Intended for
The Hall School

Date
December 2020

Project Number
1620007106

THE HALL SCHOOL
AIR QUALITY ASSESSMENT

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Project No.	**1620007106**
Issue No.	**1**
Date	**December 2020**
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Version Control Log

Revision	Date	Made by	Checked by	Approved by	Description
1	14/12/20	CG	AG	LV	Final

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EXECUTIVE SUMMARY

Ramboll UK Limited has been commissioned by The Hall School ('the applicant'), to carry out an air quality assessment to accompany a planning submission for redevelopment proposals to be carried out at The Hall School, located on Crossfields Road, Swiss Cottage. The redevelopment work is to update facilities at the school and will include partial demolition of some of the existing buildings, construction of new buildings and the refurbishment of other areas. The number of pupils and staff accommodated by the school will not be increased as a result of the development.

During the construction phase, emissions of dust and exhaust gases from construction activities can impact air quality. Dust impacts can be effectively controlled through the use of best practice mitigation measures, which should be set out in a Construction Environmental Management Plan to be agreed with LBC prior to construction commencing.

A review of existing and projected air quality has indicated that air quality across the whole school site would be expected to meet all relevant air quality objectives. It is therefore considered that staff and pupils will not be exposed to poor air quality whilst on the school site and the need for the redevelopment proposals to include mitigation in the form of mechanical ventilation with pollution filters has not been identified. Furthermore, air quality is predicted to already meet the more stringent WHO guideline values for PM_{10} and $PM_{2.5}$, which are likely to be adopted in the future.

The redevelopment would not increase operational car movements and heating and hot water requirements for the new build element would be provided through a heat source pump. As such the redevelopment is considered 'air quality neutral' for both transport and building emissions. As part of the redevelopment the school proposes to replace existing boilers with current models, which would be expected to result in a decrease in pollutant emissions over the existing situation.

1. INTRODUCTION

1.1 Overview

Ramboll UK Limited has been commissioned by The Hall School ('the applicant'), to carry out an air quality assessment to accompany a planning submission for redevelopment proposals to be carried out at The Hall School, located on Crossfield Road, Swiss Cottage. The redevelopment work is to update facilities at the school and will include partial demolition of some of the existing buildings, construction of new buildings and the refurbishment of other areas. The number of pupils and staff accommodated by the school will not be increased as a result of the development. It should be noted that there is an extant planning permission (2016/6319/P) at the property for a similar but larger redevelopment scheme than that currently proposed. That planning application was not supported by an Air Quality Assessment. The extant planning permission can still be implemented without consideration of the need for mitigation measures for air quality.

The development is located within the London Borough of Camden (LBC). The whole of the borough has been declared an Air Quality Management Area (AQMA) due to potential exceedances of both the annual mean nitrogen dioxide (NO_2) and 24 hour mean 10 µm particulate matter (PM_{10}) National Air Quality Objectives (NAQOs). NO_2 concentrations at roadside locations on the major road network in proximity to the school are currently exceeding the NAQO. In addition, the redevelopment work will comprise substantial demolition and construction works, which will be undertaken whilst the remainder of the school remains occupied. Thus, assurance is required by the council that due consideration has been given to air quality both during the demolition and construction phase and within the design of the proposed development.

1.2 Scope of the Assessment

This report describes existing air quality within the study area, considers the suitability of the site for the proposed redevelopment, and assesses the impact of the construction and operation of the development on air quality in the surrounding area. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic are nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$.

The proposed redevelopment of the school will not increase the staff or pupil numbers; as such operational traffic movements will not be increased and therefore the impact on pollutant emissions from increased road traffic is considered to be negligible and will not be assessed.

As part of the redevelopment proposals the school proposes to install air source heat pumps to provide heat for the new build element and replace the existing gas fired boilers which provide heat to the existing buildings with new boilers. The new build heat would be provided by a non-combustion source and the emissions from new boilers will be reduced compared with the existing situation.

Exceedances of the annual mean NO_2 air quality objective have been recorded at a roadside location associated with the main road network approximately 300 m west of the site, at A41 Swiss Cottage junction. NO_2 concentrations tend to fall off rapidly away from the roadside and generally meet relevant objectives in urban background locations. The ADMS Roads model has been used to predict air quality concentrations at the façade of the school to assess the site suitability and the need for mitigation to be provided in the form of pollution filters to protect pupils and staff from poor air quality.

In accordance with the LBC planning guidance for air quality[1] an Air Quality Neutral Assessment has been carried out to demonstrate that the redevelopment work would meet the relevant benchmarks as set out in the Air Quality Neutral Guidance[2].

Consideration has also been given to the potential for emissions of dust to arise during the construction phase. A qualitative assessment of the risk of dust impacts has been carried out using the Institute of Air Quality Management (IAQM) guidance[3] to identify the appropriate level of mitigation that should be applied to ensure impacts can be effectively mitigated. Consideration has also been given to the mitigation measures set out within the Mayor of London's guidance for controlling impacts from construction and demolition works[4].

In summary, the assessment includes:

- Establishment of baseline air quality;
- Demonstration that the development will not be a significant source of air pollution;
- Assessment of dust impacts during the construction phase;
- Assessment of site suitability;
- An Air Quality Neutral assessment; and
- Information on the ventilation strategy to limit site users exposure to potential elevated concentrations of air pollutants.

The assessment has been prepared taking into account relevant local and national guidance, policy and legislation

[1] LBC, 2019, Camden Planning Guidance, Air Quality
[2] Air Quality Consultants/ENVIRON, 2014, Air Quality Neutral Planning Support Update: GLA 80371
[3] Institute of Air Quality Management, 2016, Guidance on the assessment of dust from demolition and construction, Version 1.1
[4] Mayor of London, 2014, The Control of Dust and Emissions During Construction and Demolition Supplementary Planning Guidance

2. SITE DESCRIPTION

2.1 Existing Site

The redevelopment site is currently occupied by the existing Senior school element of the Hall School and is located within a residential area of Hampstead. The school is accessed by Crossfield Road to the west, which is lined on both sides by residential properties, plus the middle school element of the Hall School which is located north west on the opposite side of Adamson Road. To the north, the application site is bordered by other buildings within the school grounds which will remain in place; beyond which are residential properties on Crossfield Road. The school playground is located to the east, with the rear gardens of residential properties on Strathray Gardens beyond. To the south the site is bordered by residential properties on Crossfield Road. The site location is shown in Figure 2.1.

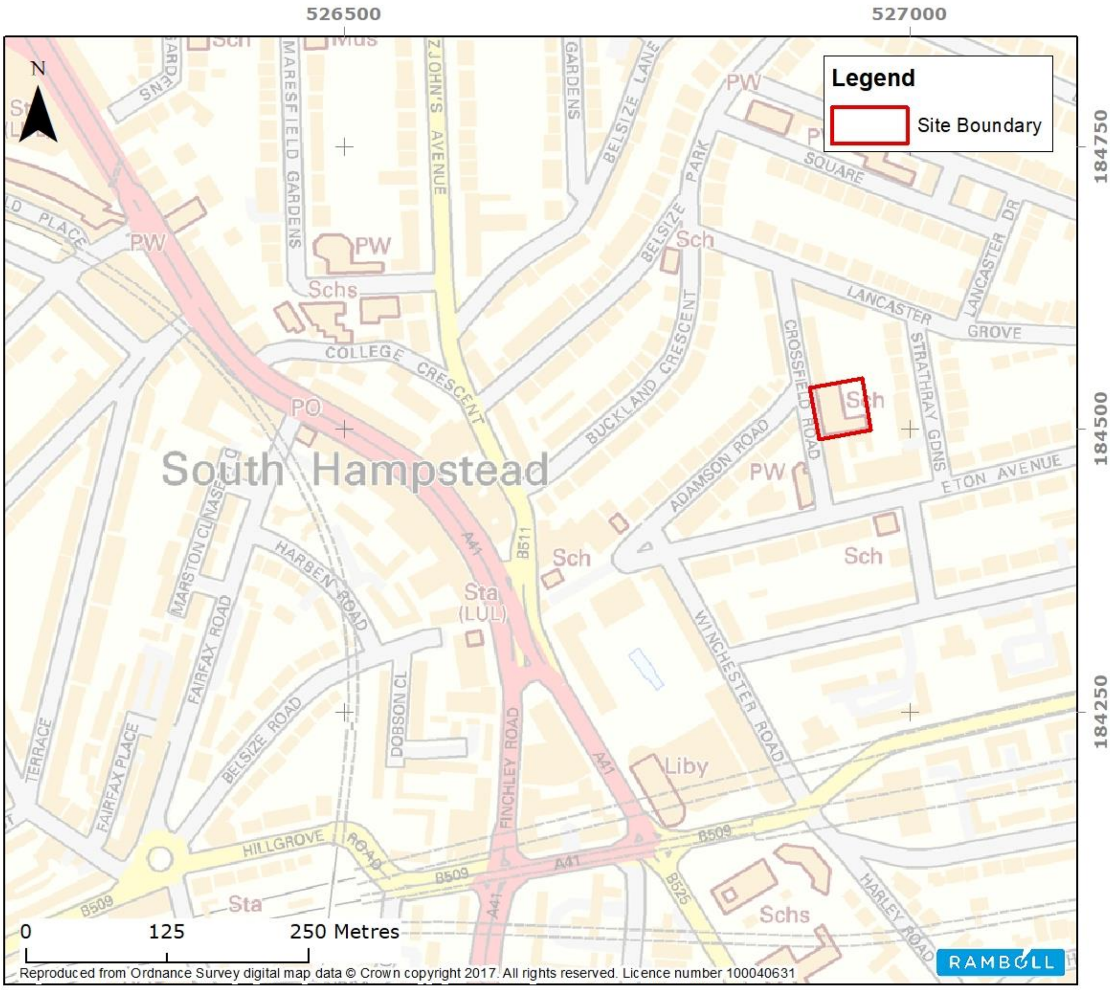

Figure 2-1: Site Location

2.2 Proposed Redevelopment

Planning permission for redevelopment of the school was granted in July of 2018. However, since that date some changes have been made to the proposals which predominantly reduce the scale of the redevelopment work.

The planning submission is for the for the demolition of the Centenary and Wathan Hall buildings, and replacement with a four storey building with glazed link, and two storey rear wing extension with roof terrace to provide school accommodation (Class D1). Subterranean excavation to provide enlarged basement area, alterations to the Old School Building's rear roofline and insertion of rear dormer windows.

The re-development work will comprise demolition and rebuilding of approximately half of the buildings on the current site, with the refurbishment of parts of the remaining buildings. In addition, the applicant is taking this opportunity to upgrade the heating and hot water systems by installing a new air source heat pump and replacing the existing outdated gas fired boilers with new low NOx models.

3. LEGISLATION AND POLICY FRAMEWORK

3.1 National

3.1.1 European Union Ambient Air Quality and Clean Air for Europe, 2008

EU Directive 2008/50/EC[5] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10}) to be achieved by 1 January 2010 and 2005 respectively. The Air Quality Standards Regulations 2010[6] implements the requirements of the Directive into United Kingdom (UK) legislation.

The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. Compliance with the European Union (EU) Limit Values is mandatory. However, Member States can apply for a time extension for compliance, subject to approval of an action plan by the European Commission.

In December 2015, the Department for Environment Food and Rural Affairs (Defra) on behalf of the UK Government produced plans to improve air quality in the UK in order to meet the EU targets in the shortest possible time[7]. The adequacy of these plans to bring about the necessary improvements in air quality to meet the relevant national air quality objectives (NAQO) within the shortest time possible were successfully challenged within the High Court in 2016[8].

Subsequently, in 2017 a plan for the reduction in roadside NO_2 concentrations was released[9] which requires local authorities to identify local actions to accelerate the improvement in air quality in their jurisdictions. It also includes the national measures, including banning the sale of conventionally powered cars and light goods vehicles by 2040 and further investment in cleaner transport.

3.1.2 Clean Air Strategy, 2019

Defra published a new Clean Air Strategy 2019[10] in January 2019, setting out how the UK will significantly reduce harmful air pollutant emissions by 2020 and 2030. The Clean Air Strategy contains an intention of working towards the World Health Organisation guideline value for $PM_{2.5}$ of 10 µg/m^3. On 19th August 2020 Defra published a policy paper[11] setting out the process for setting a target for $PM_{2.5}$ concentrations which the 2020 Environment Bill[12] requires to be set by 31st October 2022. At present therefore, there is no target or timetable set for $PM_{2.5}$ concentrations.

3.1.3 Local Air Quality Management

Part IV of the Environment Act 1995[13], requires the UK Government to publish an Air Quality Strategy and local authorities to review, assess and manage air quality within their areas. This is known as Local Air Quality Management (LAQM).

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5 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

6 Secretary of State, 2010. Statutory Instrument 2010 No. 1001, Air Quality Standards Regulations 2010. HMSO.

7 Defra, December 2015. Improving air quality in the UK, Tackling nitrogen dioxide in our towns and cities, UK overview document. Defra.

8 Royal Courts of Justice, 2016. Neutral Citation Number: [2016] EWHC 2740 (Admin). Case No: CO/1508/2016.

9 Department for Environment, Food and Rural Affairs, 2017. UK plan for tackling roadside nitrogen dioxide concentrations. Defra.

10 Defra, 2019. Clean Air Strategy.

11 https://www.gov.uk/government/publications/environment-bill-2020/august-2020-environment-bill-environmental-targets

12 https://services.parliament.uk/Bills/2019-21/environment/documents.html

13 Secretary of State, 1995. The Environment Act part IV Air Quality, HMSO.

The 2007 Air Quality Strategy[14] establishes the policy for ambient air quality in the UK. It includes the NAQOs for the protection of human health and vegetation for 11 pollutants. Those NAQOs included as part of LAQM are prescribed in the Air Quality (England) Regulations 2000 and the Air Quality (Amendment) (England) Regulations 2002. Table 1 presents the NAQOs for NO_2 and PM_{10}, the two pollutants of most concern in urban areas.

Table 1: Objectives Included in Air Quality Regulations (England) 2000 for Purpose of Local Air Quality Management

Pollutant	Air Quality Objective		
	Concentration	Measured As	Date to be Achieved By
NO_2	200 micrograms per metre cubed (µg/m³) not to be exceeded more than 18 times per year	1 hour	31 December 2005
	40 µg/m³	Annual mean	
PM_{10}	50 µg/m³ not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 µg/m³	Annual mean	

Analysis of long-term monitoring data suggests that if the annual mean NO_2 concentration is less than 60 µg/m³ then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution[15]. Therefore, in this assessment this concentration has been used to screen whether the one-hour mean objective is likely to be achieved. Similar to NO_2, a PM_{10} annual mean below 32 µg/m³ is used to screen whether the 24-hour PM_{10} mean objective is likely to be achieved.

The 2007 Air Quality Strategy also introduced a new policy framework for tackling $PM_{2.5}$ which included an exposure reduction target and a 'backstop' annual mean NAQO. The exposure reduction target is focussed on reducing average concentrations across the most polluted urban areas and is therefore not applicable to individual schemes, whilst the annual mean NAQO can be considered a concentration cap to ensure environmental compliance. The UK NAQOs for $PM_{2.5}$ are provided in Table 2.

Table 2: UK Objectives for $PM_{2.5}$

Averaging Period	Objective	Target Date
Annual mean	25 µg/m³	2020
3 year running annual mean	15 % reduction in concentrations measured at urban background sites	Between 2010 and 2020

The NAQOs apply to external air where there is relevant exposure to the public over the associated averaging periods within each NAQO. Guidance is provided within LAQM.TG (16)[16] issued by Defra for Local Authorities, on where the NAQOs apply, as detailed in Table 4.3. The NAQOs do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

[14] Department for Environment, Food and Rural Affairs, 2007. Air Quality Strategy for England, Scotland, Wales and Northern Ireland. HMSO.

[15] Department for Environment, Food and Rural Affairs, 2016. Local Air Quality Management Technical Guidance LAQM.TG (16). HMSO.

[16] Department for Environment, Food and Rural Affairs, 2016. Local Air Quality Management Technical Guidance LAQM.TG (16). HMSO.

Table 3: Locations Where National Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at**	**Objectives should generally not apply at**
Annual mean	All locations where members of the public might be regularly exposed. 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. Hotels, unless people live there as their permanent residence. Gardens of residential properties.
24 Hour Mean	All locations where the annual mean objective would apply, together with hotels. 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 and: 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets). Those parts of car parks, bus stations 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 expect to spend one hour or longer.	

It should be noted that the EU Limit Values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and legal responsibility. The compliance date for the NO_2 Limit Values was 1 January 2010, which was five years later than the date for the NAQO.

The Limit Values are mandatory whereas the NAQOs are policy objectives. Local authorities are not required to achieve them but have to demonstrate effort of working towards their achievement. In addition, the Limit Values apply in all locations except:

- where members of the public do not have access and there is no fixed habitation;
- on factory premises or at industrial installations; and
- on the carriageway/central reservation of roads except where there is normally pedestrian access.

Where a local authority's review and assessment of its air quality identifies that air quality is likely to exceed the NAQOs, it must designate these areas as AQMAs and draw up an Air Quality Action Plan (AQAP) setting out measures to reduce pollutant concentrations with the aim of meeting the NAQOs.

3.1.4 National Planning Policy Framework

The revised National Planning Policy Framework (NPPF)[17] sets out the Government's planning policies for England and how they are expected to be applied. In relation to achieving sustainable development, paragraph 8 states that:

"Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):…

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

Paragraph 103 states:

"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

Paragraph 170 on conserving and enhancing the natural environment states:

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

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality …"

Paragraph 180 within ground conditions and pollution states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."

Paragraph 181 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. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

Paragraph 182 states that:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant

[17] Ministry of Housing, Communities & Local Government, 2019. National Planning Policy Framework. HMSO

adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed".

3.2 Regional

3.2.1 The London Plan

The London Plan[18] Consolidated with Alterations since 2011 provides strategic planning guidance for Greater London. Each Borough's development plans must be in 'general conformity' with it.

The Plan includes Policy 7.14 (Improving Air Quality) which states that development proposals should:

- "*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 people vulnerable to poor air quality, such as steps to promote greater use of sustainable transport modes;*
- *Promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the Greater London Authority and London Councils 'The control of dust and emissions from construction and demolition';*
- *Be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as AQMAs);*
- *Ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where this provision is demonstrated to be impractical or inappropriate, and that 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; and*
- *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*".

3.2.2 Draft New London Plan

The 2016 London Plan is the adopted Development Plan, but the Mayor of London issued an updated and replacement version of the London Plan (Intend to Publish London Plan[19]) to the Secretary of State for Housing Communities and Local Government in December 2019 for formal adoption. It is currently unknown when formal adoption will take place following the response issued by the Secretary of State in March 2020, asking for modifications to be made before it can be adopted. However, given the advance stage of the review the Draft London Plan is a material consideration in the consideration of planning applications and considerations has been given to this draft Plan in undertaking the assessment.

The London Plan Intend to publish version Policy Planning policy GG3 on Creating a healthy City states*:*

"To improve Londoners' health and reduce health inequalities, those involved in planning and development must:

[18] Greater London Authority, 2016. 'The London Plan: The Spatial Development Strategy for London Consolidated with Alterations Since 2011'.
[19] Greater London Authority, 2019. The London Plan Intend to Publish (clean version) Spatial Development Strategy for Greater London. London

F seek to improve London's air quality, reduce public exposure to poor air quality and minimise inequalities in levels of exposure to air pollution..."

Policy D3 on Optimising site capacity through the design-led approach states:

"B Development proposals should:

9) help prevent or mitigate the impacts of noise and poor air quality"

Policy SI 1 on Improving Air Quality 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

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 should demonstrate that design measures have been used to minimise exposure.

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

a) how proposals have considered ways to maximise benefits to local air quality, and

b) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

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."*

3.2.3 London Environmental Strategy

The London Environmental Strategy[20], published in May 2018, aims, among other objectives:

"for London to have the best air quality of any major world city by 2050, going beyond the legal requirements to protect human health and minimise inequalities...

Improving London's air quality requires the following actions:

- *reducing exposure of Londoners to harmful pollution across London – especially at priority locations like schools – and tackling health inequality*
- *achieving legal compliance with UK and EU limits as soon as possible, including by mobilising action from the London boroughs, government and other partners*
- *establishing and achieving new, tighter air quality targets for a cleaner London,*
- *meeting World Health Organization (WHO) health-based guidelines by 2030 by transitioning to a zero emission London.'*

Policy 4.3.1.a states that '*The Mayor will set new concentration targets for $PM_{2.5}$, with the aim of meeting World Health Organisation guidelines by 2030*.'

The World Health Organisation guidelines for particulates are as follows:

- $PM_{2.5}$: Annual mean 10 μg/m^3, 24 hour mean 25 μg/m^3;
- PM_{10}: Annual mean 20 μg/m^3, 24 hour mean 50 μg/m^3.

3.3 Local

3.3.1 Camden Local Plan, 2017

The Camden Local Plan[21] sets out the Council's planning policies and replaces the Core Strategy and Development Policies planning documents (adopted in 2010). Policy CC4 on Air Quality states:

"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".

[20] Greater London Authority, 2018. London Environment Strategy. London.

[21] LBC, 2017. Camden Local Plan 2017.

3.3.2 Camden Planning Guidance Air Quality, 2019

The Council has prepared this Camden Planning Guidance (CPG)[22] on Air quality to support the policies in the Camden Local Plan 2017. CPG covers a range of topics (such as design, housing and sustainability) and provides information on key air quality issues within the borough and supports Local Plan Policy CC4 Air quality. CPG states that "*Camden has adopted World Health Organisation pollution levels for nitrogen dioxide of 38μg/m3 (as opposed to the EU limit value of 40μg/m3). The goal is to achieve WHO limits by 2030 and this will be steered by the Council's Clean Air Action Plan*".

3.3.3 Camden Clean Air Quality Action Plan 2019-2022

The Clean Air Action Plan[23] aims to improve air quality in the borough and has been produced as part of our duty to London Local Air Quality Management. It outlines the action LBC will take to improve air quality in Camden between 2019 and 2022.

3.4 Additional Guidance

3.4.1 GLA, Sustainable Design and Construction, Supplementary Planning Guidance, 2014

The Sustainable Design and Construction Supplementary Planning Guidance (SPG)[24] forms part of the Implementation Framework for the London Plan. The SPG aims to support developers, local planning authorities and neighbourhoods to achieve sustainable development.

The SPG also provides guidance on what is meant by 'air quality neutral'. 'Air quality neutral' applies across London as a whole and emission benchmarks have been proposed in terms of buildings' operation and transport emissions in order to meet these criteria. It is understood that the benchmark should be capable of being met without the need for significant additional mitigation. Where developments do not meet the air quality neutral benchmarks, it is suggested that appropriate on-site mitigation measures will be required to off-set any excess in emissions.

3.4.2 GLA, Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance, 2014

In addition, as part of the Implementation Framework for the London Plan, a SPG on the control of dust and emissions during construction and demolition[25] was published in July 2014. The methodology proposed and mitigation outlined is broadly in line with that provided by the Institute for Air Quality Management (IAQM)[26].

This SPG provides guidance for the preparation of an 'Air Quality and Dust Risk Assessment' and requires one to be submitted at the time of a planning application; with an Air Quality and Dust Management Plan submitted prior to the commencement of works.

Chapter 7 of the SPG states the following:

- From 1 September 2020 any Non-Road Mobile Machinery (NRMM) of net power between 27 kW and 560 kW used on any site in London will be required to meet Stage IIIB emission criteria of EU Directive 97/68/EC [27];

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[22] LBC, 2017. Camden Planning Guidance Air Quality. March 2019.
[23] LBC, 2019. Camden Clean Air Action Plan 2019-2022.
[24] Hammersmith & Fulham, 2018. Hammersmith & Fulham Planning Guidance. Supplementary Planning Document. February 2018.
[25] Greater London Authority, 2014. The Control of Dust and Emissions during Construction and Demolition.
[26] Holman et al, 2014. IAQM Guidance on the assessment of dust from demolition and construction . Institute of Air Quality Management, London.
[27] Directive 97/68/EC of the European Parliament and of the Council of 16 December 1997 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.

- Construction plant with a net power between 37 kW and 560 kW used within the London Low Emission Zone (LEZ) is required to be compliant with this standard, and registered on the NRMM register; and
- NRMM where the power output is less than 37 kW is required to be fitted with an after market treatment device as stated on the approved list managed by the Energy Saving Trust.

3.4.3 Environmental Protection UK/Institute of Air Quality Management Guidance, Land-Use Planning Guidance

Environmental Protection UK (EPUK), together with the IAQM, produced updated guidance in 2017[28] on how air quality impacts should be assessed within the land-use planning and development control process. This guidance provides clear criteria to determine when a detailed air quality assessment is required and a methodology for assessing the significance of air quality effects.

3.4.4 Defra, Local Air Quality Management Technical Guidance (LAQM TG16), 2016

Defra, in association with devolved regional environmental protection agencies, has produced technical guidance[29] designed to support local authorities in pursuit of their duties under the Environment Act 1995. It provides the methodology by which key air pollutants such as NO_2, PM_{10} and $PM_{2.5}$ should be monitored, assessed and reported for the purposes of local air quality management, and provides guidance on the actions to be taken by local authorities to improve local air quality. Whilst London has its own system of LAQM with guidance prepared by the Mayor of London, it in turn refers to this Technical Guidance.

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[28] Institute of Air Quality Management and Environmental Protection UK, 2017. Land-Use Planning & Development Control: Planning for Air Quality. Available: https://iaqm.co.uk/guidance/

[29] Department for Environment, Farming and Rural Affairs, 2016. Local Air Quality Management Technical Guidance (England) 2016 (TG16). HMSO.

4. ASSESSMENT METHODOLOGY

4.1 Baseline

In order to establish baseline air quality in the study area of the site, relevant third party monitoring data was collected, reviewed and assessed. Data was obtained from the following sources:

- Automatic and diffusion tubes monitoring operated by LBC[30];
- Automatic monitoring operated by national Automatic Urban and Rural Network (AURN) and located at London Borough of Kensington and Chelsea (LBKC); and
- Defra background maps[31].

No additional site-specific air quality monitoring was carried out.

4.2 Construction Impacts

Likely effects as a result of construction dust emissions, unlike other air borne pollutants, cannot be accurately predicted and quantified because they are highly dependent on local weather conditions and mitigation measures implemented at source.

This assessment has followed the guidance published by the IAQM on the assessment of the effects of demolition and construction on air quality. The IAQM assessment methodology considers three separate dust effects and defines their significance according to the sensitivity of the study area, as follows:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM_{10}.

The construction impact significance criteria are based on the IAQM guidance. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by legislation, planning conditions, or required by policy.

With appropriate mitigation in place, the residual effect of construction impacts on air quality is always assessed as not significant. The purpose of the construction dust assessment is therefore to identify the appropriate level of mitigation to employ.

Full details of the dust risk assessment methodology which includes the assessment criteria are provided in Appendix B.

4.3 Site Suitability and Road Traffic Impacts

4.3.1 Human Health Receptors

To assess the site suitability, the assessment has followed the guidance published by EPUK/IAQM[32].

Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors are the staff and pupils at the school.

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[30] London Borough of Camden Air Quality Annual Status Report for 2020 Date of publication: July 2019

[31] https://uk-air.defra.gov.uk/data/laqm-background-home

[32] Institute of Air Quality Management and Environmental Protection UK, 2017. Land-Use Planning & Development Control: Planning for Air Quality.

Based on the above criteria, the front façade of the school has been chosen to represent the location where impacts from existing road traffic are likely to be the greatest, i.e. on the site façade close to the road network. Concentrations have been predicted at a grid of receptors (contours) across the proposed development site in order to assess the suitability of the site for the proposed redevelopment. Concentrations were predicted at a height of 1.5 m representing ground floor exposure.

Concentrations have also been predicted at two diffusion tube monitoring sites (CD1 and CD17) in order to verify the modelled results (see Appendix E for further details on the verification method). The model uncertainty has been estimated using the root mean square error (RMSE) with an error of ±8.16µg/m^3 (±20%), i.e. below the ±25 % recommended by TG (16).

4.3.2 Site Suitability Predictions

Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of HDVs, road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2019 meteorological data from Heathrow meteorological station, which are considered suitable for this area (see Appendix C for further details on the model inputs).

Traffic data from London Atmospheric Emissions Inventory (LAEI) for the year 2019 were used. As road traffic emissions are predicted to decline with time, this is considered to provide an appropriately conservative assessment.

Traffic emissions were calculated using the latest version of Defra's Emission Factor Toolkit (EFT) v10.1. The traffic data were entered into the model, along with speed data to provide combined emission rates for each of the road links entered into the model.

For this assessment the baseline year of 2019 has been used to attain understanding of the site suitability for the proposed development.

4.4 Air Quality Neutral

The building emissions 'Air Quality Neutral' has been evaluated following the methodology described on the 'Air Quality Neutral Planning Support Update: GLA80391' guidance[33].

4.5 Assumptions and Limitations

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

The assessment has relied on data provided by the LBC and Defra to characterise baseline conditions on the site. It has been assumed that these data have been reported correctly and the instruments used have been calibrated

The traffic emissions modelling has been based on 2019 emission factors and background concentrations, whilst utilising LAEI traffic flows for 2019. The model has been verified against 2019 monitoring data. This is considered to provide a conservative assessment as air quality is expected to improve due to more stringent emission standards and air quality policies. The assumption that vehicle emissions factors and background pollutant concentrations are anticipated to decrease over time due to improvements in combustion technologies is based on the Emission Factor Toolkit (EFT) and on studies published by the Air Quality Consultants (AQC).

[33] Air Quality Consultants, 2014. Air Quality Neutral Planning Support Update: GLA80391.

AQC have published two studies that support the overall assumption that air quality is anticipated to improve in the future and that the tools and methodology used in this assessment are conservative. In 2020, AQC published a study looking at trends in nitrogen oxides in the UK between 2013 to 2019[34]. The study concluded that there is an overall reduction trend in NOx concentrations that have continued through 2019 '*with NOx concentrations at roadside sites have reduced by an average of 5.14% per year since 2013*'. Another study by AQC shows that EFT is most likely to over-predict drive-cycle average NOx emissions from Euro 6 diesel cars in the future[35].

[34] Air Quality Consultants (2020). Nitrogen Oxides Trends in the UK 2013 to 2019. January 2020. Available at: https://www.aqconsultants.co.uk/resources

[35] Air Quality Consultants (2020). Performance of Defra's Emission Factor Toolkit 2013-2019. February 2020. Available at: https://www.aqconsultants.co.uk/resources

5. EXISTING AIR QUALITY

5.1 Local Authority Monitoring

LBC[36] monitor existing air quality at a number of locations throughout the borough and in proximity to the site using both automatic continuous monitors and passive diffusion tubes. In addition, information from automatic monitors part of the national Automatic Urban and Rural Network (AURN)[37] located within LBC and the neighbouring London Borough of Kensington and Chelsea (LBKC), have been obtained to assist with characterising baseline air quality at the site as this is the nearest, representative, urban background, automatic monitoring site to the school.

Information on the monitors used within the assessment is provided within Table 5.1 and a summary of recent results in Table 5.2 and 5.3. The location of the monitoring stations is shown in Figure 5.1.

Table 5.4: Monitoring Stations in Proximity to the Proposed Development

Site	Type	Borough	Classification	Pollutants Monitored	Distance from Proposed Development
CD1, Swiss Cottage	Automatic	Camden	Kerbside	NO_2, PM_{10}, $PM_{2.5}$	300m west
CA17, Fitzjohn's Road	Diffusion Tube	Camden	Roadside	NO_2	670m north west
CA7, Frognal Way	Diffusion Tube	Camden	Urban Background	NO_2	1,190m north west
BL0, Bloomsbury	Automatic	Camden	Urban Background	NO_2, PM_{10} and $PM_{2.5}$	4km south east
KC1, North Kensington	Automatic	KLBC	Urban Background	NO_2, PM_{10} and $PM_{2.5}$	4km south west

Table 5.5: Recorded NO_2 Concentrations at Monitoring Stations

Site	2014	2015	2016	2017	2018	2019
Annual Mean Objective – NAQO 40 µg/m³						
CD1, Swiss Cottage	**<u>66</u>**	**<u>61</u>**	**<u>66</u>**	**53**	**54**	**43**
CA7, Frognal Way	28.6	27.8	27.9	29.6	22.1	22.8
CA17, Fitzjohn's Road	**<u>60.3</u>**	**55.8**	**56.4**	**<u>66.3</u>**	**48.1**	**42.5**
BL0, Bloomsbury	**45**	**48**	**42**	38	36	32
KC1, North Kensington	34	32	35	33	29	27
One Hour Objective Number of Hours exceeding 200 µg/m³ – NAQO 18 hours						
CD1, Swiss Cottage	14	11	**37**	1	2	1
BL0, Bloomsbury	0	0	0	0	0	0
KC1, North Kensington	0	0	0	0	0	0

[36] London Borough of Camden. London Borough of Camden Air Quality Annual Status Report for 2019. Published July 2020.

Site	2014	2015	2016	2017	2018	2019
Exceedance of the NO_2 annual mean NAQO of 40 µg/m^3 are shown in **bold**. NO_2 annual means in excess of 60 µg/m^3, indicating a potential exceedance of the NO_2 hourly mean NAQO objective are shown in **<u>bold and underlined.</u>**						

Table 6: Recorded PM_{10} and $PM_{2.5}$ Concentrations at Monitoring Stations

Site	2014	2015	2016	2017	2018	2019
Annual Mean PM_{10} Objective – NAQO 40 µg/m^3						
CD1, Swiss Cottage	22	20	21	20	21	19
BL0, Bloomsbury	20	22	20	19	17	18
KC1, North Kensington	23	20	20	17	14	15
Daily Objective Number of Days exceeding 50 µg/m^3 – NAQO 35 days						
CD1, Swiss Cottage	12	6	9	6	1	9
BL0, Bloomsbury	11	6	9	6	1	9
KC1, North Kensington	10	7	10	16	1	6
Annual Mean $PM_{2.5}$ Objective – target 25 µg/m^3						
CD1, Swiss Cottage	NG	12	15	16	11	11
BL0, Bloomsbury	-	11	12	13	10	11
KC1, North Kensington	15.9	10.9	12.1	12.0	9.2	10

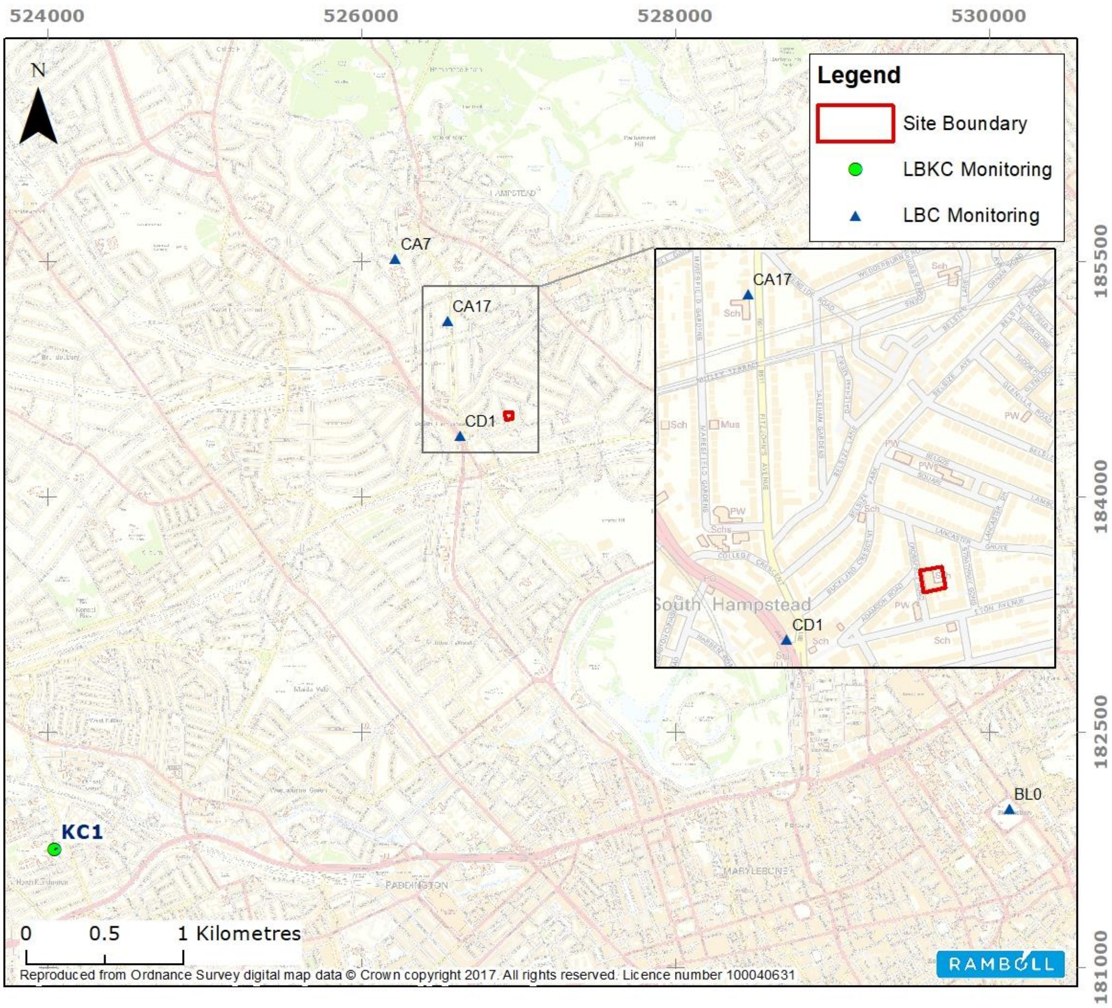


Figure 5-1: Monitoring Locations

5.2 Assessment of Monitoring Data

The monitoring data demonstrates that measured annual mean NO_2 concentrations at Swiss Cottage and Fitzjohn Road roadside monitoring stations have been above the objectives between 2015-2019. At the urban background location Bloomsbury, measured NO_2 concentrations have been below the NAQO between 2017-2019 and at North Kensington between 2015-2019. There is no clear trend in concentrations over time, however, there was an overall decrease in concentrations at the monitoring locations between 2018-2019.

The PM_{10} and $PM_{2.5}$ monitoring data indicates compliance with both annual mean and daily objectives at both the roadside and urban background stations.

5.3 Defra Background Concentrations

To assist local authorities to review and predict air quality Defra has produced maps[38] of predicted background air quality. Background concentrations are those levels that would be observed away from specific sources such as roads and industry. Average background concentrations are provided for every grid square within the country.

In order to more accurately reflect background concentrations across the study area, Defra mapped background concentrations have been compared against concentrations measured at

38 https://uk-air.defra.gov.uk/interactive-map?network=aurn

North Kensington and Bloomsbury AURN[39] automatic urban background station in 2019 to produce a calibration factor, which then has been applied to background concentrations across the study area. Full details of the background adjustment process are presented in Appendix D. Background concentrations used in the assessment are presented in Table 5.4.

Table 5.7: Defra Predicted Annual Mean Background Concentrations at the Site

Year and Grid Square	Annual Mean (µg/m^3)		
	NO_2	**PM_{10}**	**$PM_{2.5}$**
2019 (526500, 184500)	24.4	15.2	9.7

NO_2, PM_{10} and $PM_{2.5}$ background concentrations are well below the NAQOs in 2019.

5.4 Existing On-site Air Quality

It is considered that the site is located in an urban background location as it is set some 300 m away from the main road network at the Swiss Cottage junction. Monitoring data from the two urban background stations in proximity to the site indicate that air quality at these locations comfortably meets relevant air quality objectives.

Predicted background concentrations provided by Defra indicate that air quality is predicted to be well below the NAQOs, it is expected therefore that the site would be expected to meet all relevant objectives.

[39] https://uk-air.defra.gov.uk/networks/site-info?uka_id=UKA00253

6. CONSTRUCTION PHASE IMPACTS

6.1 Introduction

Construction effects as a result of the redevelopment have been assessed using the recent guidance provided by the IAQM. This guidance is considered to supersede the current Mayor of London's construction dust guidance SPG and requires the implementation of a similar level of mitigation.

Demolition work is programmed to start in the summer school holidays of 2020, with the entire demolition and construction works covering a period of 85 weeks. Temporary accommodation will be installed at the school to accommodate teaching during the work.

6.2 Assessment of Impacts

Whilst the level of construction for the proposed development is relatively minor, residential receptors are located within 20 metres of the site boundary, therefore, according to IAQM guidance an assessment of the demolition and construction impacts is required.

There are no ecological receptors or habitats that would be sensitive to dust impacts within 50 m of the proposed site boundary or within 500m of a route taken by heavy duty vehicles (HDV), therefore no ecological effects are predicted to occur.

Using the evaluation criteria within the IAQM's Guidance the potential dust emission magnitude has been identified for each stage of the redevelopment as shown in Table 6.1 below.

Table 6.1: Dust Emission Magnitude for Each Construction Phase

Activity	Dust Emission Magnitude	Justification
Demolition	Medium	Total building volume less than 20,000 m^3, but some will be carried out at heights of greater than 10 m.
Earthworks	Small	Site area less 2,500 m^2. Material to be moved less than 20,000 tonnes.
Construction	Medium	Total building volume less than 25,000 m^3 but likely to include potentially dusty materials such as concrete.
Trackout	Small	No information provided on vehicle movements but given the scale and location of the development daily number of vehicles is assumed as less than 10. There would be no movements on unpaved roads.

The next stage of the process is to define the sensitivity of the assessment area to dust soiling and human health impacts. This process combines the sensitivity of the receptor with distance from the source to determine the overall sensitivity.

The sensitivity of the dust impacts is provided in Table 4.2.

Table 8: Sensitivity of Area to Dust Impacts (taking into account distance to construction activity)

Sensitivity to Dust Soiling	Sensitivity to Human Health Impacts
High – School is located in a residential area and will continue to be occupied during the works	Medium – PM_{10} concentrations are less than 24 μg/m^3, but there would be more than 100 receptors within 20 m if school is occupied during the work.

The dust emission magnitude determined in Table 6.1 has been combined with the sensitivity assessment in Table 6.2 to define the risk of impacts for each phase of development in the absence of mitigation as shown in Table 6.3.

Table 6.3: Summary Dust Risk Table in the Absence of Mitigation

Potential Impact	**Risk**			
	Demolition (Medium)	**Earthworks (Small)**	**Construction (Medium)**	**Trackout (Small)**
Dust Soiling (High)	Medium Risk	Low Risk	Medium Risk	Low Risk
Human Health (Medium)	Medium Risk	Low Risk	Medium Risk	Negligible

6.3 Mitigation of Construction Impacts

The control of dust emissions from demolition and construction sites relies upon good site management and mitigation techniques to reduce emissions of dust and limit dispersion. A summary of the mitigation measures recommended in the IAQM and Mayor of London's guidance to reduce impacts from medium risk sites is provided in Table 6.4. It is recommended that these measures would be set out in a Construction Environmental Management Plan (CEMP) which would form part of the redevelopment's overall Construction Management Plan. The requirement to produce a Construction Management Plan would be secured through an appropriately worded condition.

Table 6.9: Recommended Mitigation Measures for Medium Risk Sites

Phase/Task	**Highly Recommended**	**Desirable**
Communications	Implement a stakeholder communication plan. Display name and contact details of responsible person for dust issues on Site boundary in addition to head/regional office contact information.	
Dust Management Plan	Develop and implement a Dust Management Plan (DMP), to be approved by the Local Authority.	
Site Management	Record all complaints and incidents in a site log. Take appropriate measures to reduce emissions in a timely manner, and record the measures taken within the log. Make the complaints log available to the Local Authority if requested. Record any exceptional dust incidents on or off site.	
Monitoring	Carry out regular inspections to ensure compliance with the DMP and record results in the site log book. Increase the frequency of inspections during activities with a high potential to create dust or in prolonged dry weather.	Undertake daily on and off site visual inspections for dust.
Preparing and Maintaining the Site	Plan site layout to locate dust generating activities as far as possible from receptors. Use solid screens around dusty activities and around stockpiles. Avoid site runoff of water and mud. Fully enclose the site or specific operations where there is a high potential for dust production and the site is active for an extensive period. Keep site fencing barriers and scaffolding clean using wet methods.	

Phase/Task	Highly Recommended	Desirable
	Remove dusty materials from site as soon as possible. Minimise emissions from stockpiles by covering, seeding, fencing or damping down.	
Operating Vehicle/Machinery and Sustainable Travel	Ensure vehicles switch of engines when stationary. Avoid use of generators where possible. Produce a Construction Logistics Plan to manage the sustainable delivery of materials. Ensure all NRMM comply with the standards set in the Mayor of London's The Control of Dust and Emissions During Construction and Demolition SPG. The air quality section of the CEMP should include a statement of compliance with the GLA NRMM emissions requirements as set out in the Control of Dust and Emissions during Construction and Demolition SPG. The standards for the NRMM Low Emission Zone will get progressively tighter over time. From 1 September 2020 the standards will be stage IIIB for construction machinery operating at the site. Stages IIIB and IV have not been defined for machines with constant speed engines, such as generators. This means that these machines will need to meet stage V from September 2020 by default.	Enforce an on-site speed limit of 15 mph on surfaced roads. Implement a sustainable travel plan for site workers
Operations	Cutting, grinding or sawing equipment only to be used with suitable dust suppression equipment or techniques. Ensure adequate water supply for effective dust and particulate matter suppression. Use enclosed chutes, conveyors and covered skips. Minimise drop heights of materials. Ensure suitable cleaning material is available at all times to clean up spills.	
Waste Management	Avoid bonfires.	
Measures Specific to Demolition	Ensure effective water suppression is used, preferably through the use of hand held sprays. Avoid explosive blasting. Bag and remove biological debris or damp down material prior to demolition.	Where practical, soft strip inside buildings before demolition of external walls and windows.
Measures Specific to Earthworks		Re-vegetate earthworks and exposed areas/soil stockpiles as soon as practicable. Use hessian, mulch or trackifiers where it is not possible to re-vegetate or cover with topsoil. Only expose small areas of ground or stockpile when working.

Phase/Task	Highly Recommended	Desirable
Measures Specific to Construction	Ensure aggregates are stored in bunded areas and are not allowed to dry out.	Avoid concrete scabbling where possible. Ensure bulk cement and other fine powder is delivered in tankers and stored in silos with suitable emission control. Smaller supplies of fine powder material to be in sealed containers and stored appropriately.
Measures Specific to Trackout	Use water-assisted dust sweepers to clean access and local roads. Avoid dry sweeping of large areas. Ensure vehicles entering and leaving the site are appropriately covered. Inspect on-site haul roads for integrity and repair as necessary. Inspections of haul roads to be recorded in site log, including any remedial action taken. Implement a wheel washing system.	

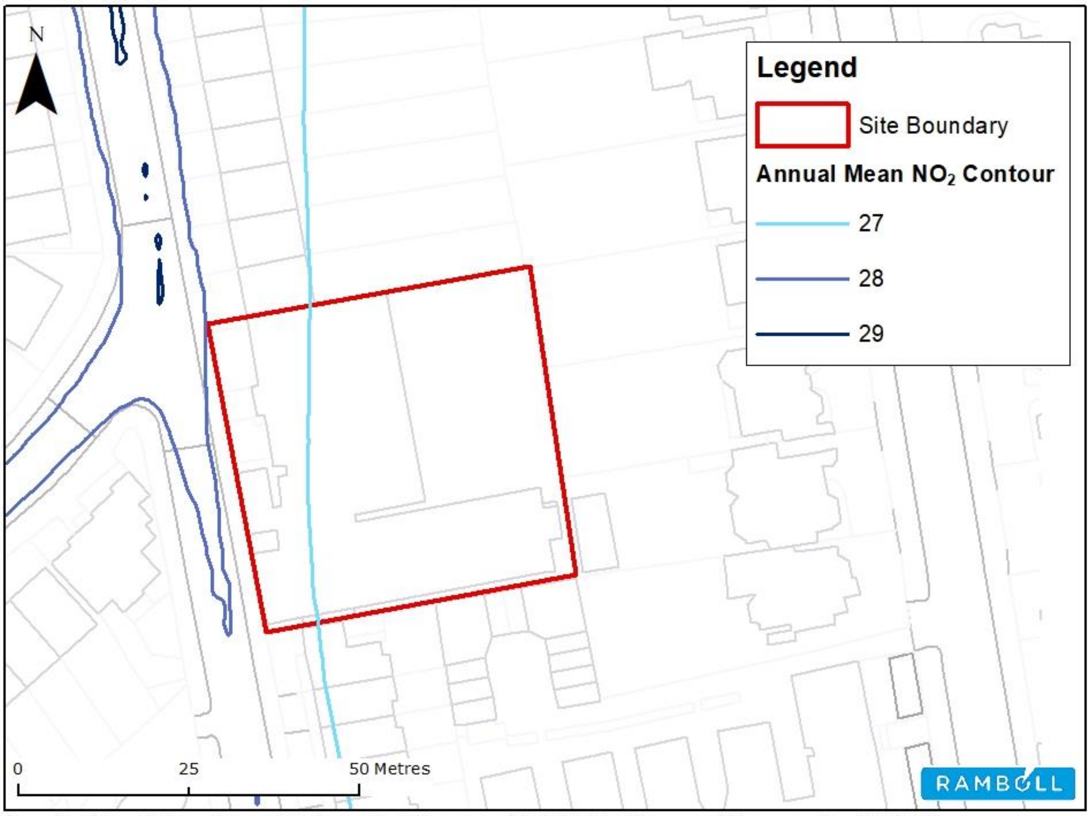
7. SITE SUITABILITY

7.1 Assessment of Impacts

The suitability of the site for development and the need for mitigation has been assessed against the annual mean objective for NO_2, PM_{10} and $PM_{2.5}$.

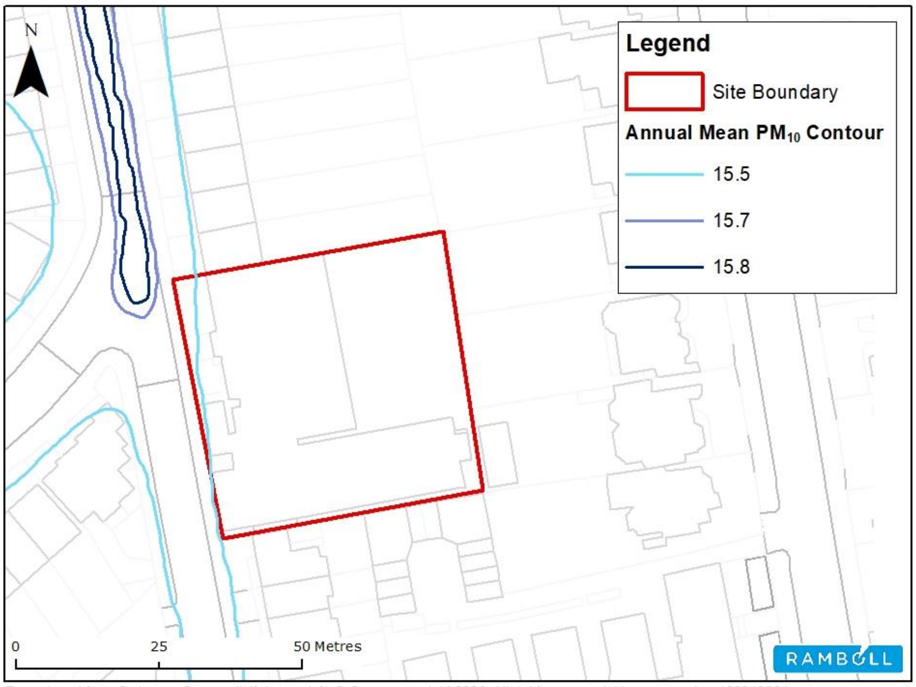
The predicted annual mean NO_2 concentration in 2019 is shown in Figure 7.1. The concentration at the school building façade is approximately 28 µg/m^3, and therefore well below the NAQO. The predicted annual mean NO_2 concentrations do not exceed 60 µg/m^3 and therefore exceedance of the 1-hour mean NO_2 objective is unlikely.

Figure 7-1: Annual Mean NO_2 Contour (µg/m^3)



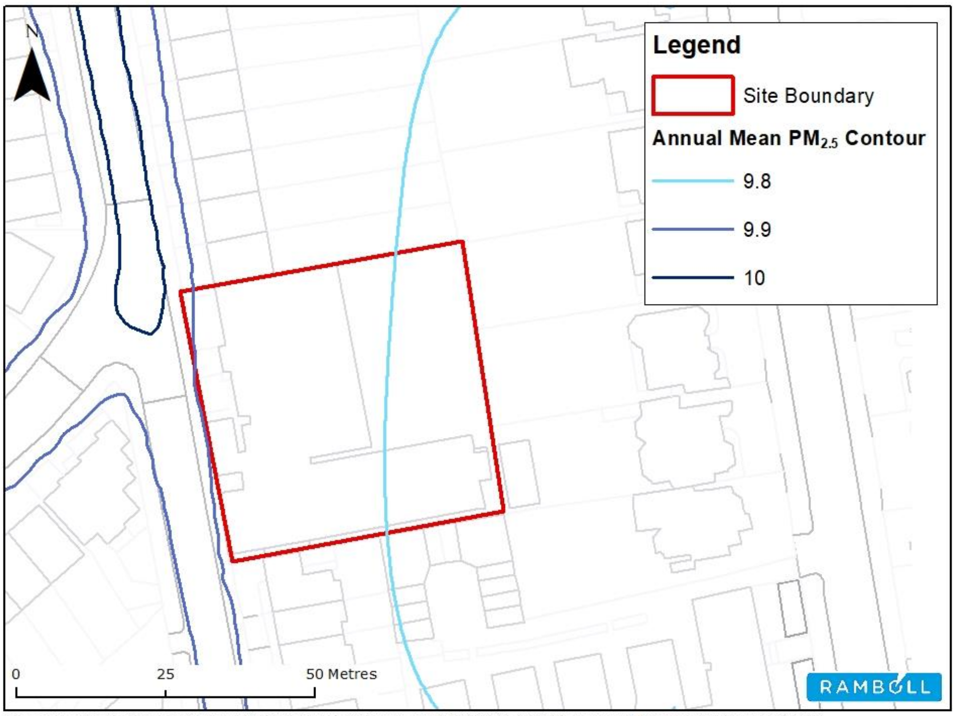
The predicted annual mean PM_{10} concentration at the school building façade is approximately 9.9 µg/m^3,as shown in Figure 7.2 and therefore well below the NAQO. The predicted annual mean PM_{10} concentrations do not exceed 32 µg/m^3 and therefore the 24-hour mean PM_{10} objective is not predicted to be exceeded.

Figure 7-2: Annual Mean PM_{10} Contour (µg/m^3)



The predicted annual mean $PM_{2.5}$ concentration at the school building façade is approximately 9.9 µg/m^3, and therefore well below the NAQO. The $PM_{2.5}$ concentration at the site is also below the WHO limit objective of 10 µg/m^3, expected to be met by 2030.

Figure 7-3: Annual Mean $PM_{2.5}$ Contour (µg/m^3)



7.2 Mitigation and Ventilation

The review of existing air quality has indicated that air quality would be expected to meet all relevant objectives across the whole school site by the time the proposed development is completed. On this basis the need for mitigation in the form of mechanical ventilation with air pollution filtration has not been identified.

The majority of the classrooms would rely on natural ventilation with intakes on the facades of the buildings.

7.3 Air Quality Neutral

The Sustainable Design and Construction SPG issued by the Mayor of London, indicates that for all new major development an assessment should be undertaken to demonstrate whether the proposed development would meet the relevant air quality neutral emission benchmarks and thus can be considered air quality neutral. Where a development cannot meet the emission benchmarks, additional mitigation may be required either on or off-site to reduce the air quality impacts.

With regard to the proposed development, the air quality neutral assessment only applies to the new element of the development.

7.3.1 Building Emissions

The proposed redevelopment proposes an air source heat pump for heating and cooling of the new building. It is considered that the new development will therefore be air quality neutral.

7.3.2 Transport Emissions

As the redevelopment work will not result in an increase in operational traffic the need to consider transport emissions within the Air Quality Neutral assessment has not been identified.

7.3.3 Conclusion

The assessment demonstrates that the redevelopment would be expected to meet both the Building Emission Benchmark and Transport Emission Benchmark. As such the redevelopment can be considered air quality neutral and no additional mitigation is required to meet the air quality neutral criteria.

8. SUMMARY AND CONCLUSIONS

During the construction phase, emissions of dust and exhaust gases from construction activities can impact air quality. The demolition and construction phase risk assessment has indicated that there is a medium risk of dust impacts in the absence of mitigation. Dust impacts would be effectively controlled through the use of best practice mitigation measures, which should be set out in a Construction Environmental Management Plan which should be agreed with LBC prior to construction commencing.

A review of existing and projected air quality has indicated that air quality across the whole school site would be expected to meet all relevant air quality objectives. It is therefore considered that staff and pupils will not be exposed to poor air quality whilst on the school site and the need for the redevelopment proposals to include mitigation in the form of mechanical ventilation with pollution filters has not been identified. Furthermore, air quality is predicted to already meet the more stringent WHO guideline values for PM_{10} and $PM_{2.5}$, which may be adopted in the future.

The redevelopment would not increase operational car movements and heating and hot water requirements for the new build elements would be provided through a heat source pump. As such the redevelopment is considered 'air quality neutral' for both transport and building emissions. As part of the redevelopment the school proposes to replace existing boilers with current models, which would be expected to result in a decrease in pollutant emissions over the existing situation.

APPENDIX A
GLOSSARY

Abbreviations	Meaning
AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
ASHP	Air Source Heat Pump
AURN	Automatic Urban and Rural Network
CHP	Combined Heat and Power
CEMP	Construction Environmental Management Plan
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EA	Environmental Agency
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
ha	Hectares
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes. Includes Heavy Goods Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LBC	London Borough of Camden
LBKC	London Borough of Kensington and Chelsea
LDV	Light Duty Vehicle; a vehicle with a gross vehicle weight less than or equal to 3.5 tonnes.
LEZ	Low Emission Zone
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides, generally considered to be nitric oxide and NO_2
NPPF	National Planning Policy Framework
NRMM	Non-Road Mobile Machinery
PM_{10}/$PM_{2.5}$	Small airborne particles less than 10/2.5 microns in aerodynamic diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
SPG	Supplementary Planning Guidance
($\mu g/m^3$)	Micrograms per metre cubed

APPENDIX B
DUST RISK ASSESSMENT METHODOLOGY

Determining Dust Emission Magnitude

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

Determining Receptor Sensitivity

High	Medium	Low
Sensitivities of People to Dust Soiling Effects		

High	Medium	Low
• users can reasonably expect a enjoyment of a high level of amenity; or • The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or • the appearance, aesthetics or value of their property could be diminished by soiling; or • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • Indicative examples include parks and places of work.	• the enjoyment of amenity would not reasonably be expected; or • property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or • there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • indicative examples include playing fields, farmland (Unless commercially-sensitive horticultural), footpaths, short term car parks and roads.
Sensitivities of People to the Health Effects of PM_{10}		
• locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include residential properties, Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Indicative examples include office and shop workers but will generally not include workers occupationally exposed to PM10, as protection is covered by Health and Safety at Work legislation.	• Locations where human exposure is transient. • Indicative examples include public footpaths, playing fields, parks and shopping streets.
Sensitivities of Receptors to Ecological Effects		
• locations with an international or national designation *and* the designated features may be affected by dust soiling; or • locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List For Great Britain. • Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.	• locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or • Locations with a national designation where the features may be affected by dust deposition. • Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.	• Locations with a local designation where the features may be affected by dust deposition. • Indicative example is a local Nature Reserve with dust sensitive features.

Determining Sensitivity of the Area

Dust Soiling Effects on People and Property

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

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
Low	>1	Low	Low	Low	Low

Human Health Impacts

	Annual Mean PM_{10} concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	>28-32 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	>24-28 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium		>1	High	Medium	Low	Low	Low
Low		>1	Medium	Low	Low	Low	Low

Ecological Impacts

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

Determining Risk of Dust Impacts

Demolition

Sensitivity of Area	Dust 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

Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

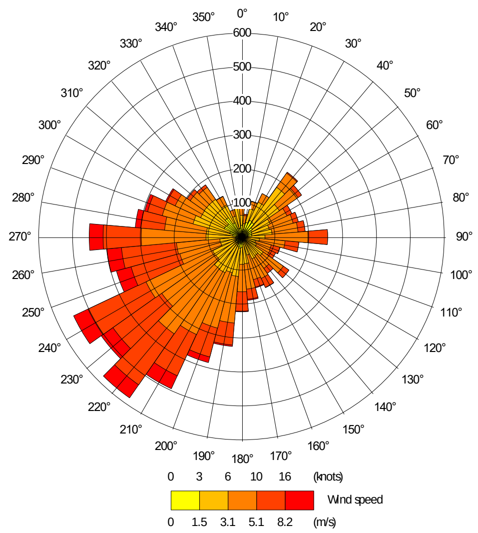
Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

APPENDIX C
MODEL INPUTS AND RESULTS PROCESSING TOOLS

Meteorological Data	2019 Hourly meteorological data from Heathrow Airport Station has been used in the model. The wind rose is shown below. London Airport Station is not considered representative of the site due to its location in close proximity to high buildings that condition the data capture. 
ADMS	Version 5. Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v10, embedded in the ADMS model, which utilises nitrogen oxides (NOx), PM_{10} and $PM_{2.5}$ emission factors from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the ADMS roads model, along with speed data to provide combined emission rates for each of the modelled road links.
Street Canyon	Not applicable.
Time Varying Emission Factors	Based on Department for Transport statistics. Table TRA0307. Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2020.
Latitude	51.5
Surface Roughness	A value of 1.5 for Large Urban areas were used to represent the modelled area. A value of 0.3 for agricultural areas was used to represent the meteorological station site.
Minimum Monin-Obukhov length	A value of 100 for Large Conurbations was used to represent the modelled area. A value of 30 for mix urban industrial areas was used to represent the meteorological station site.
Emission Factor Toolkit (EFT)	V10.1, August 2020. Road type Outer London. Department for Environment Food and Rural Affairs. Emissions Factors Toolkit. https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.htm
NO_x to NO_2 Conversion	NO_x to NO_2 calculator version 8.1, May 2019. Traffic Mix All London traffic.
Background Maps	2018 reference year background maps

APPENDIX D
BACKGROUND CONCENTRATIONS AND TRAFFIC DATA AND ROAD NETWORK

Background Concentrations

Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid[40].

In order to more accurately reflect background concentrations across the study area, Defra mapped background concentrations have been compared against concentrations measured at North Kensington and Bloomsbury AURN[41] automatic urban background station in 2019 to produce a calibration factor, which then has been applied to background concentrations across the study area

Table D.1: DEFRA NO_2 Background Mapping adjustment factors (µg/m³)

Station	Distance to Application Site (km)	Defra Modelled Background (µg/m³)	Measured Concentration (µg/m³)	Factor
KC1 Kensington	4	33.8	27.3	0.81
London Bloomsbury	4	39.3	31.5	0.80
Average factor				**0.81**

Table D.1: DEFRA PM_{10} Background Mapping adjustment factors (µg/m³)

Station	Distance to Application Site (km)	Defra Modelled Background (µg/m³)	Measured Concentration (µg/m³)	Factor
KC1 Kensington	4	20.4	15	0.71
London Bloomsbury	4	20.3	18	0.87
Average factor				**0.79**

Table D.1: DEFRA $PM_{2.5}$ Background Mapping adjustment factors (µg/m³)

Station	Distance to Application Site (km)	Defra Modelled Background (µg/m³)	Measured Concentration (µg/m³)	Factor
KC1 Kensington	4	12.9	10	0.74
London Bloomsbury	4	12.9	11	0.83
Average factor				**0.79**

The factors above have been applied to the mapped background for baseline year scenarios across the study area.

[40] Department of the Environment, Food and Rural Affairs (Defra) (2019). '2017 Based Background Maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$'

[41] https://uk-air.defra.gov.uk/networks/site-info?uka_id=UKA00253

Traffic Data

Table D.3: Traffic data extracted from LAEI

Road Link	Petrol Car	Diesel Car	Taxi (black cab)	LGV	Rigid HGV	Artic HGV	Bus and Coach	Motorcy -cle
Fitzjohn's Avenue	8316	6595	502	2084	518	116	457	231
Belsize Park/ Buckland Crescent	8316	6595	502	2084	518	116	457	231
Finchley Road (North Junction, North Bound)	8513	6755	818	2318	491	65	1298	773
Finchley Road (North Junction, South Bound)	8513	6755	818	2318	491	65	1298	773
Finchley Road (South Junction)	6686	5305	1333	2154	530	25	1441	792
Avenue Road	17026	13509	1636	4635	983	130	1757	1545
College Crescent East	4129	3277	251	1062	265	59	1051	149
College Crescent West	3343	2652	666	1077	265	13	825	396
Fairfax Road	1542	1223	61	352	67	15	205	117

* Data from 2016 LAEI

Table D.4: Traffic data provided by Transport Consultants

Road Link**	Total Traffic Flow	Car	Taxi (black cab)	LGV	HGV	Bus and Coach	Motorcy -cle
Adamson Road	938	694	26	129	30	3	56
Crossfield Road North Adamson Road	1301	992	36	165	41	4	63
Crossfield Road South Adamson Road	781	628	21	92	22	2	16
Eton Av East Crossfield Road	1496	1187	41	172	42	10	43
Eton Av West Crossfield Road	1457	1134	40	177	39	10	56
Lancaster Grove East	1295	988	36	162	53	5	52
Lancaster Grove West	2199	1680	60	283	73	8	95

** Data provided by Ramboll Transport Consultant based on count points undertaken in 2016.

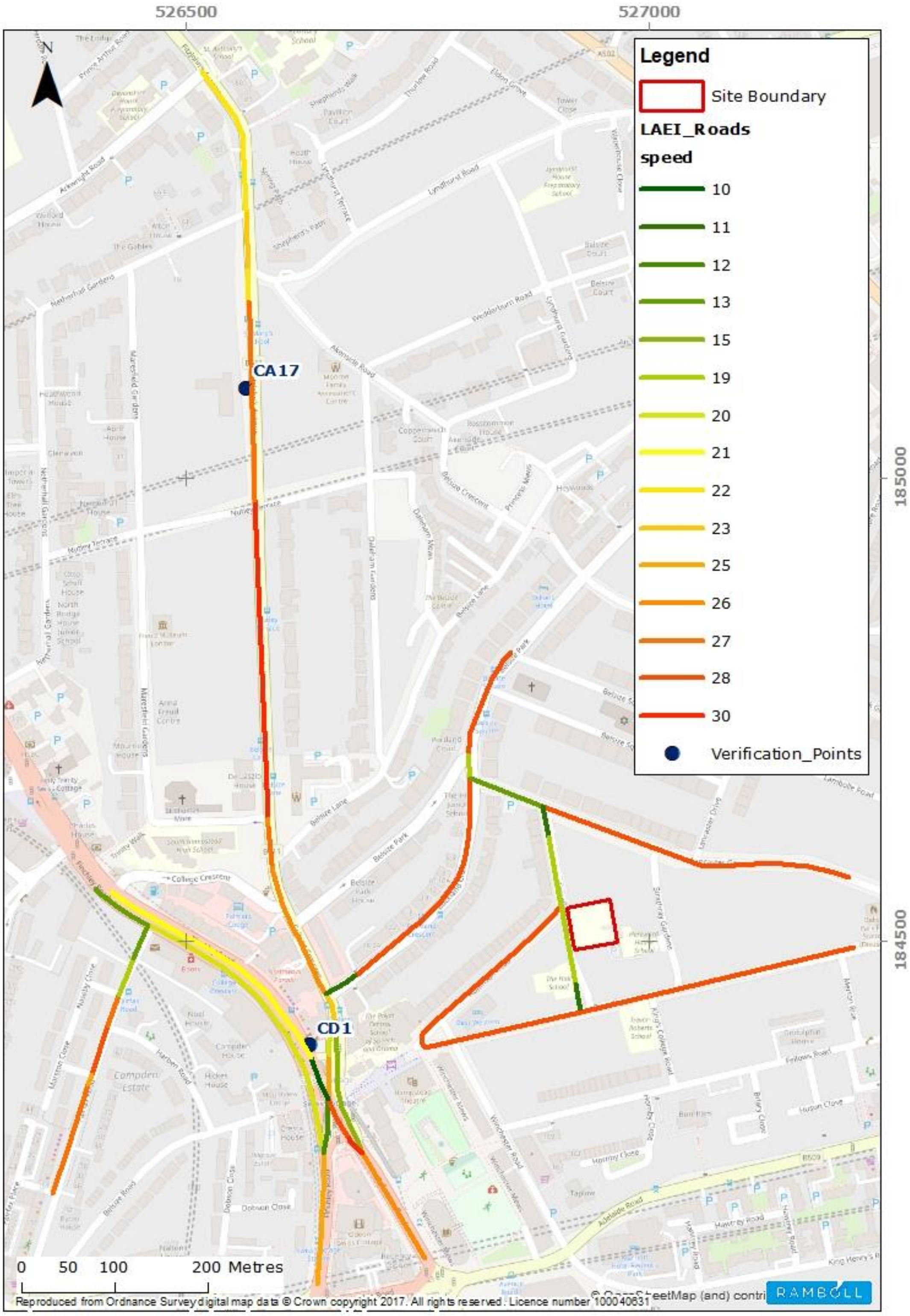


Figure D.1: Modelled Road Network and Speed

APPENDIX E
MODEL VERIFICATION

NITROGEN DIOXIDE

The model has been run to predict the 2019 annual mean road-NOx contribution at two monitoring locations shown in Figure D.1 (CD1 and CD17). The initial model output of road-NO_x was converted to NO_2, within the NO_x from NO_2 calculator, and compared with the measured road-NO_2 (Table E.1). The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator (Table E.2).

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure E.1). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations (Table E.2). The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure E.2).

Table E.1: Verification Process Initial Comparison (RMSE 24%)

Monitor	Measured NO_2 µg/m³	Measured Road NO_x µg/m³	Unadjusted Modelled NO_x	Unadjusted Modelled NO_2	% Difference Modelled/Measured NO_2
CD1	42.8	42.3	39.8	41.8	-2%
CA17	42.5	48.9	16.4	28.9	-32%

Table E.2: Verification Process Followed by Adjustment

Monitor	Measured NO_2 µg/m³	Measured Road NO_x µg/m³	Modelled Roadside NO_x µg/m³	Ratio Measured NO_x/ Modelled road NO_x	Total NO_2 after adjustment µg/m³	% Difference in NO_2 after adjustment
CD1	42.8	42.3	39.8	1.06	49.2	15%
CA17	42.5	48.9	16.4	2.98	32.9	-23%

The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Table E.3: Verification factors

Primary Adjustment Factor	1.3422
Secondary adjustment factor	1.0481

Diffusion tube CA17 is located adjacent to Fitzjohn's Avenue, which has a noteworthy gradient and is enclosed by a mature tree canopy. Those particular local conditions, which the model setup cannot capture, might justify the higher ratio between measured and modelled NOx when compared with CD1 monitoring site. Including CA17 in the verification process results in a higher primary factor and therefore worst case.

The results imply that overall, the model was under-predicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

The model uncertainty has been estimated using the root mean square error (RMSE) with an error of ±8.16μg/m^3 (20%), i.e. below the ±25 % recommended by TG(16).

The final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line.

Figure E1: Comparison of Measured Road-NOx with Unadjusted Modelled Road-NOx Concentrations

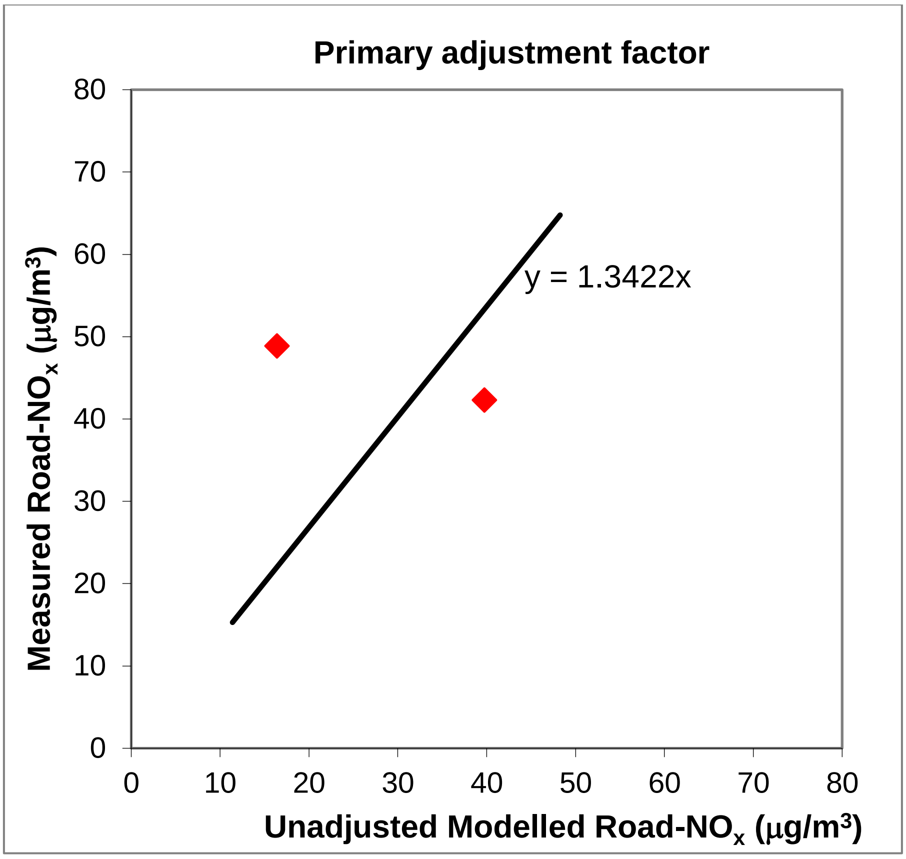


Figure E2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO2 Concentrations

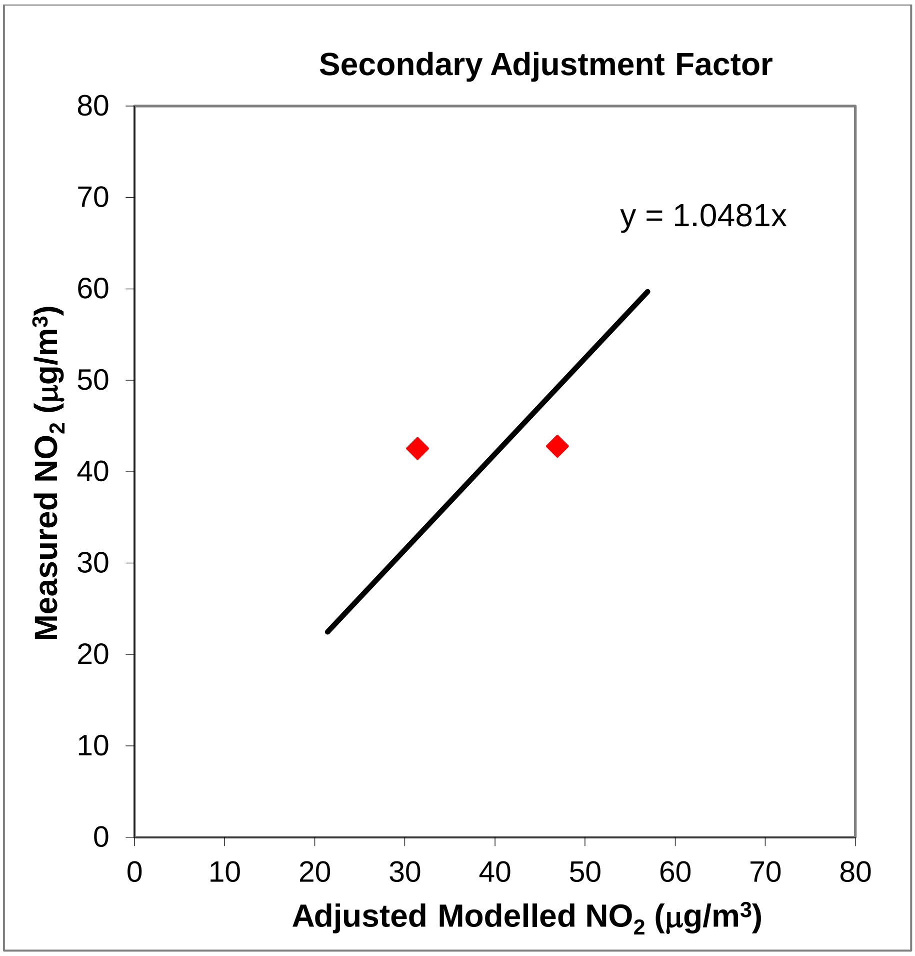
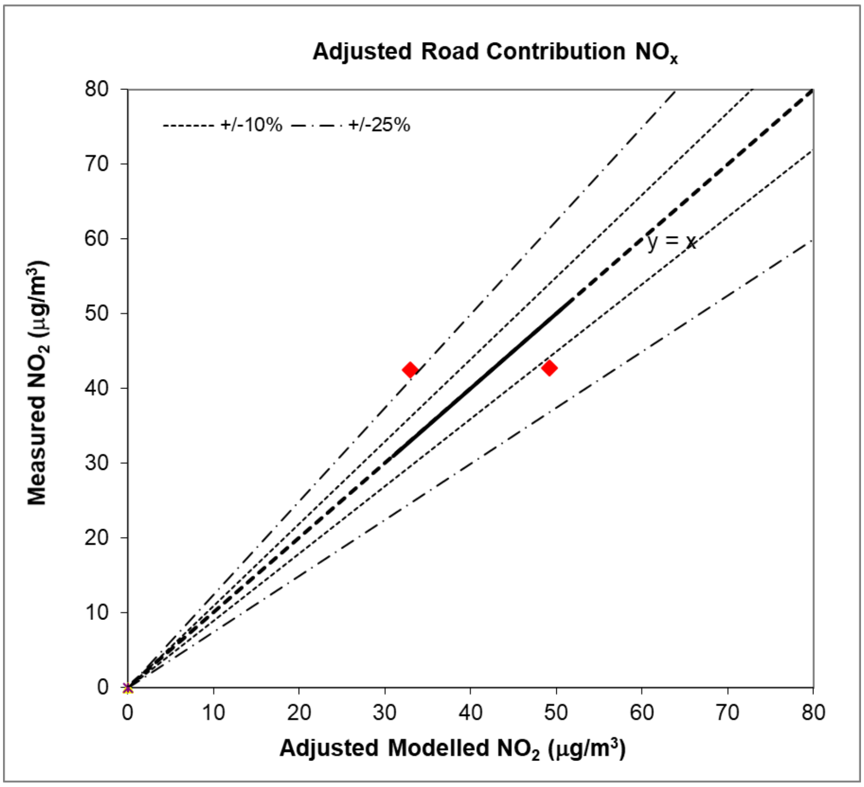


Figure E3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO2 Concentrations



Particulates (PM_{10} and $PM_{2.5}$)

The Swiss Cottage monitoring station has been used to calculate a verification factor for PM_{10} following a similar methodology as that used for nitrogen dioxide.

Road PM_{10} is divided by the modelled road PM_{10} to produce a factor which can be applied to PM_{10} model outputs as detailed in Table E4.

Monitoring of $PM_{2.5}$ is also carried out at Swiss Cottage automatic site, and verification factor has been estimated following a similar methodology as that used for PM_{10}.

Table E4: PM_{10} and $PM_{2.5}$ Verification

	Measured µg/m³	Calibrated background µg/m³	Measured Road Contribution µg/m³	Measured Road / Modelled Road	Verification Factor
PM_{10}	19.5	15.2	4.3	2.8	1.56
$PM_{2.5}$	11.1	9.7	1.5	1.7	0.86

The primary factor calculated for $PM_{2.5}$ indicates that the model is over predicting at this location. For a conservative approach, the primary adjustment factor calculated for PM_{10} concentrations has been applied to the modelled road $PM_{2.5}$ concentrations instead.