind on exposed soils and surfaces. Dust levels can be affected by long-range transport of dust from distant sources into the local vicinity.

4.1.2 Residents in the area of the Proposed Development currently experience dust deposition at a rate that is determined by the contributions of local and distant sources. This baseline rate of soiling is considered normal and varies dependent on prevailing climatic conditions. The tolerance of individuals to deposited dust is therefore shaped by their experience of baseline conditions.

4.1.3 Typical existing local sources of particulate matter includes wind-blown dust from agricultural land, exhaust emissions from energy plant, industry and road vehicles, brake and tyre wear from road vehicles and the long-range transport of material from outside the study area.

4.2 Baseline Concentrations within the Study Area

4.2.1 As part of its LAQM duties, LBC undertakes the measurement of NO_x, PM_{10} and $PM_{2.5}$ concentrations in its administrative area. LBC manages a network of 16 passive diffusion tube sites and four automatic monitoring sites. In addition to the sites operated by the council, LBC invited local residents to apply for free diffusion tubes to monitor NO_2 in their local area for six months from July 2017 to March 2018.

The closest monitoring sites to the Proposed Development are resident-managed passive diffusion tube monitoring sites at Chalk Farm Road (350m south-east of the Proposed Development) and Prince of Wales Road (370m north-east of the Proposed Development). The available data for July and August 2017 were downloaded from https://opendata.camden.gov.uk/stories/s/Camden-Air-Quality-Monitoring/bmrm-k7pv. The measured concentrations at Chalk Farm Road were 59.6 µg/m^{3}and 68.8µg/m^3, both exceeding the annual mean AQO. The concentrations at Prince of Wales Road were 35.1µg/m^{3}and 36.5µg/m^3, both below the annual mean AQO. The site at Prince of Wales Road is representative of an urban background site, while the Chalk Farm Road site is representative of a roadside site. The available monthly results show that there is the potential for the annual mean AQO to be exceeded on Haverstock Hill/Chalk Farm Road on which the Proposed Development is located.

5 Assessment

5.1 Construction Phase

Construction Dust Emissions

5.1.1 The construction phase is anticipated to last up to 2 years.

5.1.2 As with the majority of construction projects of this type, the early phases of the works are likely to involve demolition, excavations and earthworks and temporary stockpiling of potentially dusty materials. During the middle phases, when the buildings are erected, the principal sources of dust are likely to be from the cutting and grinding of materials and the movement of construction related road vehicles. The latter phases, when the majority of the buildings and infrastructure are complete, will involve the landscaping and finishing works. During these phases, the principal sources of dust will include the storage, handling and movement of materials generated during the associated earthworks.

5.1.3 The proposal has the potential to increase levels of airborne dust and PM_{10} during the construction phase. Specifically, there is potential for exposure to dust emissions at neighbouring existing residential and commercial properties.

5.1.4 There are no ecologically sensitive receptors in close proximity of the Proposed Development site, therefore the dust effects on ecological receptors have been scoped out of this assessment.

5.1.5 A dust risk assessment has been carried out using the IAQM guidance criteria (IAQM, 2014) to determine the potential construction phase effects. The assessment process is presented in **Appendix D** and summarised in **Table 6** below, without specific mitigation measures in place.

5.1.6 The dust risk assessment concluded that there are areas of Negligible to Medium risk of dust impacts without mitigation in place during the construction of the Proposed Development. A Construction Environment Management Plan (CEMP) will be submitted to LBC by the appointed contractor for approval prior to the commencement of any works on site. It will include and an inventory of all Non-Road Mobile Machinery (NRMM) specifying engine size and emissions limits and site-specific mitigation measures including those described in **Appendix D.**

Table 6 - Summary Dust Risk to define site-Specific Mitigation

Potential Impact	Risk of Dust Impact			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Low	Medium	Low
Human Health	Low	Negligible	Low	Low

5.2 Operational Phase

Assessment of Site Suitability for Future Commercial and Residential Occupancy

5.2.1 The predicted concentrations within the Proposed Development site are shown in **Table 7** in order to assess the suitability of the site for future residential and commercial use.

Table 7 - Summary of Predicted Annual Mean Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Proposed Receptors

Receptor name	Annual Mean NO_2 ($\mu g/m^3$)	Comply with AQO? YES/NO	Annual Mean PM_{10} ($\mu g/m^3$)	Comply with AQO? YES/NO	No. of Exceedances of Daily Mean	Comply with AQO? YES/NO	Annual Mean $PM_{2.5}$ ($\mu g/m^3$)	Comply with AQO? YES/NO
Proposed Development - Commercial Units	41.8	n/a	20.5	n/a	4	YES	13	n/a
Residential Receptor 1st to 4th floors	31.3-36.3	YES	18.8-19.6	YES	3	YES	12	n/a
Terrace on the 5th floor	31	n/a	18.7	n/a	3	YES	12	n/a
Residential Receptor on the 5th floor	31	YES	18.7	YES	3	YES	12	n/a

5.2.2 The predicted NO_2 annual mean concentrations are below the AQO of $40\mu g/m^3$ at all residential (long-term) receptors within the Proposed Development.

5.2.3 The maximum predicted annual mean concentration of NO_2 within the Proposed Development site is significantly below $60\mu g/m^3$. There is therefore no predicted exceedance of the 1-hour AQO for NO_2 at any of the commercial or residential receptors within the Proposed Development.

5.2.4 The predicted PM_{10} annual mean concentrations are below the AQO of 40µg/m^3 at all receptors within the Proposed Development. LBC has recently set a target to meet the WHO PM_{10} limit of 20µg/m^3 which is met at all modelled future residential receptors within the Proposed Development.

5.2.5 The 24-hour mean PM_{10} objective is not predicted to be exceeded at any modelled receptors within the Proposed Development.

5.2.6 There is no set AQO for $PM_{2.5}$ in England but only a will to "work towards the reduction of annual mean concentrations" however annual mean $PM_{2.5}$ are presented in **Table 7** for information purposes.

5.2.7 The short-term and long term mean concentrations, which are relevant for the duration of exposure of members of public within the Proposed Development, comply with the relevant air quality objectives for NO_2 and PM_{10}. The site is therefore considered suitable for residential and commercial use.

6 Air Quality Neutral Assessment

6.1.1 The air quality neutral assessment is provided in **Appendix E**. The assessment concludes that energy use will comply with air quality neutral benchmarks and confirms that energy plant will comply with minimum emission standards set out in GLA's Sustainable Design and Construction SPG.

6.1.2 Transport emissions associated with the development are negligible and comply with the air quality neutral benchmarks.

6.1.3 Therefore overall, the assessment concludes that the Proposed Development is considered air quality neutral.

7 Mitigation

7.1 Sustainable Travel Measures Included in the Development Proposals

7.1.1 The Proposed Development is very well served by public transport including buses, and underground. The nearest underground and bus stops are located within 20m of the Proposed Development.

7.1.2 The Proposed Development results in the removal of existing car parking spaces from the site.

7.1.3 No additional sustainable travel measures are proposed.

7.2 Mitigation Measures Embedded in the Design

7.2.1 There are a number of mitigation measures embedded in the design that will reduce air pollution and minimise the potential exposure of future occupants to poor air quality. These include:

- The balconies on the Haverstock Hill façade of the Proposed Development have been minimised to reduce the potential for exposure to high levels of air pollution. The majority of balcony space is to the rear of the Proposed Development where air quality improves with distance from the busy road;
- The portion of openable windows is minimised to approximately 1/3rd ensuring the risk of overheating is avoided whilst limiting exposure to pollution;
- Green roofs and planted terraces are included in the design;
- Photo-voltaic roof panels are proposed to preheat water for the communal heating system minimising gas-consumption;

- The annual heating demand will be reduced by using high insulation values including triple glazing;
- The communal domestic heating will be delivered by a low NO_x, high efficiency gas-fired boilers;
- The boiler flue at roof level will not be located adjacent to any ventilation air intakes; and
- Commercial units are anticipated to use air source heat pumps.

7.3 Proposed Mitigation for Construction Dust Management

7.3.1 The general mitigation measures that will be implemented during the construction phase to minimise risks of adverse air quality effects will be collated within a Construction Environmental Management Plan (CEMP) and will include actions such as those listed in **Appendix D**.

8 Conclusions

8.1.1 This report is the air quality impact assessment of the proposed redevelopment of the existing block of flats located at 18-22 Haverstock Hill, London.

8.1.2 The assessment has been undertaken to demonstrate compliance with air quality objectives as set out in the NAQS. It has been undertaken in accordance with IAQM, EPUK and DEFRA technical guidance.

8.1.3 Detailed dispersion modelling using the ADMS-Roads modelling software was undertaken to predict the concentrations of NO_2, PM_{10} and $PM_{2.5}$ due to emissions from existing road traffic in conjunction with existing background concentrations at proposed future receptor locations within the Proposed Development site.

8.1.4 The long-term and short-term average concentrations, which are relevant for the duration of exposure of members of public within the Proposed Development, comply with the relevant air quality objectives for NO_2, PM_{10} and $PM_{2.5}$.

8.1.5 The Proposed Development will not introduce new sensitive receptors into an area of poor air quality.

8.1.6 The traffic generated by the Proposed Development is negligible and existing parking spaces on the site will be removed.

8.1.7 The Proposed Development is assessed to be air quality neutral.

8.1.8 There are a number of mitigation measures embedded in the design that will reduce air pollution and minimise the potential exposure of future occupants to poor air quality.

8.1.9 In summary, the site is assessed as being suitable for future residential and commercial development with respect to air quality.

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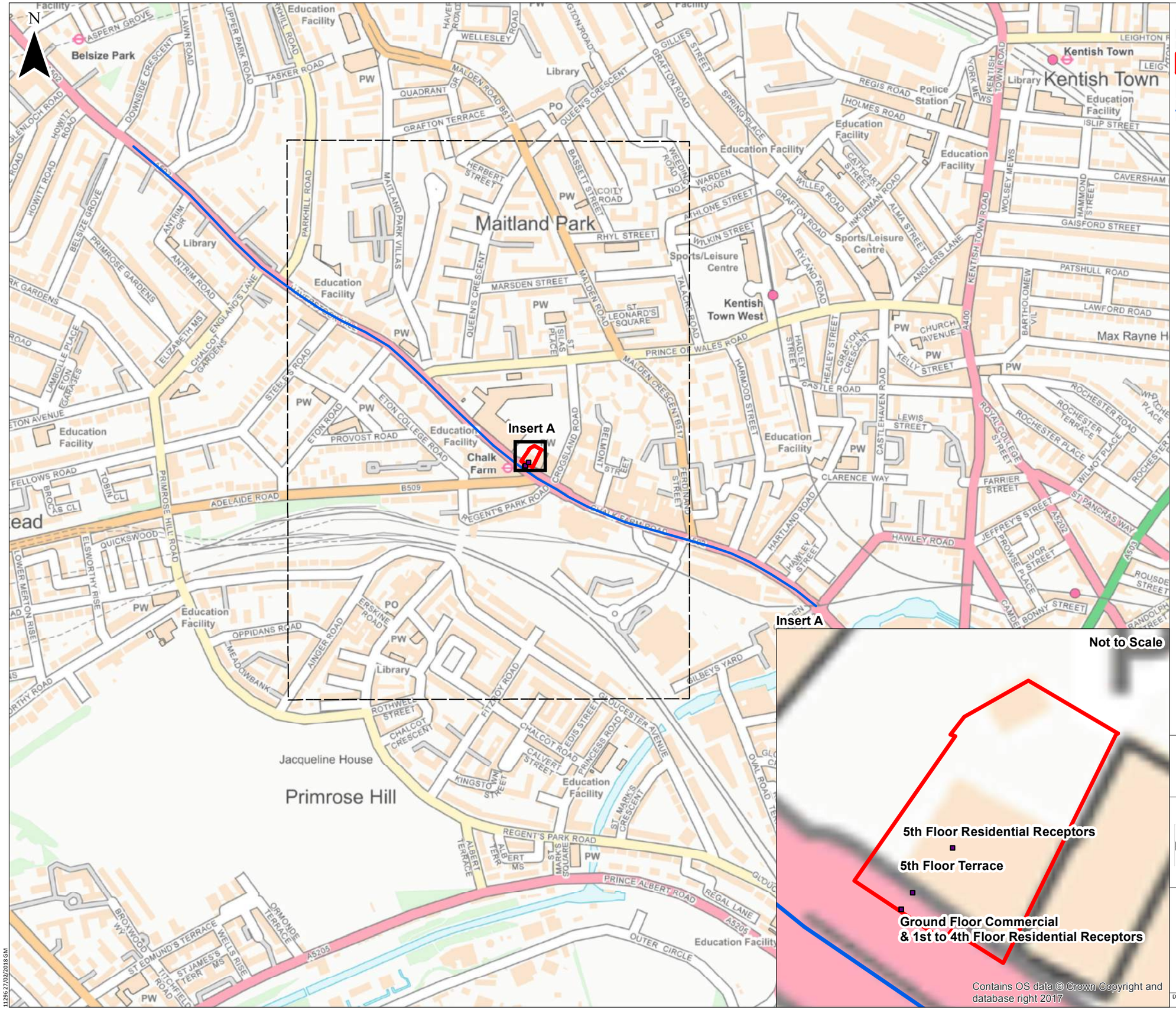
Appendix A

Figures



KEY

- Study Area
- Site Boundary (aprox.)
- Modelled Receptors
- Modelled Source

0 150 300 Meters

Scale 1:6,500 @ A3

pprestates

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Proposed Mixed Residential and Commmercial Development Development - 18-22 Haverstock Hill, London

Air Quality Impact Assessment

Figure 2

Modelled Roads and Receptors

Date:	Drawn by:	Checked by:	Version:
27/02/2018	GM	JB	V1

11296.27/02/2018 GM

KEY

Study Area

Site Boundary

Insert A

1st Floor Layout

Not to Scale

0 180 360 Meters

Scale 1:6,500 @ A3

pprestates

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Proposed Mixed Residential and Commercial Development
- 18-22 Haverstock Hill, London
Air Quality Impact Assessment

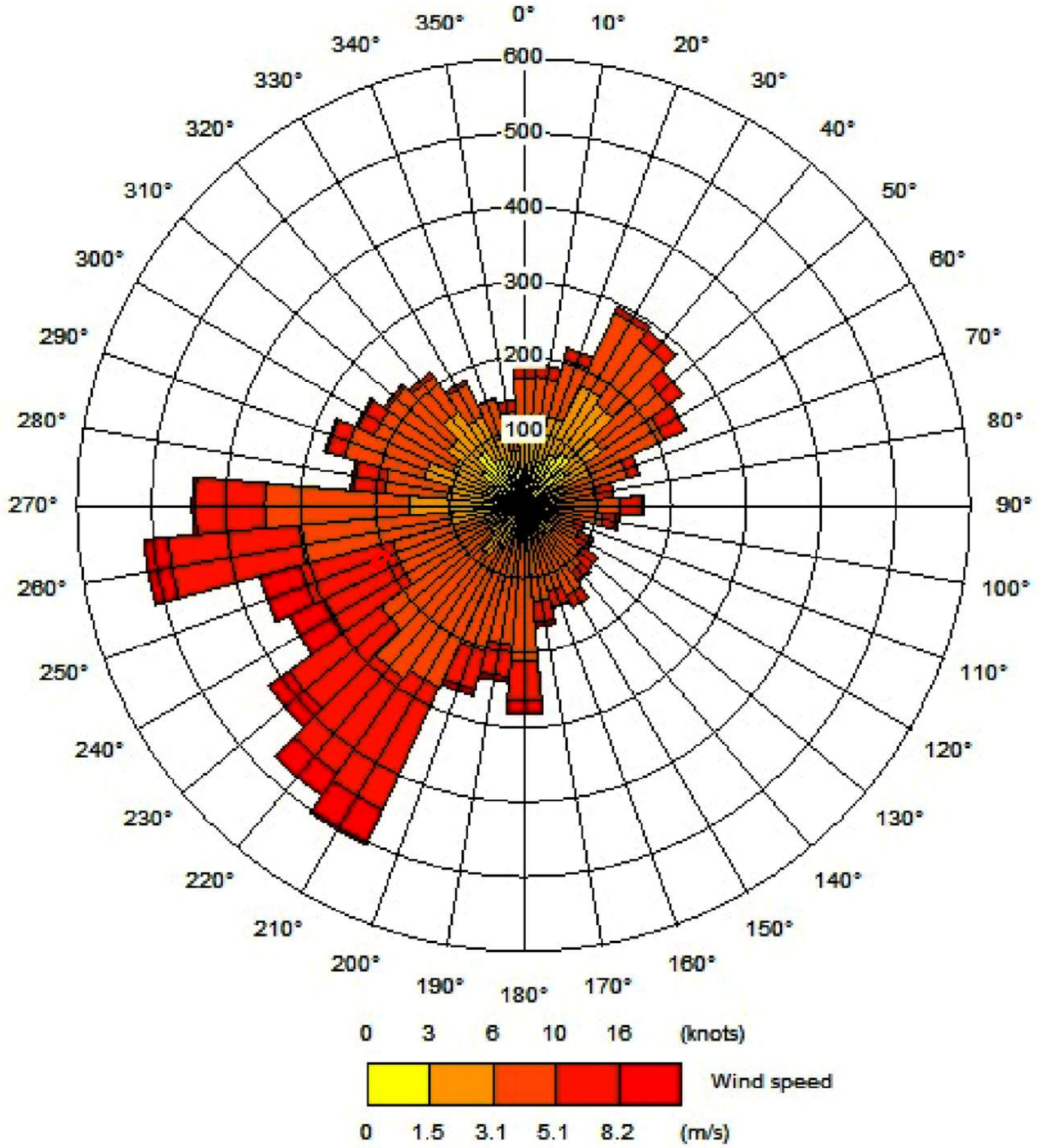
Figure 1

Site location and layout

Date:	Drawn by:	Checked by:	Version:
27/02/2018	GM	JB	V1

11296 27/02/2018 GM

N



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Proposed Mixed Residential and Commercial Development
- 18-22 Haverstock Hill, London
Air Quality Impact Assessment

Figure 3

2016 Wind Rose from Heathrow Airport

Date: 27/02/2018	Drawn by: GM	Checked by: JB	Version: V1

11296 27/02/2017 GM

Appendix B

EPUK & IAQM Stage 1 & 2 Screening Assessment

Stage 1 Criteria

If any of the following apply:

10 or more residential units or a site area of more than 0.5ha	**YES**	The Proposed Development will include 29 residential units and two commercial properties
More than 1,000m^2 of floor space for all other uses or a site area greater than 1ha	**NO**	The Proposed Development area is 0.074 ha

Coupled with any of the following:

The development has more than 10 parking spaces	**NO**	
The development will have a centralised energy facility or other centralised combustion process	**YES**	The Proposed Development will have a communal gas-fired boiler to provide domestic heating.

Stage 2 Criteria

1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	**NO**	The Proposed Development is unlikely to result in a change of LDV flows of more than 100 AADT within or adjacent to the AQMA or more than 500 AADT elsewhere
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	**NO**	The Proposed Development is unlikely to result in a change of HDV flows of more than 25 AADT within or adjacent to the AQMA or more than 100 AADT elsewhere
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	**NO**	-
4. Introduce a new junction or remove an existing junction near to relevant receptors.	**NO**	-
5. Introduce or change a bus station.	**NO**	-
6. Have an underground car park with extraction system.	**NO**	-
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	**NO**	**Boiler will comply with a NO_x Emission limit of <40mg/kWh and have an efficiency >90%, mass emission <5mg/s.** -

Appendix C

Traffic Data on Modelled Roads

Table C.1 Traffic Data on Modelled Road Links

Link ID	Approximate Description	Total AADT	AADT LDV	Hourly LDV	LDV Speed (kph)	%HGV	AADT HGV	Hourly HGV	HGV Speed (kph)	Road Width (m)
1	Bellsize Grove to Fountain Mews	16608	16296	679	32	1.87	312	13	32	10
2	Fountain Mews to Pedestrian Crossing England's Lane	16608	16296	679	20	1.87	312	13	20	10
3	Pedestrian Crossing England's Lane to Eton Road	16608	16296	679	32	1.87	312	13	32	10
4	Between Crossings at Junction Prince of Wales Road	16608	16296	679	20	1.87	312	13	20	10
5	Crossing to Haverstock School	16608	16296	679	32	1.87	312	13	32	10
6	Haverstock School to Development Site	16608	16296	679	20	1.87	312	13	20	10
7	Development Site to Roundhouse	16608	16296	679	20	1.87	312	13	20	17
8	Roundhouse to Belmont Street	16608	16296	679	20	1.87	312	13	20	10
9	Belmont Street to Morrisons	16608	16296	679	32	1.87	312	13	32	10
10	Morrisons to Ferdinand Street	16608	16296	679	20	1.87	312	13	20	10
11	Ferdinand Street to Camden Lock Place	16608	16296	679	32	1.87	312	13	32	10

Traffic speeds were based on observations of traffic congestion during ITPE site visit in November and reduced to 20kph within 25m of pedestrian crossings/traffic lights.

Appendix D

Air Quality Dust Risk Assessment

Dust Risk Assessment

The dust risk assessments below have been carried out using the criteria in IAQM guidance[1] to determine the impact magnitude and sensitivity of the area around the site.

- **Demolition** – There are existing buildings within the Proposed Development boundary that will require to be demolished and therefore demolition has been included in this assessment.

  Dust Emission Magnitude

  - The total volume of Demolition is estimated to be between 20,000 to 50,000m^3. In accordance with the IAQM guidance, the potential dust emission magnitude is assessed as **Medium**.

  Sensitivity and Risk of Impacts

  - There are between 10-100 residential properties within 50m of proposed demolition areas. Sensitivity of the area to dust soiling due to demolition is therefore assessed as **Medium**.

    The Medium magnitude with Medium sensitivity results in the risk of dust soiling impacts due to demolition as being **Medium**.

  - Annual mean PM_{10} background concentrations at the site are currently below 24 µg/m^3, with between 10-100 properties within 50m of demolition areas. Sensitivity of the area to human health impacts due to demolition is therefore assessed as **Low**.

    The Medium magnitude with Low sensitivity results in the risk of dust impact on human health due to earthworks as being **Low**.

- **Earthworks –** Site clearance works, the digging of trenches for foundations and utilities and temporary stockpiling of material represent the principal activities that may generate emissions of particulate material. The potential for stockpiles of materials to generate dust depends on the nature of the material. The majority of the Site is earth which is soft and friable compared to hardcore.

  Dust Emission Magnitude

  - The total area of earthworks is estimated to be < 2,500 m^2. In accordance with the IAQM guidance, the potential dust emission magnitude for earthworks is assessed as **Small**.

  Sensitivity and Risk of Impacts

  - There are between 10-100 residential properties within 50 m of the proposed earthwork areas. Sensitivity of the area to dust soiling due to earthworks is therefore assessed as **Medium**.

  - The small magnitude with medium sensitivity results in the risk of dust soiling impacts due to earthworks being assessed as **Low.**

  - Annual mean PM_{10} background concentrations at the site are currently below 24 µg/m^3, with between 10-100 properties within 50m of earthworks areas. Sensitivity of the area to human health impacts due to earthworks is therefore assessed as **Low**.

  - The small magnitude with low sensitivity results in the risk of dust impacts on human health due to earthworks as being **Negligible**.

[1] IAQM (February 2014) Guidance on the assessment of dust from demolition and construction

- **Construction Phase -** Dust emissions during construction can give rise to elevated dust deposition and PM_{10} concentrations. These are generally short-lived changes over a few hours or days, which occur over a limited time period of several weeks or months, and are usually in defined phases.

  Dust Emission Magnitude

  - The total building volume is estimated to be between 25,000-100,000m^3. The potential dust emission magnitude for construction is assessed as **Medium**.

  Sensitivity and Risk of Impacts

  - There are between 10-100 residential properties within 50 m of the proposed construction areas. Sensitivity of the area to dust soiling due to construction is therefore assessed as **Medium**.
  - The medium magnitude with medium sensitivity results in the risk of dust soiling impacts due to construction being assessed as **Medium**.
  - Annual mean PM_{10} background concentrations at the site are currently below 24 µg/m^3, with between 10-100 properties within 50m of construction areas. Sensitivity of the area to human health impacts due to construction is therefore assessed as **Low**.
  - The medium magnitude with the low sensitivity results in the risk of dust impacts on human health due to construction being assessed as **Low.**

- **Track-out Material -** Without site-specific mitigation, the IAQM guidance states that track-out can occur from roads up to 200 m from the site exit of a medium construction site. The impact declines with distance from the roads and therefore it is only necessary to consider track-out up to 50 m from the edge of the road.

  Dust Emission Magnitude

  - It has been estimated that this development will introduce between 10-50 HGV movements per day during peak construction. It is envisaged that the primary service route to/from the site will be Haverstock Hill to the north of the site. The potential dust emission magnitude for track-out for 10-50 HDV is assessed as **Medium**.

  Sensitivity and Risk of Impacts

  - There are >100 residential properties within 100m of the site access. Sensitivity of the area to dust soiling due to track-out is therefore assessed as **Medium**.
  - The medium magnitude with medium sensitivity results in the risk of dust soiling impacts due to track-out being assessed as **Low**.
  - Annual mean PM_{10} background concentrations at the site are currently below 24 µg/m^3, with between 10-100 properties within 50m of track-out routes. Sensitivity of the area to human health impacts due to track-out is therefore assessed as **Low**.
  - Medium magnitude with low sensitivity results in the risk of dust impacts on human health due to track-out being assessed as **Low.**

  Dust Emission Magnitude

  The overall dust emission magnitude is summarised in **Table D.1**

Table D.1 – Overall Dust Emission Magnitude

Activities	Dust Emission Magnitude
Demolition	**Medium**
Earthworks	**Small**

Activities	Dust Emission Magnitude
Construction	Medium
Trackout	Medium

Overall Sensitivity of the Surrounding Area

Table D.2 below summarises the sensitivity of the surrounding area.

Table D.2– Overall Sensitivity of the Surrounding Area

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

Overall Risk of Dust Impacts

Table D.3 below summarises the dust risk to define site-specific mitigation.

Table D.3 – Summary of Dust Risk to define site-Specific Mitigation

Potential Impact	Risk of Dust Impact			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Low	Medium	Low
Human Health	Low	Negligible	Low	Low

Emissions from Non-Road Mobile Machinery (NRMM)

The Mayor's guidance[2] provides details of emissions limits for all NRMM on major London developments from 1st September 2015 for all equipment with a net power of between 37kW and 560kW. Tighter emissions limits are provided from 1st September 2020. The emissions limits are based on engine emission standards set in EU Directive 97/68/EC[3] and its subsequent amendments.

It is not known at the time of submission of the planning application what equipment will be required on site during the construction phase. It will be a requirement for all bidding contractors to provide written evidence that their equipment can meet the required emissions limits. An inventory of all NRMM will be kept on-site stating the emissions limits for each item and a log of regular service checks will be maintained.

Proposed Dust Mitigation Measures for Inclusion in a Construction Environmental Management Plan (CEMP)

Outlined below are recommendations for mitigation measures to be included in a CEMP, based on the overall risk of dust impacts as assessed above. These are measures that are listed as Desirable or Highly Recommended in the IAQM guidance.

Proposed mitigation for communications:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;

[2] Mayor of London (2014a), Sustainable Design and Construction Supplementary Planning Guidance.

[3] Council of European Communities (1997), Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery.

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; and
- Display the head or regional office contact information.

Proposed mitigation for site management:

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- Make the complaints log available to the local authority when asked;
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book; and
- Hold regular liaison meeting with other high risk construction sites within 400m of the site boundary, to ensure plans are co-ordinated and dust and particular matter emissions are minimised.

Proposed mitigation for preparing and maintaining the site:

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible;
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean using wet methods;
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site; and
- Cover, seed or fence stockpiles to prevent wind whipping.

Proposed mitigation for site operations:

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- 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.

Operating vehicle/machinery and sustainable travel:

- Ensure all vehicles switch off engines when stationary;
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- Impose and signpost a maximum speed limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials;

- Issue all suppliers and contractors with delivery routes and access times/restrictions;
- Implement a staff travel plan to support sustainable travel where possible.

Proposed mitigation specific to earthworks:

- Re-vegetate earthworks and exposed areas/soils 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; and
- Only remove the cover in small areas during work and not all at once.

Proposed mitigation 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 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; and
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Proposed mitigation specific to trackout:

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. this may require a sweeper being continuously in use;
- Avoid dry sweeping of large areas;
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; and
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Conclusions

For all construction activities, the aim is to prevent significant effects of dust emissions on receptors though the use of effective mitigation measures. The dust risk assessment concluded that there are areas subject to low and medium risk of dust impacts. The good-practice mitigation measures and site-specific mitigation measures outlined above will be adopted to minimise these identified risks such that the residual impact of dust is negligible and therefore ***not significant***. These will be included in a CEMP submitted by the contractor to the local authority for approval prior to the commencement of any works.

A log of all NRMM including records of regular servicing will be maintained on-site for inspection by LBC if required. All equipment will comply with the relevant emissions limits for engine size and date on-site.

Appendix E

Air Quality Neutral Assessment

Introduction

The London Plan[4] includes a policy relating to 'air quality neutral development' and aims to bring forward developments that are air quality neutral or better and do not degrade air quality in areas where European Union (EU) limit values (also known as air quality objectives) are not currently achieved.

The Air Quality Neutral Planning Support[5] was published in April 2014 to accompany the 2014 publication of the Mayor of London's revised Sustainable Design and Construction supplementary planning guidance (SPG)[6]. It provides specialist consultants with a methodology to undertake an 'air quality neutral' assessment, as well as emission benchmarks for buildings and transport, against which the predicted values for the considered development will be compared.

With regards to emissions from road traffic and energy plants, the current assessment approach most widely adopted for developments in London is to calculate the change in pollutant concentrations, for the pollutants nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). Through the application of physical mitigation (stacks, catalysts, particle traps or ventilation systems), the concentration of pollutants that receptors are exposed to can be controlled so that the effect is not significant. However, the emitted pollutants contribute to the background pollutant concentration in London as a whole, and in combination, are helping to maintain pollutant concentrations higher than legislation requires. To address this, the air quality neutral approach compares the amount of pollutant(s) emitted against a benchmark value, with the aim of minimising the mass of pollutant emitted, instead of solely targeting the ambient concentration of the pollutant.

In accordance with the GLA's Sustainable Design and Construction SPG, an air quality neutral assessment has been undertaken using the latest information about the Proposed Development, as outlined in the Air Quality Impact Assessment and Transport Assessment. The methodology and emission factors are taken from the Air Quality Neutral Planning Support.

Operational Road Traffic Emissions

The air quality neutral assessment for the road traffic associated with the Proposed Development compares the road traffic related emissions for new trips generated against calculated benchmark values which are based upon land use, the number of anticipated trips per year, and the average distance travelled per trip, in accordance with the GLA Air Quality Neutral Planning Support Update.

The Total Benchmarked Transport Emissions for the Proposed Development have been calculated using default NO_x and PM_{10} emission factors per square metre of building or dwelling, which have been determined for the different land use classes and for each of the three areas within London (the Central Area Zone (CAZ), Inner and Outer London), as defined in the guidance. The Inner London factors were used in this assessment due to the location of Camden.

The emission factors were multiplied by the gross internal floor area of each land use (GIA) area and number of residential dwellings for the Proposed Development in order to obtain the Transport Emissions Benchmarks for NO_x and PM_{10}, as presented in Table E.1.

[4] Mayor of London (March 2016); The London Plan – The Spatial Development Strategy for London consolidated with alterations since 2011

[5] Air Quality Consultants and Environ (2014), Air Quality Neutral Planning Support Update: GLA 80371.

[6] Mayor of London, (2014); Sustainable Design and Construction Supplementary Planning Guidance, London Plan 2011 Implementation Framework, April 2014.

Table E.1-Calculation of Benchmarked Transport Emissions

Land Use Class	Quantity	NO_x Transport Emission Benchmark	Total NO_x Transport Emissions Benchmark
Retail A1-A4	284.6 m^2 (GIA)	219 g/m^2/annum	62.3 kg/annum
Residential C3	29 dwellings	558 g/dwelling/annum	16.2 kg/annum
Total NO_x Benchmarked Transport Emissions			**78.5 kg/annum**
Land Use Class	**Quantity**	**PM_{10} Transport Emission Benchmark**	**Total PM_{10} Transport Emissions Benchmark**
Retail A1 – A4	284.6 m^2 (GIA)	39.3 g/m^2/annum	11.2 kg/annum
Residential C3	29 dwellings	100 g/dwelling/annum	2.9 kg/annum
Total PM_{10} Benchmarked Transport Emissions			**14.1 kg/annum**

The Total Transport Emissions of NO_x and PM_{10} have been calculated for the Proposed Development. The predicted number of new vehicle trips per year (from Transport Assessment) has been multiplied by the average distance travelled per trip, to obtain the total average distance travelled per year for the Proposed Development, as shown in Table E.2.

Table E.2-Calculation of Total Average Distance Travelled per year for Each Land-Use Category

Land Use Class	Quantity	Number of vehicle trips/m^2/year	Average distance travelled per trip (km/trip)	Average distance travelled per year (km/year)
A1 – A4	284.6 m^2 (GIA)	17	5.9	28,545
C3	29 dwellings	88/dwelling/yr	6	15,312
Total Average Distance travelled per year (km/year)				**43,195**
***** Values relating to number of vehicle trips per year for each land use have been provided by the project's transport consultants. Retail trips associated with 5 HGV deliveries per store per day and remaining residential trips associated with service vehicles such as refuse collection.				

Emission factors for NO_x and PM_{10} for the three areas of London (the Central Area Zone (CAZ), Inner and Outer London) are presented in the Air Quality Neutral Planning Support Update. Emission factors for Inner London have been selected in this assessment.

Emission factors sourced from the guidance for NO_x and PM_{10} have been multiplied by the total average distance travelled per year to obtain the Total Transport Emissions, as set out in Table E.3.

The Total Transport Emissions have been subtracted from the Total Benchmarked Transport Emissions, as presented in Table E.4, to assess whether the Total Transport Emissions for the Proposed Development are within the benchmark.

Table E.3-Calculation of Total Transport Emissions

Land Use	Total Average Distance travelled per year (km/annum)	NO_x Transport Emission Factor (gNO_x/vehicle-km)	Total NO_x Transport Emissions (kg)
A1-A4 & and C3	43,857	0.37	16.2
Land Use	**Total Average Distance travelled per year (km/annum)**	**PM_{10} Transport Emission Factor (gPM_{10}/vehicle-km)**	**Total PM_{10} Transport Emissions (kg)**

A1-A4 & C3	43,857	0.0665	2.9

Table E.4-Comparison between Total Transport Emissions and Benchmarked Transport Emissions

NO_x	
Total Transport Emissions (kg/annum)	16.2
Total Benchmarked Transport Emissions (Assessment Criteria) (kg/annum)	78.5
Difference (kg/annum)	**-62.3**
PM_{10}	
Total Transport Emissions (kg/annum)	2.9
Total Benchmarked Transport Emissions (Assessment Criteria) (kg/annum)	14.1
Difference (kg/annum)	**-11.2**

As the total Transport Emissions (16.2 kg NO_x/annum and 2.9 kg PM_{10}/annum) are less than the Total Benchmarked Transport Emissions (78.5 kg NO_x/annum and 14.1 kg PM_{10}/annum), the development transport emissions are within the benchmark and no further mitigation will be required for this source of emissions when considered in isolation.

Operational Energy Plant Emissions

The air quality neutral assessment for the proposed energy centre compares the energy related emissions of NO_x for the energy used in the Proposed Development against calculated benchmark values based upon floor area, land use and energy demand, in accordance with the Air Quality Neutral Planning Support guidance.

The Total Benchmarked Building Emissions for the proposed development are calculated using the floor area for each land-use class, multiplied by default emission factors for each land-use category, as shown in Table E.5. The retail classes for the development are A1-A4. There are different emissions benchmarks for A1, A2 and A3-A5. The lowest benchmarks are for A1 and these have been applied to all retail use to provide the most stringent assessment.

Table E.5-Calculation of Benchmarked Building Emissions

Land Use	**Gross Internal Area (m^2 GIA)**	**Building Emissions Benchmarks (g NO_x/m^2/annum)**	**Benchmarked Emissions (kg NO_x/annum)**
A1-A4	284.6	22.6	6.4
C3	2972.5	26.2	77.9
Total Benchmarked Building Emissions			**84.3**
Land Use	**Gross Internal Area (m^2 GIA)**	**Building Emissions Benchmarks (g PM_{10}/m^2/annum)**	**Benchmarked Emissions (kg PM_{10}/annum)**
A1-A4	284.6	1.29	0.37
C3	2972.5	2.28	6.7
Total Benchmarked Building Emissions			**7.1**

The Total Building emissions were calculated using the energy breakdown by class and area and data provided in the Air Quality Neutral Planning Support guidance and are shown in Table E.6.

Table E.6-Calculation of Operational Building Emissions

Type	Gross Internal Area (m^2 GIA)	kWh/annum	Building Emissions kg NO_x/kWh	Building Emissions (kg NO_x/annum)
Domestic	2972.5	107,237	0.00004	4.3
Commercial	284.6	1031	0.000194	0.2
Total Building Emissions				**4.5**

The Total Benchmarked Building Emissions were subtracted from the Total Building Emissions, as presented in Table E.7, to assess whether or not the Total Building Emissions for the Proposed Development are within the benchmark.

Table E.7-Comparison between Total Building Emissions and Benchmarked Building Emissions

NO_x (kg/annum)	
Total Building Emissions	4.5
Total Benchmarked Building Emissions (Assessment Criteria)	84.3
Difference	**-79.8**
PM_{10} (kg/annum)	
Total Building Emissions	**0**
Total Benchmarked Building Emissions (Assessment Criteria)	**7**
Difference	**-7**

The Total Benchmarked Building Emissions (84.3 kg NO_x/annum and 7 kg PM_{10}/annum) are higher than the Total Building Emissions (4.5 kg NO_x/annum and 0 kg PM_{10}/annum) giving a negative score. It is therefore concluded that the building emissions are within the "air quality neutral" benchmarks.

Minimum Emissions Standards for Boilers, Solid Biomass and CHP Plant

In addition to the achievement of benchmark emissions, the London Plan states that energy generating plant in new developments should meet the minimum emissions standards outlined in the SPG. Emission standards are provided for:

- Individual gas boilers;
- Communal gas boilers;
- Solid biomass boilers; and
- Combined Heat and Power (CHP) plants.

The energy plant under consideration for the Proposed Development is a communal gas-fired boiler. The SPG states that where individual and/or communal gas boilers are installed in commercial and domestic buildings they should achieve a NO_x rating of <40 mg NO_x/kWh. The boilers including with the Proposed Development will meet this emissions standard and be >90% efficient.

Summary

The Proposed Development will include a new energy plant for heating and hot water.

The air quality neutral assessment for the Proposed Development compares the building energy related emissions for the energy used in the Proposed Development against calculated benchmark values based upon floor space, land use and energy demand. The assessment shows that the building emissions are within the air quality neutral benchmarks.

The Proposed Development's transport emissions are also within air quality neutral emissions benchmarks for transport.

In addition the boiler plant will comply with the minimum emission standards as set out in the Greater London Authority's (GLA's) Sustainable Design and Construction SPG.

In summary the Proposed Development is considered to be air quality neutral.

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