ENVIRONMENT
& HEALTH

Nora-Andreea Constantinescu
The Planning Officer
London Borough of Camden
5 Pancras Square,
Kings Cross,
London
N1C 4AG

Dear Ms Constantinescu

THE HALL SENIOR SCHOOL – PLANNING REFERENCE 2019/1325/P
DISCHARGE OF PLANNING CONDITION 6

Date 11/02/2020

Ramboll
Aston Court
Pynes Hill
Exeter
Devon
EX2 5AZ
United Kingdom

T +44 1392 440 600
www.ramboll.co.uk

Ref L1620007106_110220_2

Introduction

Ramboll UK Ltd has been retained by The Hall School to assist in the discharge of air quality planning conditions relating to the refurbishment of The Hall Senior School, planning reference 2019/1325/P. Planning Condition 6 states:

'Prior to commencement of development excluding demolition and site preparation works, further information on air quality at the site should be provided to the Council to determine the need for mechanical ventilation system. In the event that existing annual mean nitrogen dioxide concentrations at the façade fronting Crossfield Road are shown to exceed 38 µg/m^3 full details of the mechanical ventilation system including air inlet locations shall be submitted to and approved by the local planning authority in writing. Air inlet locations should be located away from busy roads and the boiler stack and as close to roof level as possible, to protect internal air quality. The development shall thereafter be constructed and maintained in accordance with the approved details.

Reason: To protect the amenity of residents in accordance with London Borough of Camden Local Plan Policy CC4 and London Plan policy 7.14.'

Background

An air quality assessment and a letter have been prepared by Ramboll UK Ltd (Report reference R1620007106 and letter reference L1620007106 200819, Appendix A and B) and submitted as part of the planning application. Both documents, which provided details of existing monitoring and future predicted concentrations in the vicinity of the site, concluded that air quality would be expected to meet all relevant objectives at the application site and the need for

Ramboll UK Limited
Registered in England & Wales
Company No: 03659970
Registered Office:
240 Blackfriars Road
London
SE1 8NW

a mechanical ventilation system to protect staff and pupils from poor air quality was not required.

However, further assurance has been requested by the London Borough of Camden and therefore a detailed modelling assessment has been carried out.

Modelling Assessment

Atmospheric dispersion modelling was used to predict air quality concentrations at the front façade of the school. Predictions of the annual mean NO_2 concentrations at Hall Senior School have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics, the vehicle speed and also meteorological data. The model has been run using 2018 meteorological data from Heathrow meteorological station, which are considered suitable for this area and verified with 2018 monitored concentrations (see Appendix C to Appendix E for further details on data and the model inputs). Concentrations across the Hall Senior School were predicted for a grid of receptors (contour), modelled at a height of 1.5 m representing exposure at ground floor level.

Figure 1 shows the annual mean NO_2 contour for 2018 base year. The NO_2 concentrations at the school façade are predicted to be approximately 31 µg/m^3. Air quality is predicted to improve in future years as cleaner vehicles are introduced and as a result of the initiatives introduced by local and national policies. No account of these improvements have been included within the modelling and therefore the predicted concentrations shown in Figure 1 can be considered a worst case.

Conclusions

The modelling has demonstrated that air quality across the school site would comfortably meet relevant air quality objectives with annual mean nitrogen dioxide concentrations comfortably below 38 µg/m^3. As a result, it is concluded that a mechanical ventilation system to protect staff and pupils from poor air quality is not required.

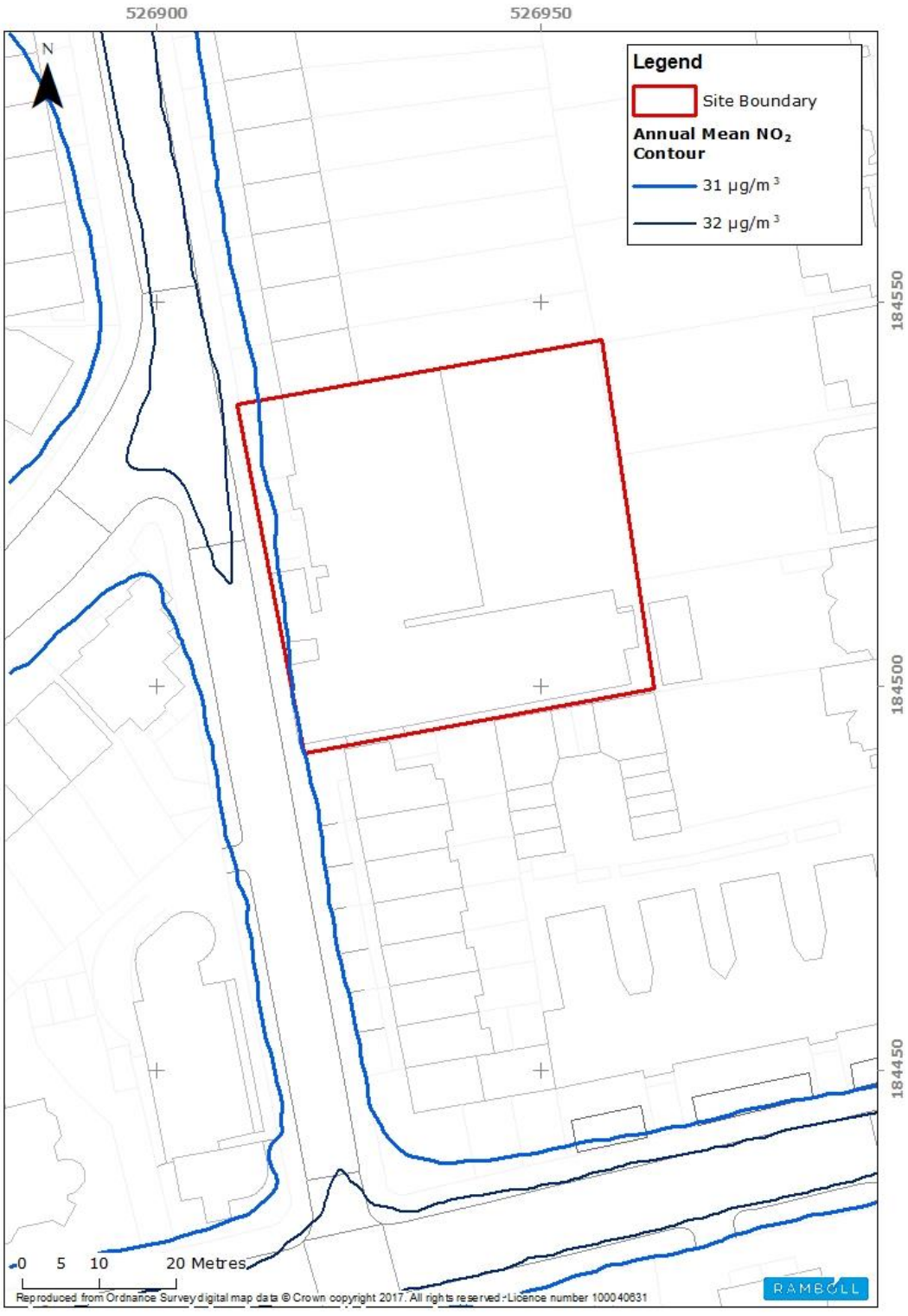

Figure 1: Annual Mean NO_2 Contour (µg/m³)

I trust that this letter has provided sufficient information to discharge Planning Condition 6, but should you require additional information or points of clarification please do not hesitate to contact me.

Yours sincerely,

Lesley Vining
Senior Managing Consultant
Air Quality

D 01392 440605
M 07739 819695
lvining@ramboll.com

Encl. Appendix A, Report reference R1620007106

Appendix B, Letter reference L1620007106 200819

Appendix C, Methodology

Appendix D, Baseline Data: Background and Traffic Data

Appendix E, Verification

APPENDIX A REPORT REFERENCE R1620007106

Intended for
The Hall School

Date
June 2019

Project Number
1620007106

THE HALL SCHOOL
AIR QUALITY ASSESSMENT

RAMBOLL

THE HALL SCHOOL
AIR QUALITY ASSESSMENT

Project No.	**1620007106**
Issue No.	**2**
Date	**June 2019**
Made by	**Lesley Vining**
Checked by	**Graham Harker**
Approved by	**Graham Harker**

Made by:

Checked/Approved by:

Version Control Log

Revision	Date	Made by	Checked by	Approved by	Description
1	26/06/19	LV	GH	GH	Final Draft
2	27/06/19	LV	GH	GH	Final

Ramboll
Aston Court
Pynes Hill
Exeter
Devon
EX2 5AZ
United Kingdom
T +44 1392 440 600
www.ramboll.co.uk

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EXECUTIVE SUMMARY

Ramboll Environment and Health 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.

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.

The proposed development would not increase operational car movements, and heating and hot water requirements would be provided through low NOx boilers and electrical water heaters. As such the redevelopment would be expected to result in a decrease in pollutant emissions over the existing situation and has been demonstrated to be air quality neutral.

During the construction phase, emissions of dust and exhaust gases from construction activities can impact air quality. This will be of particular concern as it is proposed that parts of the school will remain in use whilst the construction work is undertaken. The demolition and construction 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 suitable mitigation measures outlined in this report which should be implemented through the provision of a dust management plan which would be agreed with LBC prior to the start of construction.

1. INTRODUCTION

1.1 Overview

Ramboll Environment and Health 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

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 road traffic is considered to be negligible and will not be assessed.

As part of the redevelopment proposals the school proposes to replace the boilers that provide heat for all the buildings with a new low NOx gas fired boiler. Hot water for toilets and classrooms would be provided by individual electric powered units. Emissions from heating plant will therefore be reduced compared with the existing situation. Information on the proposed boiler has been used within the air quality neutral assessment, but no other assessment of heating plant emissions has been carried out.

Exceedances of the annual mean NO_2 air quality objective have been recorded at roadside locations associated with the main road network close to the site, at Swiss Cottage junction. NO_2 concentrations tend to fall off rapidly away from the roadside and generally meet relevant objectives in urban background locations. A review of available monitoring and predicted information has been carried out to establish air quality at the school site to determine whether there is a requirement for mitigation to be inbuilt into the design to protect staff and pupils 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].

[1] LBC, 2019, Camden Planning Guidance, Air Quality
[2] Air Quality Consultants/ENVIRON, 2014, Air Quality Neutral Planning Support Update: GLA 80371

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;
- An Air Quality Neutral assessment; and
- Information on the ventilation strategy to limit site users exposure to elevated concentrations of air pollutants.

1.3 General Limitations and Reliance

This report has been prepared by Ramboll UK Limited ("Ramboll") exclusively for the intended use by The Hall School (the "client") in accordance with the agreement (e-mail dated 13th June 2019) between Ramboll and Ainsley and Partners working on behalf of the client defining, among others, the purpose, the scope and the terms and conditions for the services. No other warranty, expressed or implied, is made as to the professional advice included in this report or in respect of any matters outside the agreed scope of the services or the purpose for which the report and the associated agreed scope were intended or any other services provided by Ramboll.

In preparation of the report and performance of any other services, Ramboll has relied upon publicly available information, information provided by the client and information provided by third parties. Accordingly, the conclusions in this report are valid only to the extent that the information provided to Ramboll was accurate, complete and available to Ramboll within the reporting schedule.

[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 and an aerial image of the site and surrounds provided in Figure 2.2.

Figure 2.1: Site Location

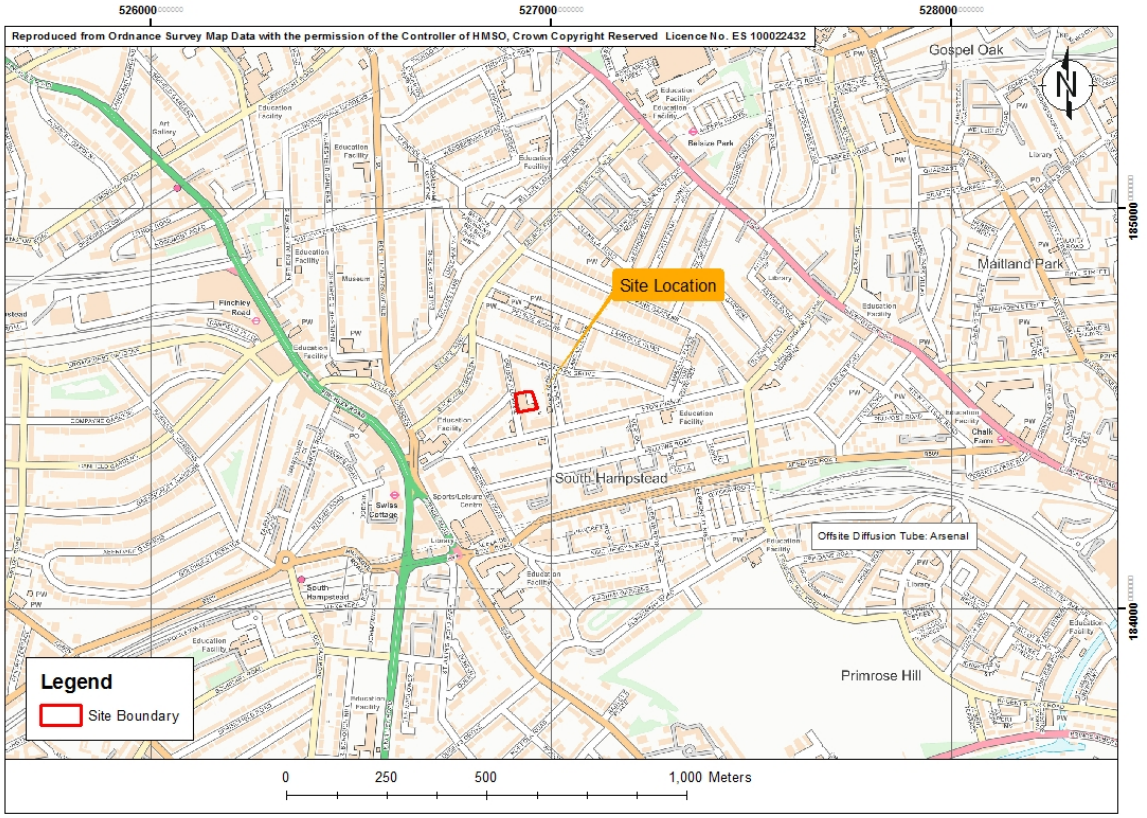


Figure 2.2: Site Setting

2.2 Proposed Development

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 2019 planning submission is for the variation of planning permission reference number 2016/06319/P dated 05/07/2018 for demolition of the Centenary and Wathan Hall buildings, erection of a new four storey building, two storey rear extension and enlarged basement. The changes to the original planning permission include reduction of the basement area and depth by one floor, reduction in scale of the extension to replace Wathan Hall, removal of external staircase and terrace and new louvers to windows on the front elevation.

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 low NOx boiler to serve the whole school site and new electrical water heaters.

3. EXISTING AIR QUALITY

3.1 Local Authority Monitoring

LBC 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 an automatic monitor located within the neighbouring London Borough of Islington (LBI) has 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 3.1 and a summary of recent results in Table 3.2 and 3.3. The location of the monitoring stations is shown in Figure 3.1.

Table 3.1: Monitoring Stations in Proximity to the Proposed Development

Site	Type	Borough	Classification	Pollutants Monitored	Distance from Proposed Development
Swiss Cottage	Automatic	Camden	Kerbside	NO_2, PM_{10}, $PM_{2.5}$	300m west
Arsenal	Automatic	Islington	Urban Background	NO_2, PM_{10}	4,400m east
Swiss Cottage DT, CA15	Diffusion Tube	Camden	Kerbside	NO_2	300m west
Frognal Way DT, CA7	Diffusion Tube	Camden	Urban Background	NO_2	1,190m north west
Fitzjohn's Road DT, CA17	Diffusion Tube	Camden	Roadside	NO_2	670m north west

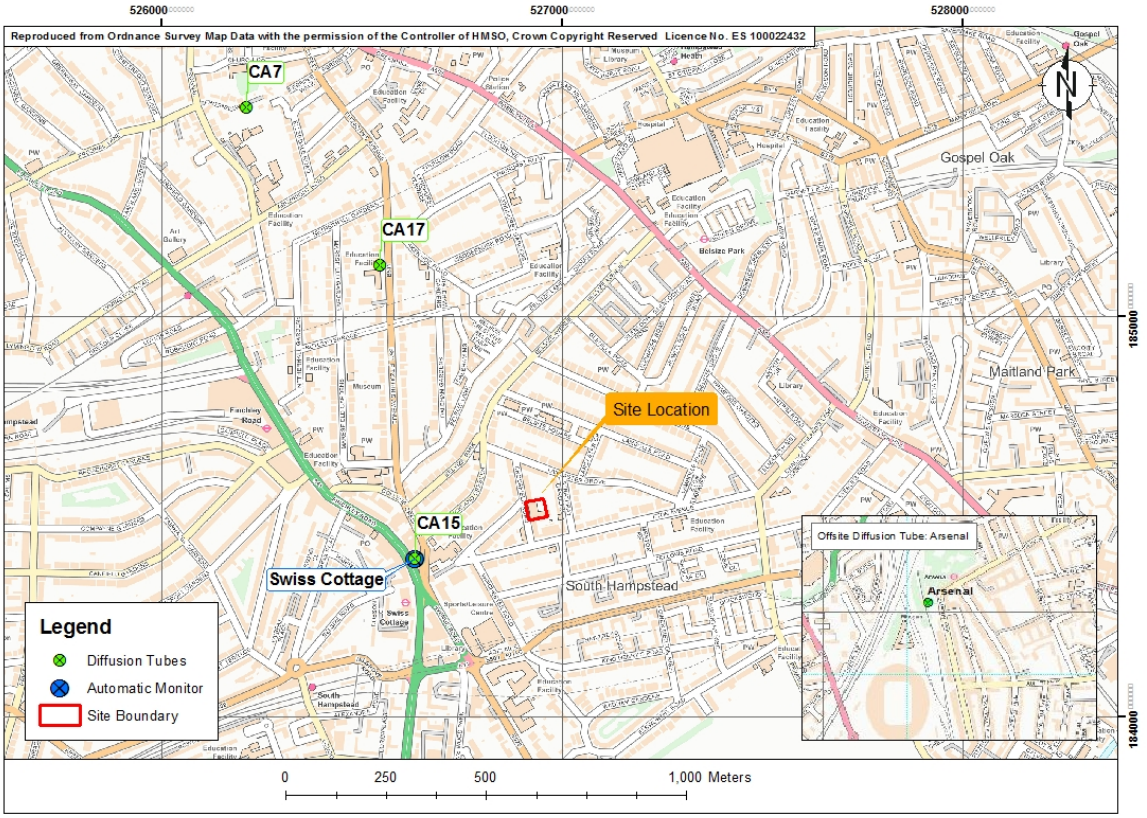
Table 3.2: Recorded NO_2 Concentrations at Monitoring Stations

Site	2013	2014	2015	2016	2017	2018	2019 (to date)
Annual Mean Objective – target 40 µg/m³							
Swiss Cottage	**63**	**66**	**61**	**66**	**53**	**54**	**41**
Arsenal	40	NG	29	33	31	27	27
Swiss Cottage DT, CA15	**83**	**74**	**69**	**74**	NA	NA	NA
Frognal Way DT, CA7	32	29	28	28	32	NA	NA
Fitzjohn's Road DT CA17	**65**	**60**	**56**	**56**	NA	NA	NA
One Hour Objective Number of Hours exceeding 200 µg/m³ – target 18 hours							
Swiss Cottage	**42**	13	11	**37**	1	2	0
Arsenal	10	NG	0	0	1	0	0
NG = Not given Numbers in bold indicate an exceedance of the relevant objective							

Table 3.3: Recorded PM_{10} and $PM_{2.5}$ Concentrations at Monitoring Stations

Site	2013	2014	2015	2016	2017	2018	2019 (to date)
Annual Mean PM_{10} Objective – target 40 µg/m³							
Swiss Cottage	20	NG	20	21	NA	21	22
Arsenal	22	NG	18	18	18	19	22
Daily Objective Number of Days exceeding 50 µg/m³ – target 35 days							
Swiss Cottage	7	NG	8	7	NA	4	8
Arsenal	7	NG	1	3	3	1	8
Annual Mean $PM_{2.5}$ Objective – target 25 µg/m³							
Swiss Cottage	NG	NG	12	15	16	NA	14

Figure 3.1: Monitoring Locations



3.2 Assessment of Monitoring Data

The monitoring data demonstrates that there has been significant exceedance of the NO_2 NAQO at the Swiss Cottage and Fitzjohn Road roadside monitoring stations. At the urban background locations substantially lower concentrations have been recorded with concentrations within the objective at the Arsenal and Frognal Way monitoring stations.

At both roadside and urban background locations the monitoring results show a steady decline in concentrations between 2013 and the present day.

With regard to the short term NO_2 objective a similar pattern is observed with some exceedance in past years at the Swiss Cottage site, but no exceedance at the Arsenal station.

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.

3.3 Predicted Concentrations

3.3.1 London Atmospheric Emissions Inventory

Additional information on local air quality can be extracted from modelling carried out for the Greater London Authority as part of the London Atmospheric Emissions Inventory (LAEI). This inventory uses traffic count data and modelled background data to provide predicted concentrations for the whole of London. These predictions are then verified using monitored concentrations and the data also used to project forward to future years. The two most recent years of verified predictions are 2013 and 2016.

The previous 2013 modelled concentrations indicated that air quality at the school site would just meet the annual mean NO_2 objective, as shown in Figure 3.2. However, the updated predicted concentration in 2016 predicted that there was potential for the NO_2 concentrations to exceed the NAQO on the western half of the site, as shown in Figure 3.3.

Figure 3.2: LAEI Predicted 2013 Annual Mean NO_2 Concentrations µg/m^3

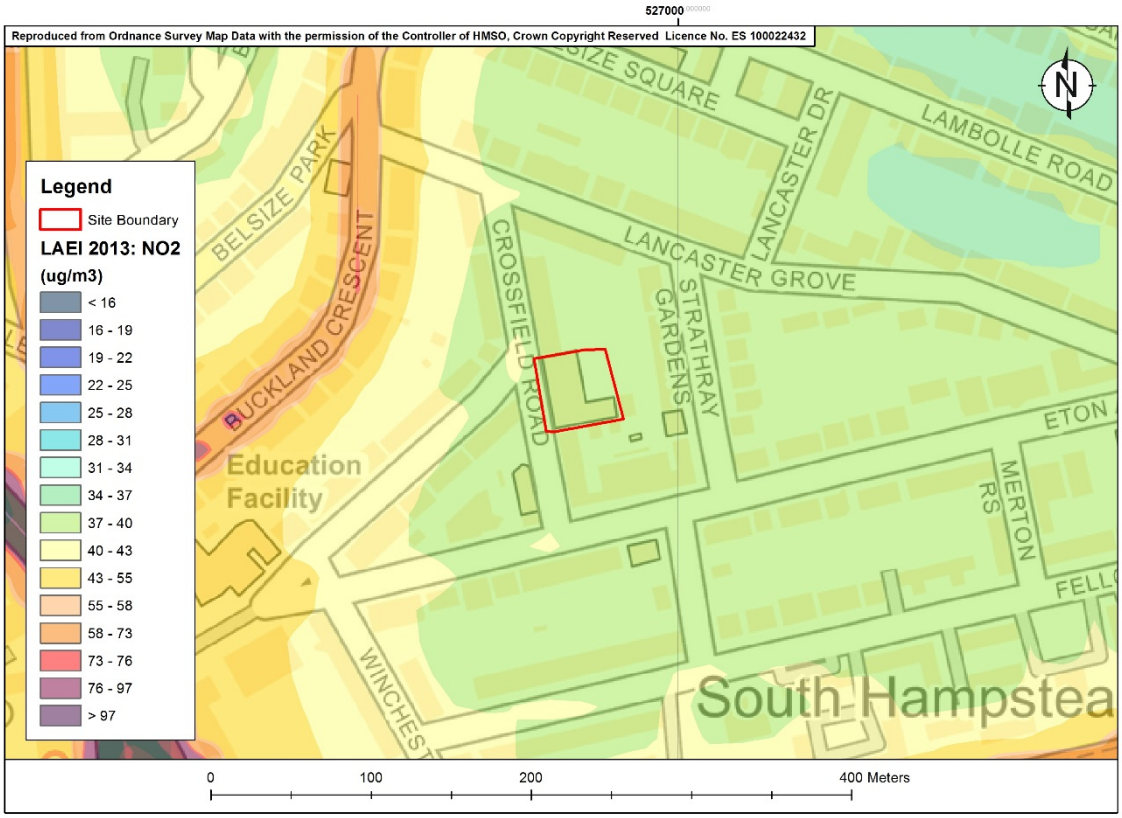


Figure 3.3: LAEI Predicted 2016 Annual Mean NO_2 Concentrations µg/m^3

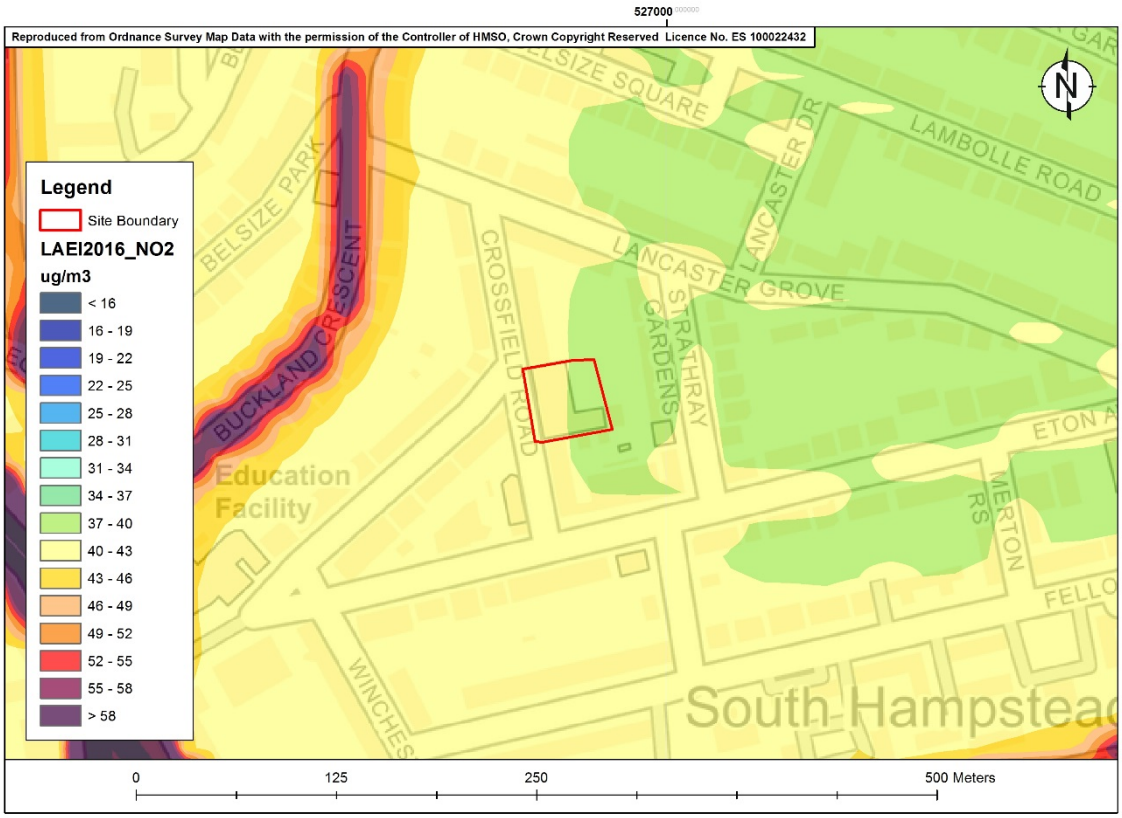
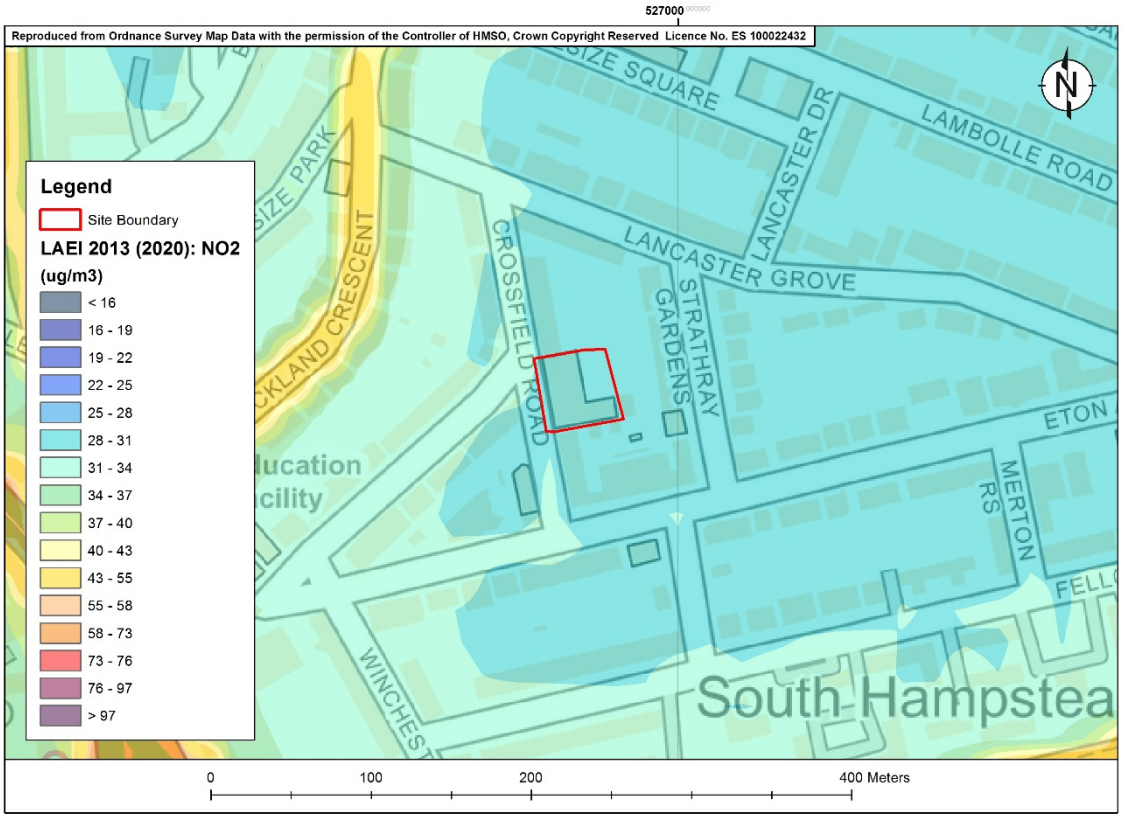


Figure 3.4: LAEI Predicted 2020 Annual Mean NO_2 Concentrations µg/m^3 (from 2013 projections)



The projected future concentrations for the most recent 2016 dataset are yet to be released. However, the projected 2020 concentrations based on the 2013 verified monitoring is provided in Figure 3.4. This indicates that concentrations would be expected to comfortably meet the air quality objective across the site.

The LAEI data indicates that daily mean PM_{10} and $PM_{2.5}$ concentrations are predicted to meet the relevant objective in 2016 as shown in Figures 3.5 and 3.6.

Figure 3.5: LAEI Predicted 2016 Annual Mean PM_{10} Concentrations µg/m^3

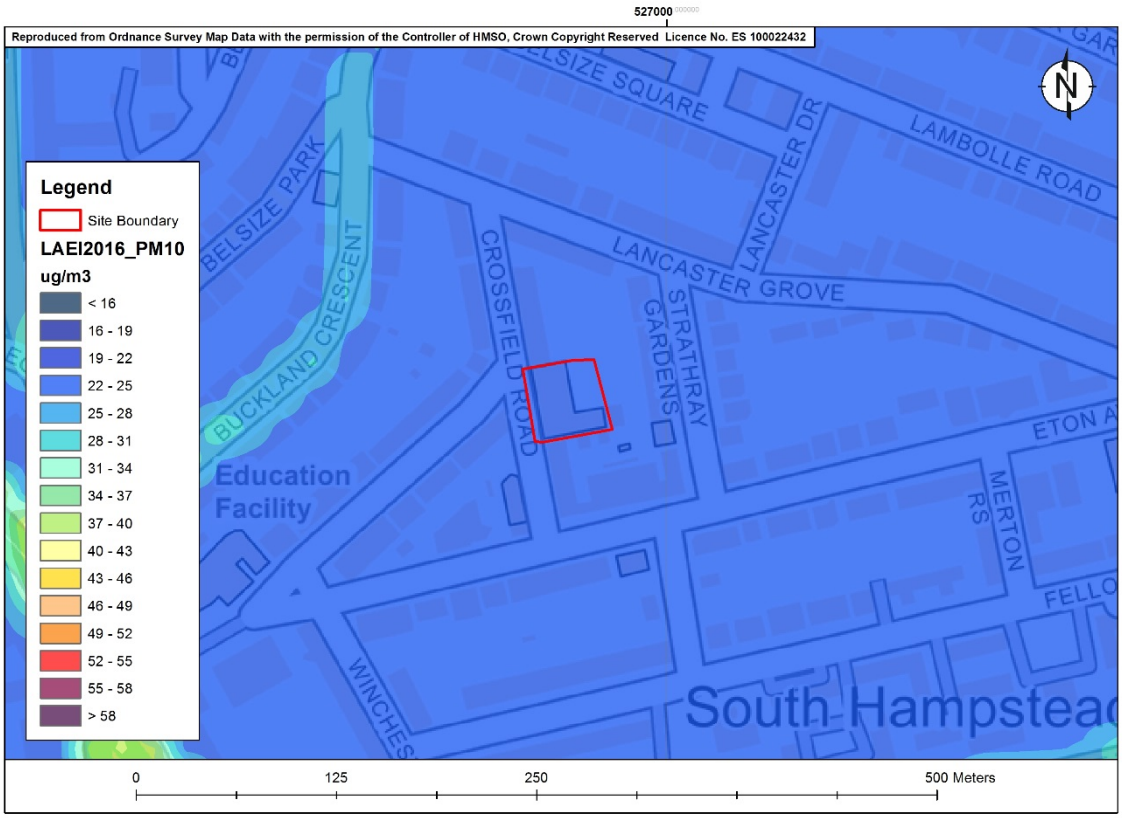
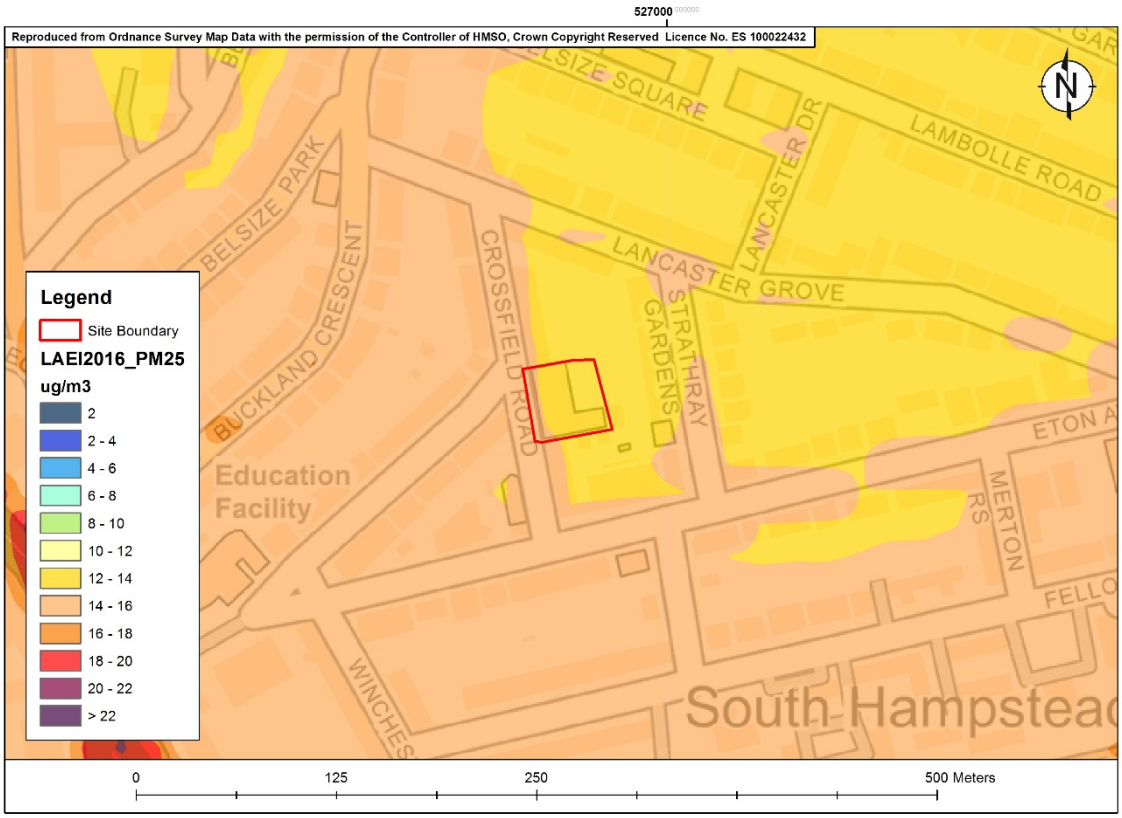


Figure 3.6: LAEI Predicted 2016 Annual Mean $PM_{2.5}$ Concentrations µg/m^3



3.3.2 Defra Background Concentrations

To assist local authorities to review and predict air quality the Department of Environment Food and Rural Affairs (Defra) has produced predicted maps of background air quality which can be projected forward to estimate how background concentrations are likely to change as a result of initiatives to improve air quality such as the gradual replacement of the vehicle fleet with newer and cleaner vehicles and the introduction of the London Low Emission Zone. Average background concentrations are provided for every grid square within the country. Information for 2017 and 2020 from the most recent version of the maps for the grid square in which the school lies is provided within Table 3.4.

This indicates that a decrease of 5 µg/m^3 in background NO_2 is predicted to arise at the school site between 2017 and 2020.

Table 3.4: Defra Predicted Annual Mean Background Concentrations for Grid Square 526500, 184500

Year	NOx	NO_2
2017	56.5	32.7
2020	43.6	27.1

3.4 Existing On-site Air Quality

It is considered that the site is located in an urban background location as it is set some 280 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. Additionally, monitored data indicates that there has been a steady decrease in concentrations from 2013 to the present day.

Contrary to the monitoring data, the predicted LAEI 2016 data indicates that there is potential for air quality to exceed the annual mean NO_2 objective on the western half of the school site closest to Crossfield Road. However, it should be noted that this is for 2016. The projected concentrations for 2020 together with the predicted background concentrations provided by Defra indicate that air quality is predicted to improve in future years, and given that the LAEI data indicates only a minor exceedance in 2016 it is considered that by 2020 air quality would be expected to meet all relevant objectives across the site.

4. CONSTRUCTION PHASE IMPACTS

4.1 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.

4.2 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 4.1 below.

Table 4.1: 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 4.2: Sensitivity of Area to Dust Impacts (taking into account distance to construction activity)

Sensitivity to Dust Soiling	Sensitivity to Human Health Impacts	Sensitivity to Ecological Receptors
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.	No designated sensitive ecological sites have been identified within 50 m of the proposed development or within 50 m of the access route used for construction vehicles

Sensitivity to Dust Soiling	Sensitivity to Human Health Impacts	Sensitivity to Ecological Receptors
		for a distance of 500 m from the site.

The dust emission magnitude determined in Table 4.1 has been combined with the sensitivity assessment in Table 4.2 to define the risk of impacts for each phase of development in the absence of mitigation as shown in Table 4.3.

Table 4.3: 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

4.3 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 4.4. It is recommended that these measures would be set out in the Dust Management Plan 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 s106 Legal Agreement.

Table 4.4: 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.	

Phase/Task	Highly Recommended	Desirable
	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. 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 Low Emission Zone emissions requirements as set out in the Control of Dust and Emissions during Construction and Demolition SPG. Site manager to maintain a list of all on-site NRMM using the GLA's nrmm.london database.	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.	

5. OPERATIONAL IMPACTS

5.1 Traffic Impacts

There will be no increase in the number of staff or pupils using the school as a result of the redevelopment work and therefore on increase in operational road traffic emissions is anticipated.

5.2 Energy Plant Emissions

As part of the redevelopment work new heating and hot water plant will be installed for the whole school. Heating would be provided by a Wessex Modumax Mk3 low NOx boiler comprising of 3 modules each providing 116 kWth and with emissions of less than 40 mg/kWh. Hot water is to be provided through individual electrical heaters.

Emissions from the boiler when operating at full capacity has been estimated as 3.3 mg/s. The exhaust gas would be released from the existing boiler flue chimney which would be released at roof level from the existing building. Using the guidance provided with the Institute of Air Quality Management guidance[5], no further consideration of impacts from this source has been carried out.

5.3 Ventilation

The review of existing and projected 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. Some mechanical ventilation would be provided where greater air exchange is required.

[5] Institute of Air Quality Management (IAQM) and Environmental Protection UK, 2017, Land-Use Planning & Development Control: Planning for Air Quality, Version 1.2

6. AIR QUALITY NEUTRAL

6.1 Introduction

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.

6.2 Building Emissions

The proposed development includes a natural gas high efficiency, low NOx boiler to meet the heating demand of the proposed development.

The annual buildings emission has been calculated as shown in Table 6.1. This is a highly conservative estimate assuming that boiler would operate a full capacity for 12 hours per day, 365 days per year.

The Air Quality Neutral guidance has been used to calculate the relevant Building Emission Benchmarks based on the proposed floor area as detailed in Table 6.2. Because the boiler plant will provide heat to the school as a whole the entire building area has been used to determine the emission benchmark.

Table 6.1: Annual Building Emissions

Plant	**NOx Emission (mg/kWh)**	**Assumed average daily operating hours**	**Annual NOx Emission (kg/annum)**
1 x 116 kW/348V comprising 3 modules	34.3	12	52
Total predicted development building emission (kg/annum)			**52**
Notes: Wessex ModuMax mk3 boiler to be installed comprising 3 modules – conservative assessment carried out assuming all 3 modules running 12 hours per day 365 days per year			

Table 6.2: Air Quality Neutral Assessment – Building Emissions

Class	**Description**	**Gross Floor (Internal) Area (m2)**	**NOx Benchmark (g/m2)**	**Estimated Development NOx Emission (kg/annum)**
Class D1 (c-h)	Schools, Libraries etc.	3,374	104.6	105
Total building emissions benchmark (BEB)		3,374	N/a	**105**
Total predicted development building emission (kg/annum)				**52**
Difference between predicted development building emission and BEB				**-53**

6.3 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.

6.4 Conclusion

The assessment demonstrates that the redevelopment would be expected to meet the Building 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.

7. SUMMARY AND CONCLUSIONS

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.

The redevelopment would not increase operational car movements and heating and hot water requirements would be provided through low NOx boilers and electrical water heaters. As such the redevelopment would be expected to result in a decrease in pollutant emissions over the existing situation and has been demonstrated to be air quality neutral.

During the construction phase, emissions of dust and exhaust gases from construction activities can impact air quality. This will be of particular concern as it is proposed that parts of the school will remain in use whilst the construction work is undertaken. The demolition and construction 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 suitable mitigation measures outlined in this report which should be implemented through the provision of a dust management plan which would be agreed with LBC prior to the start of construction.

APPENDIX B LETTER REFERENCE L1620007106 200819

ENVIRONMENT
& HEALTH

Nora-Andreea Constantinescu
The Planning Officer
London Borough of Camden
5 Pancras Square,
Kings Cross,
London
N1C 4AG

Dear Ms Constantinescu

THE HALL SENIOR SCHOOL – PLANNING REFERENCE 2019/1325/P

Date 20/08/2019

Ramboll
Aston Court
Pynes Hill
Exeter
Devon
EX2 5AZ
United Kingdom

T +44 1392 440 600
www.ramboll.co.uk

Ref L1620007106_200819

AIR QUALITY PLANNING CONDITION

I am writing with regard to the suggested planning condition which is being proposed for the redevelopment works proposed for The Hall Senior School (the application site). The reasoning given by Camden Council behind the condition and the resulting planning condition is as follows:

"The AQA takes into consideration predictions of air quality improvements, which is contrary to CPG Air Quality section 3.5. As such, based on the current information the air quality exceeds the annual mean NO2 objective on the western half of the school site, closest to Crossfield Road. As such, condition would be attached for:

1. Prior to commencement of development excluding demolition and site preparation works, full details of the mechanical ventilation system including air inlet locations shall be submitted to and approved by the local planning authority in writing. Air inlet locations should be located away from busy roads and the boiler stack and as close to roof level as possible, to protect internal air quality. The development shall thereafter be constructed and maintained in accordance with the approved details.

Reason: To protect the amenity of residents in accordance with London Borough of Camden Local Plan Policy CC4 and London Plan policy 7.14."

An air quality assessment was undertaken by Ramboll UK Ltd (Report reference R1620007106) and submitted as part of the planning application. The main aim of the assessment was to determine whether air quality at the application site would meet relevant health-based air quality objectives so as to determine

Ramboll UK Limited
Registered in England & Wales
Company No: 03659970
Registered Office:
240 Blackfriars Road
London
SE1 8NW

whether mitigation in the form of mechanical ventilation with filtration would be required to protect staff and children from poor air quality.

The assessment presented both monitored and predicted long term concentrations of pollutants and concluded that air quality would be expected to meet all relevant objectives at the application site.

This conclusion was further strengthened by the argument that air quality is expected to gradually improve both as a result of the gradual renewal of the vehicle fleet with cleaner vehicles and from the initiatives introduced throughout London and by Camden Council. This is clearly demonstrated by information presented in Figure 9 of the latest Camden Air Quality Action Plan[1] provided in Appendix 1 which demonstrates that pollutant emissions within Camden are predicted to significantly decrease between 2013 and 2020.

However, the response from the council indicates that current Camden Planning Guidance states that no allowance should be taken of this gradual improvement and that the need for mitigation should be determined on the basis of the existing air quality. It appears that the council has requested the condition on the basis of the 2016 London Atmospheric Emissions Inventory (LAEI) predicted concentrations given within the Air Quality Assessment Report at Figure 3.3. These are predicted modelled concentrations which have been verified against 2016 monitored concentrations.

The assessment also presented monitored data at nearby monitoring stations. This included data for 2017, 2018 and 2019 to date. Data was presented for a number of stations including those at Swiss Cottage adjacent to the main road network and data for Arsenal which is considered more representative of the application conditions. This monitored data demonstrates that whilst there are exceedances close to the main road network, concentrations decline away from the roadside and comfortably meet the air quality objective of 40 µg/m^3 at locations similar to The Hall School site. Furthermore, the data demonstrates a steady reduction in concentrations at the monitoring sites and in particular at the Swiss Cottage site. This is further demonstrated in evidence from the Camden Air Quality Action Plan presented in Appendix 2 which indicates that across Camden there has been a steady decline in concentrations at all automatic monitoring sites within its area.

From the monitored evidence, it is considered that the predicted figures presented for 2016 by the LAEI are an over estimate of existing air quality at The Hall School site for 2019, and current air quality would be expected to meet all relevant air quality objectives across the application site. Therefore, the need for a mechanical ventilation system to protect staff and pupils from poor air quality is not required and the condition should not be included within the planning consent.

Yours sincerely

Lesley CR Vining

Lesley Vining
Senior Managing Consultant
Air Quality

D 01392 440605
M 07739 819695
lvining@ramboll.com

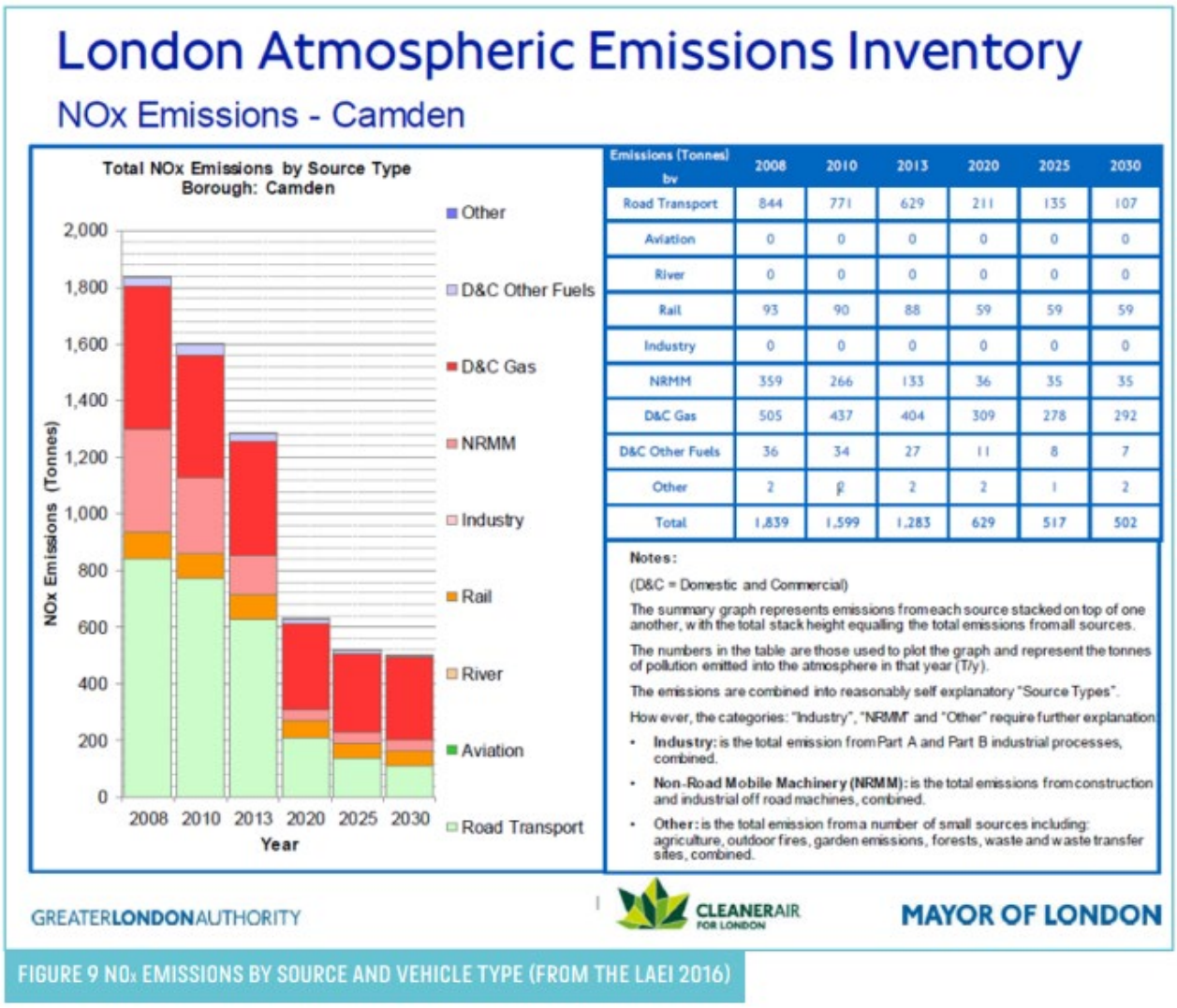
[1] London Borough of Camden, Camden's Clean Air Action Plan 2019 - 2022

Encl. Appendix 1, NO_2 Emissions by Source and Vehicle Type (From the LAEI 2016)

Appendix 2, Annual Mean NO_2 Concentrations at Camden Automatic Monitoring Sites 2010 to 2017

Appendix 1

NO_2 Emissions by Source and Vehicle Type (From the LAEI 2016)



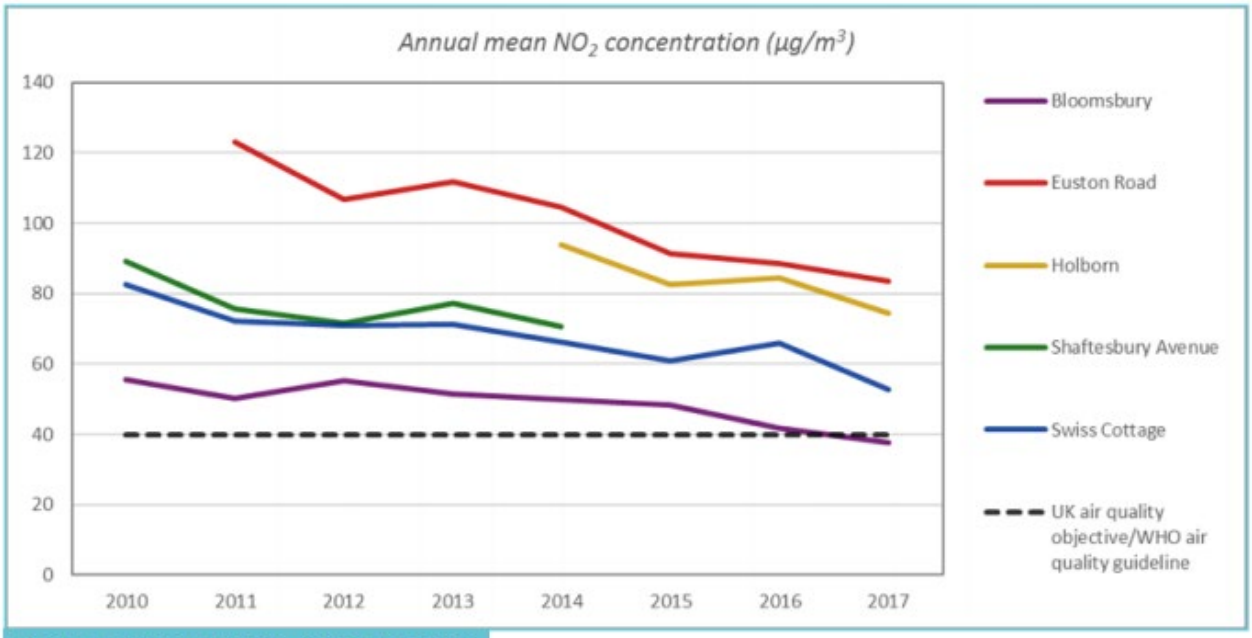
Emissions (Tonnes) by	2008	2010	2013	2020	2025	2030
Road Transport	844	771	629	211	135	107
Aviation	0	0	0	0	0	0
River	0	0	0	0	0	0
Rail	93	90	88	59	59	59
Industry	0	0	0	0	0	0
NRMM	359	266	133	36	35	35
D&C Gas	505	437	404	309	278	292
D&C Other Fuels	36	34	27	11	8	7
Other	2	2	2	2	1	2
Total	1,839	1,599	1,283	629	517	502

FIGURE 9 NO_x EMISSIONS BY SOURCE AND VEHICLE TYPE (FROM THE LAEI 2016)

Source: Camden's Clean Air Action Plan 2019-2022

Appendix 2

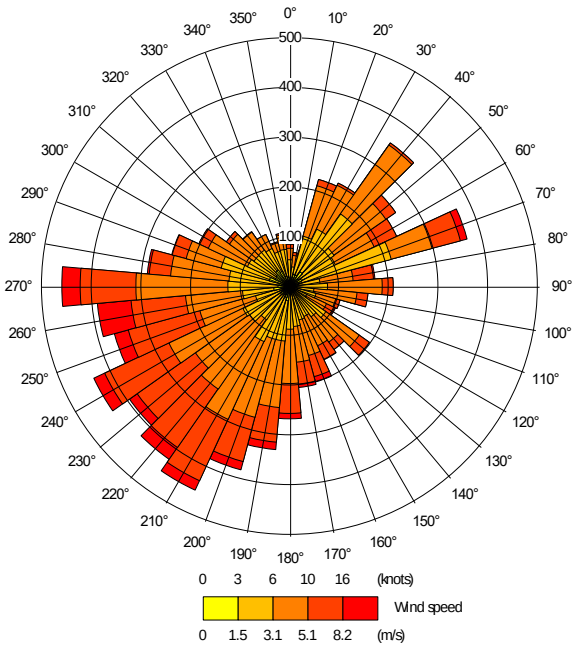
Annual Mean NO_2 Concentrations at Camden Automatic Monitoring Sites 2010 to 2017



GRAPH 1: ANNUAL MEAN NO2 CONCENTRATIONS

Source: Camden's Clean Air Action Plan 2019-2022

APPENDIX C METHODOLOGY

Meteorological Data	2018 Hourly meteorological data from Heathrow 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 4.1.1
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: 2018.
Latitude	51.5º
Surface Roughness	A value of 1.5 for Large Urban Areas was 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)	V9.0 , May 2019.
Urban Canopy	The changes in vertical profiles of velocity and turbulence caused by the presence of buildings in an urban area was modelled using the urban canopy option in ADMS. Data available at: https://www.cerc.co.uk/environmental-research/atmospheric-boundary-layer.html

NO_x to NO_2 Conversion	NO_x to NO_2 calculator version 7.1, May 2019[1]
Background Maps	2017 reference year background maps

[1] DEFRA. LAQM Support. https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc.

APPENDIX D BASELINE DATA: BACKGROUND AND TRAFFIC DATA

Background

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[2].

The London Borough of Camden run an urban background monitoring site approximately 5 km south east of the development site at Russell Square, Bloomsbury. In order to more accurately reflect background concentrations across the study area, Defra mapped background concentrations at this site have been compared against concentrations measured at the site in 2018 to produce a calibration factor which is applied to background concentrations across the study area.

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

Pollutant	Measured Concentrations	Defra Background	Factor
NO_2	36.4	40.7	0.89

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

Table D.2: Adjusted Background Mapping (µg/m³)

Year	Grid Reference (x, y)	NO_2
2018	526_184[a]	27.6
	526_185[b]	24.6
Objective		**40**

a: monitoring site CD1 and Development Site; b: monitoring site CA17.

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	8394	6335	510	2083	525	117	456	228
Belsize Park/ Buckland Crescent	8394	6335	510	2083	525	117	454	149
Finchley Road (North Junction, North Bound)	8559	6464	809	2307	487	64	1284	760

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

Road Link	Petrol Car	Diesel Car	Taxi (black cab)	LGV	Rigid HGV	Artic HGV	Bus and Coach	Motorcy-cle
Finchley Road (North Junction, South Bound)	8559	6464	809	2307	487	64	1284	760
Finchley Road (South Junction)	6721	5076	1318	2143	525	25	1429	779
Avenue Road	17117	12928	1619	4613	975	128	1738	1520
College Crescent East	4151	3135	248	1057	262	59	1042	147
College Crescent West	3361	2538	659	1072	263	13	818	390
Fairfax Road	1556	1174	62	352	68	15	204	115

* 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.

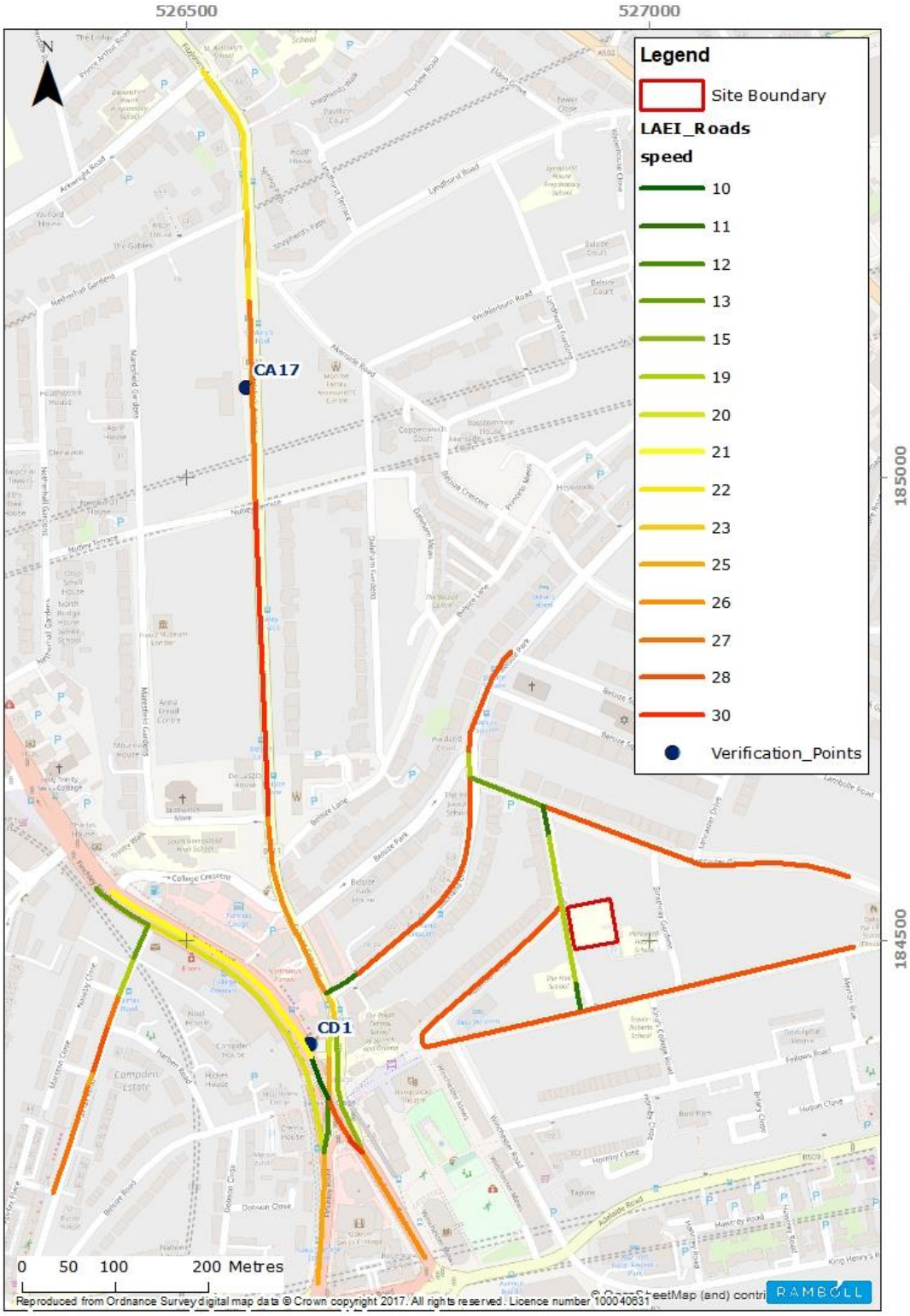


Figure D.1: Modelled Road Network and Speed

APPENDIX E VERIFICATION

Nitrogen Dioxide

The model has been run to predict the 2018 annual mean road-NOx contribution at three monitoring locations. Concentrations for the Bloomsbury Automatic Site CD1 have been modelled at 3 m height and for CA17 have been modelled at 2 m height.

The model output of road-NO_x has been compared with the 'measured' road-NOx, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

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. 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

Monitor	Monitored NO_2 µg/m³	Measured Road NOx µg/m³	Modelled Roadside NO_x µg/m³	Ratio Measured NOx/ Modelled road NOx	Total NO_2 after adjustment µg/m³	% Difference in NO_2 after adjustment
CD1	53.7	67.1	45.4	1.48	59.0	9.9
CA17	48.1	58.2	19.5	2.99	40.3	-16.2

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

Table E.1: Verification factors

Primary Adjustment Factor	1.7151
Secondary adjustment factor	1.0332

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 ±6.7 µg/m³ (±17%), i.e. below the ±25% recommended by TG(16).

Figure C.3 compares 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.

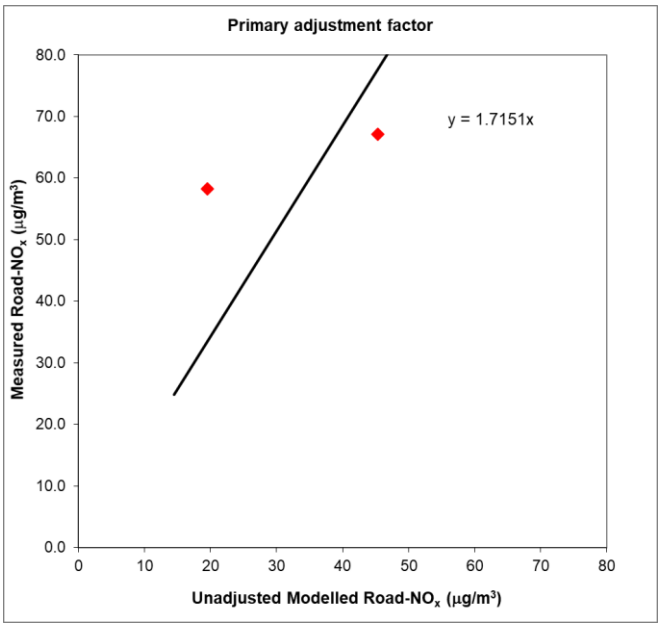


Figure E.1: Comparison of Measured Road-NOx with Unadjusted Modelled Road-NOx Concentrations

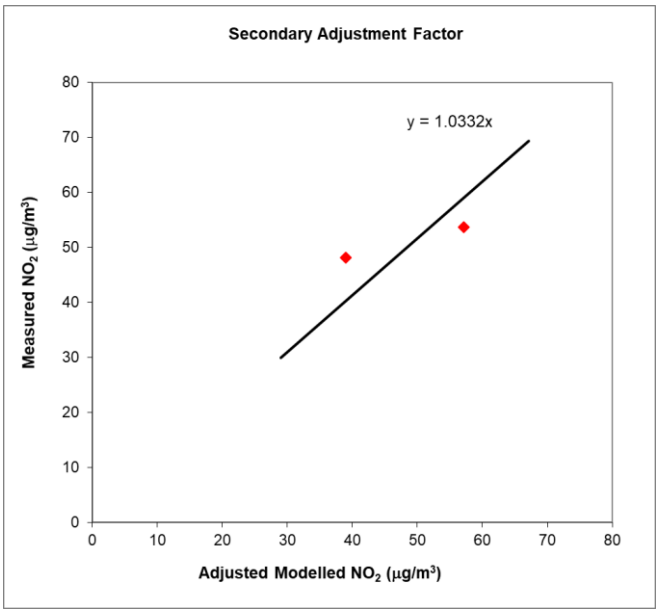


Figure E.2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO_2 Concentrations

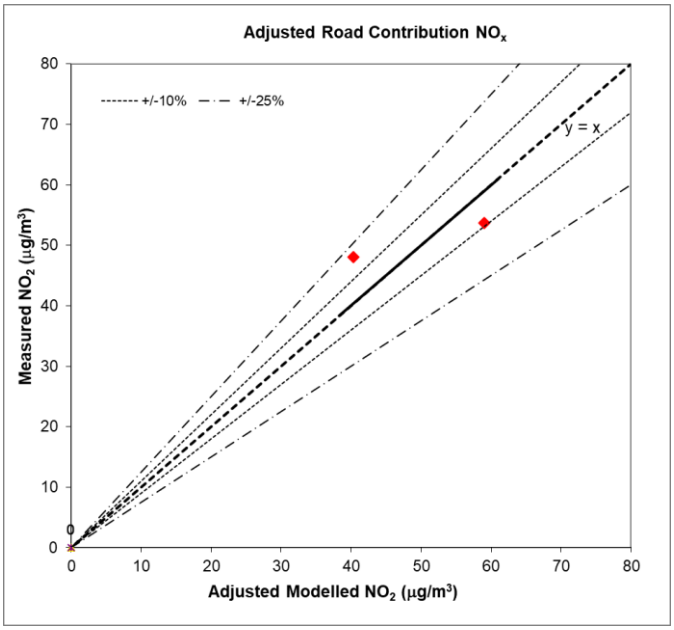


Figure E.3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO_2 Concentrations