AIR QUALITY ASSESSMENT
HAMPSTEAD POLICE STATION, LONDON

REC REFERENCE: AQ106285R1

REPORT PREPARED FOR: RIDGE AND PARTNERS ON BEHALF OF THE DEPARTMENT FOR EDUCATION

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EXECUTIVE SUMMARY

Resource and Environmental Consultants Ltd was commissioned by Ridge and Partners on behalf of the Department for Education to undertake an Air Quality Assessment in support of the proposed development at the former Hampstead Police Station, London.

The proposals comprise the redevelopment of the site to provide a primary school.

The site is located within an area identified by London Borough of Camden as experiencing elevated pollutant concentrations. Subsequently there is the potential that the proposals have the potential to introduce future site users into an area of high pollutant concentrations as well as to cause adverse impacts during the operational and construction phases. As such, an Air Quality Assessment was required to quantify pollution levels across the site, consider its suitability for the proposed end-use and assess potential impacts as a result of the development.

Potential construction phase air quality from fugitive dust emissions were assessed as a result of earthworks, construction, and trackout activities from the site. These were assessed in accordance with the Greater London Authority methodology. Assuming appropriate mitigation measures are implemented, air quality impacts during the construction phase are considered to be acceptable for a development of this size and nature.

Dispersion modelling was undertaken in order to quantify pollutant concentrations at the site and to assess the potential for future users to be exposed to poor air quality. This indicated that, predicted pollutant concentrations were predicted to be above relevant national objectives at school classrooms on the ground floor. As such specific mitigation techniques will be required to prevent future users from elevated pollutant concentrations.

Potential impacts during the operational phase of the development may occur due to road traffic exhaust emissions associated with vehicles travelling to and from the site. A screening assessment was therefore undertaken to determine the potential for trips generated by the development to affect local air quality. This indicated that impacts were anticipated to be **not significant**.

The London Plan states that new developments must be considered Air Quality Neutral. Pollutant emissions associated with traffic generated by the development were compared to relevant benchmarks. This indicated that transport emissions from the proposals were below the benchmarks and as such, no further action will be required to tackle excess development emissions.

Based on the assessment results and provision of mitigation measures, the site should be considered suitable for the proposed end use. The use of robust assumptions, where necessary, were considered to provide sufficient results confidence for an assessment of this nature.

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1. INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd was commissioned by Ridge and Partners on behalf of the Department for Education to undertake an Air Quality Assessment in support of the proposed development at the former Hampstead Police Station, London.

It is understood that a revised planning application is to be submitted for an updated layout for the proposed primary school at the former Hampstead police Station, London. An Air Quality Assessment was conducted in March 2016 (ref. AQ101271r1) and since submission of the original assessment, more up to date information has become available and as such, it is necessary to submit an updated Air Quality Assessment with the application.

Additionally, it is understood that the original application was refused by the London Borough of Camden (LBoC) with reasons stating:

> *"In the absence of sufficient information, the applicant has failed to demonstrate that the proposed development would not have a detrimental impact on air quality as a result of the proposal, contrary to policies CS13 (Tackling climate change through promoting higher environmental standards) and CS16 (Improving Camden's health and wellbeing) of the London Borough of Camden Local Development Framework Core Strategy; and policy DP32 (Air quality and Camden's Clear Zone) of the London Borough of Camden Local Development Framework Development."*

An updated Air Quality Assessment is therefore required in order address the concerns raised by LBoC and to define baseline conditions, assess site suitability for the proposed end-use and consider potential impacts as a result of the development in accordance with the requirements of the National Planning Policy Framework (NPPF) and Greater London Authority (GLA).

1.2 Site Location and Context

The site is located at the former Hampstead Police Station, London at approximate National Grid Reference (NGR): 526880, 185560. Reference should be made to Figure 1 within Appendix I for a location plan.

The proposed development is located within the London Borough of Camden (LBoC) Air Quality Management Area (AQMA) which has been declared for exceedances of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO_2) and the 24-hour mean AQO for and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}). Subsequently, the development has the potential to introduce future site users to poor air quality. Additionally, the proposals have the potential to cause impacts on existing pollution levels at nearby sensitive receptors within the AQMA. Potential impacts may arise as a result of fugitive dust emissions associated with construction works, and road traffic exhaust emissions associated with the operational phase

An Air Quality Assessment is therefore required in order to define baseline conditions, assess site suitability for the proposed end-use and consider potential impacts as a result of the development. This detailed within the following report.

1.3 Limitations

This report has been produced in accordance with REC's standard terms of engagement. REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2. LEGISLATION AND POLICY

2.1 European Legislation

European Union (EU) air quality legislation is provided within Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new air quality objectives for particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$). The consolidated Directives include:

- Directive 99/30/EC - the First Air Quality "Daughter" Directive - sets ambient Air Quality Limit Values (AQLVs) for NO_2, oxides of nitrogen (NO_x), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10});
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK Legislation

The Air Quality Standards (Amendment) Regulations (2016) came into force on 31st December 2016. These Regulations amend the Air Quality Standards Regulations 2010 and transpose the EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 6 pollutants.

Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published in July 2007[1]. The AQS sets out AQOs that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale. These are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 1 presents the AQOs for pollutants considered within this assessment.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration (µg/m^3)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM_{10}	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
$PM_{2.5}$	25	Annual mean

Table 2 summarises the advice provided in Greater London Authority (GLA) guidance LLAQM.TG (16)[2] on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives Should 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 Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
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-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 be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

[2] London Local Air Quality Management Technical Guidance 2016 LLAQM.TG (16), GLA, 2016.

2.3 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves considering present and likely future air quality against the AQOs. If it is predicted that levels at sensitive locations where members of the public are regularly present for the relevant averaging period are likely to be exceeded, the LA is required to declare an AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 Dust

The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2018) are those provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

> *"any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."*

Enforcement of the Act, in regard to nuisance, is currently under the administration of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). Enforcement can insist that there be no dust beyond the boundary of the works. The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practice measures.

2.5 National Planning Policy

2.5.1 National Planning Policy Framework

The National Planning Policy Framework[3] (NPPF) was published on 24th July 2018 and sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to this assessment:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality.*
>
> *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*

[3] National Planning Policy Framework, Department for Communities and Local Government, 2018.

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."

The implications of the NPPF have been considered throughout this assessment.

2.5.2 National Planning Practice Guidance

The National Planning Practice Guidance[4] (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 to support the NPPF and make it more accessible. The relevant air quality sections are highlighted below:

Paragraph 001 states that: *"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values" and "It is important that the potential impact of new development on air quality is taken into account, where the national assessment indicates that relevant limits have been exceeded or are near the limit". The role of Local Authorities under LAQM are stated and that Air Quality Action Plans should "identify measures that will be introduced in pursuit of the objectives"*

Paragraph 005 states that *"Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation*

Paragraph 007 states that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality". In terms of mitigation, it states that "Mitigation options where necessary will be location specific, will depend on the proposed development and should be proportionate to the likely impact".*

Paragraph 009 shows a flow chart highlighting how the assessment of air quality impacts should fit into the development management process. It makes it clear that air quality impact risks, AQLVs and AQOs should be considered in the decision-making process.

These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

[4] http://planningguidance.planningportal.gov.uk/

2.6 Local Planning Policy

2.6.1 The London Plan

The Minor Alterations to The London Plan[5] was published in March 2016 and sets out a fully integrated economic, environmental, transport and social framework for the development of the capital until 2031. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

The London Plan policies relating to air quality are outlined below:

"***Policy 3.2 Improving health and addressing health inequalities***

Strategic

- *The Mayor will take account of the potential impact of development proposals on health and health inequalities within London. The Mayor will work in partnership with the NHS in London, boroughs and the voluntary and community sector as appropriate to reduce health inequalities and improve the health of all Londoners, supporting the spatial implications of the Mayor's Health Inequalities Strategy.*

- *The Mayor will promote London as a healthy place for all – from homes to neighbourhoods and across the city as a whole – by:*

- *Coordinating planning and action on the environment, climate change and public health to maximise benefits and engage a wider range of partners in action*

[…]

- *The impacts of major development proposals on the health and wellbeing of communities should be considered, for example through the use of Health Impact Assessments (HIA).*

Planning decisions

- *New developments should be designed, constructed and managed in ways that improve health and promote healthy lifestyles to help to reduce health inequalities.*

Policy 5.3 - Sustainable design and construction

Strategic

- *The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.*

[5] The London Plan, Minor Alterations to the London Plan, Greater London Authority, March 2016.

Planning decisions

- *Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.*

- *Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:*

  […]

- *Minimising pollution (including noise, air and urban run-off)*

  […]

Policy 7.14 - Improving air quality

Strategic

- *The Mayor recognises the importance of tackling air pollution and improving air quality to London's development and the health and well-being of its people. He will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimise public exposure to pollution.*

Planning decisions

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 those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3).*

- *Promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Council's '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 Air Quality Management Areas (AQMAs).*

- *Ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly*

demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches."

These policies have been considered throughout the completion of this Air Quality Assessment.

The Draft New London Plan sets out the proposed development strategy for London from 2019 to 2041. It was consulted from 29th November 2017 until 2nd March 2018. A review of the Draft New London Plan indicated the following policy in relation to air quality:

"***Draft Policy SI1 Improving air quality***

London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced:

- *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) reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality

  d) create unacceptable risk of high levels of exposure to poor air quality.

- *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. Particular care should be taken with developments that are 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.*

- *The development of large-scale redevelopment areas, such as Opportunity Areas and those subject to an Environmental Impact Assessment should propose methods of achieving an Air Quality Positive approach through the new development. All other developments should be at least Air Quality Neutral.*

- *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*

- *Air Quality Assessments (AQAs) should be submitted with all major developments, unless they can demonstrate that transport and building emissions will be less than the previous or existing use.*

- *Development proposals should ensure that where emissions need to be reduced, this is done on-site. Where it can be demonstrated that on-site provision is impractical or*

inappropriate, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated."

This policy has been considered throughout the undertaking of this Air Quality Assessment. However, it should be noted that the plan carries limited weight in the determination of this application.

2.7 London Borough of Camden Local Plan

The Local Plan was adopted by LBoC in July 2017 and sets out the Council's planning policies and has replaced the Core Strategy and Camden Development Policies planning documents (adopted in 2010). It ensures that Camden continues to have robust, effective and up to-date planning policies that respond to changing circumstances and the borough's unique characteristics and contribute to delivering the Camden Plan and other local priorities. The Local Plan will cover the period from 2016-2031.

As such, the policies contained within the Local Plan provide the current basis for the determination of planning applications within the London Borough of Camden.

A review of the Local Plan indicated the following policy in relation to air quality that is relevant to this assessment:

"Policy A1 Managing the impact of development

The Council will seek to protect the quality of life of occupiers and neighbours. We will grant permission for development unless this causes unacceptable harm to amenity.

We will:

a) *seek to ensure that the amenity of communities, occupiers and neighbours is protected;*
b) *seek to ensure development contributes towards strong and successful communities by balancing the needs of development with the needs and characteristics of local areas and communities;*
c) *resist development that fails to adequately assess and address transport impacts affecting communities, occupiers, neighbours and the existing transport network; and*
d) *require mitigation measures where necessary.*

The factors we will consider include:

e) *visual privacy, outlook;*
f) *sunlight, daylight and overshadowing;*
g) *artificial lighting levels;*
h) *transport impacts, including the use of Transport Assessments, Travel Plans and Delivery and Servicing Management Plans;*
i) *impacts of the construction phase, including the use of Construction Management Plans;*
j) *noise and vibration levels;*
k) *odour, fumes and dust;*

l) microclimate;
m) contaminated land; and
n) impact upon water and wastewater infrastructure."

"Policy CC4 Air quality

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."

These policies have been considered where appropriate throughout the undertaking of this Air Quality Assessment.

3. METHODOLOGY

The proposed development has the potential to expose future site users to elevated pollution levels as well as causing air quality impacts during the construction phase. These issues have been assessed in accordance with the following methodology.

3.1 Construction Phase Assessment

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the GLA document 'The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance'[6].

Activities on the proposed construction site have been divided into three types to reflect their different potential impacts. These are:

- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- 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 assessment steps are detailed below.

3.1.1 Step 1

Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 350m from the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should proceed to Step 2. Additionally, should ecological receptors be identified within 50m of the boundary site or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should also proceed to Step 2.

Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

3.1.2 Step 2

Step 2 assesses the risk of potential dust impacts. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and

[6] The Control of Dust and Emissions During Construction And Demolition Supplementary Planning Guidance, GLA, 2016.

- The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).

The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.

Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 3.

Table 3 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Earthworks	• Total site area greater than 10,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • More than 10 heavy earth moving vehicles active at any one time • Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m^3 • On site concrete batching • Sandblasting
	Trackout	• More than 50 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Earthworks	• Total site area 2,500m^2 to 10,000m^2 • Moderately dusty soil type (e.g. silt) • 5 to 10 heavy earth moving vehicles active at any one time • Formation of bunds 4m to 8m in height • Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	• Total building volume 25,000m^3 to 100,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching
	Trackout	• 10 to 50 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m

Magnitude	Activity	Criteria
Small	Earthworks	• Total site area less than 2,500m^2 • Soil type with large grain size (e.g. sand) • Less than 5 heavy earth moving vehicles active at any one time • Formation of bunds less than 4m in height • Total material moved less than 20,000 tonnes • Earthworks during wetter months
	Construction	• Total building volume less than 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• Less than 10 HDV trips per day • Surface material with low potential for dust release • Unpaved road length less than 50m

Step 2B defines the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table 4**.**

Table 4 Examples of Factors Defining Sensitivity of an Area

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	• Users expect of high levels of amenity • High aesthetic or value property • People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	• Internationally or nationally designated site e.g. Special Area of Conservation
Medium	• Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • 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 e.g. parks and places of work	• Nationally designated site e.g. Sites of Special Scientific Interest

Sensitivity	Examples	
	Human Receptors	Ecological Receptors
Low	• Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	• Locally designated site e.g. Local Nature Reserve

The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts during the construction phase:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

These factors were considered in the undertaking of this assessment.

The sensitivity of the area to dust soiling effects on people and property is shown in Table 5.

Table 5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table 6 outlines the sensitivity of the area to human health impacts.

Table 6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m^3	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m^3	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m^3	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	-	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
Low	-	1 - 10	Low	Low	Low	Low	Low

Table 7 outlines the sensitivity of the area to ecological impacts.

Table 7 Sensitivity of the Area to Ecological Impacts

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

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts.

Table 8 outlines the risk category from earthworks and construction activities.

Table 8 Dust Risk Category from Earthworks and Construction

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

Table 9 outlines the risk category from trackout.

Table 9 Dust Risk Category from Trackout

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

3.1.3 Step 3

Step 3 requires the identification of site specific mitigation measures within the GLA guidance to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with **negligible** risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

3.1.4 Step 4

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'.

The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The GLA[6] guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix III.

3.2 Operational Phase Impact Assessment

3.2.1 Future Exposure

The proposed development includes sensitive land uses and is located within an AQMA. As such, the proposals have the potential to introduce new receptors into an area of existing poor air quality. Detailed dispersion modelling was therefore undertaken to quantify NO_2, PM_{10} and $PM_{2.5}$ concentrations across the site and determine suitability for the proposed end-use. Reference should be made to Appendix II for details of the assessment inputs.

The results of the dispersion modelling assessment were compared against the Air Pollution Exposure Criteria (APEC) contained within the London Councils Air Quality and Planning Guidance[7] from the London Air Pollution Planning and the Local Environment (APPLE) working group. These are outlined in Table 10.

Table 10 Air Pollution Exposure Criteria

Category	Applicable Range	Recommendation
APEC - A	Below 5% of the annual mean AQO	No air quality grounds for refusal; however, mitigation of any emissions should be considered
APEC - B	Between 5% below or above the annual mean AQO	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g. maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised
APEC - C	Above 5% of the annual mean AQO	Refusal on air quality grounds should be anticipated, unless the LA has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures

It should be noted that significant areas of London would fall under APEC - C due to high NO_2 concentrations throughout the city. As such, a presumption against planning consent in these locations may result in large areas of land becoming undevelopable and prevent urban regeneration. The inclusion of suitable mitigation measures to protect future users is therefore considered a suitable way to progress sustainable schemes in these locations and has been considered within this assessment.

3.2.2 Road Vehicle Exhaust Emissions

The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$ associated with vehicles travelling to and from the site. A screening assessment was therefore undertaken using the criteria contained within the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) 'Land-Use Planning & Development Control: Planning for Air Quality (2017)'[8] guidance documents to determine the potential

[7] London Councils Air Quality and Planning Guidance, London Councils, 2007.
[8] Land-Use Planning & Development Control: Planning for Air Quality, EPUK and IAQM, January 2017 Update.

for trips generated by the development to affect local air quality.

The EPUK and IAQM guidance[8] document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:

- Proposals that will cause a change in Light Duty Vehicle (LDV) flows of more than 100 AADT within or adjacent to an AQMA or more than 500 elsewhere;
- Proposals that will cause a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 elsewhere;
- Proposals that would realign roads within an AQMA by more than 5m;
- Proposals that will introduce new junctions or remove existing junctions near relevant receptors;
- Proposals that will introduce or change a bus station or change flows of buses by more than 25 AADT within an AQMA or more than 100 AADT elsewhere;
- Proposals which will include an underground car park with extraction system which will be within 20m of a relevant receptor and have more than 100 movements per day;
- Proposals which include either a centralised plant using biofuel, a combustion plant with single or thermal input >300KWh or a standby emergency generator associated with a centralised energy centre; and
- Proposals which include combustion processes of any size.

Should these criteria not be met, then the EPUK and IAQM guidance[8] documents consider air quality impacts associated with a scheme to be **not significant** and no further assessment is required. Should screening of the traffic data indicate that any the above criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the predicted change in NO_2 and PM_{10} concentrations as a result of the proposed development. The significance of predicted impacts can then be determined in accordance with the methodology outlined in the EPUK and IAQM guidance[8].

3.2.3 Combustion Emissions

The development includes the provision of on-site energy generating facilities, which may have the potential to impact on existing air quality. The following information has been provided by the client, and is set to be installed as part of the scheme:

- **3No. Mikrofill Ethos 130 Gas Condensing Boilers – Rated at 134.3kW**
  - *NOx emissions 33Mg/kWh or 1.231mg/s (3.692mg/s combined)*
- **1No. Greenstar i Gas Condensing Boiler – Rated at 21.5.6kW**
  - *NOx emissions 49Mg/kWh or 0.293mg/s (max)*

Following the above specifications, a screening assessment was undertaken following the criteria provided within the EPUK and IAQM[8] guidance documents to determine whether a detailed assessment of energy emissions is required.

The EPUK and IAQM[8] document states the following criteria to establish when an air quality assessment is likely to be considered necessary:

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

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

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

    a) *As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler or a 30kW CHP unit operating at*

Should these criteria not be met, then the guidance document considers air quality impacts associated with the energy generating facilities to be not significant and no further assessment is required.

Should screening of the energy emissions breach the above criteria, then potential impacts at sensitive receptor locations can be assessed by calculating the predicted change in pollutant concentrations as a result of the operation of the plant facility. The significance of predicted impacts can then be determined in accordance with the methodology outlined in the EPUK and IAQM guidance[8].

3.3 Air Quality Neutral

An assessment is usually undertaken to compare benchmark emissions with the application site use emissions in accordance with the methodology outlined within the GLA Air Quality Neutral Planning Support GLA 80371[9]. The methodology is outlined below:

3.3.1 Air Quality Neutral Assessment

The following potential scenarios have been considered within the assessment:

- Benchmark; and
- Development.

The benchmark scenario is representative of annual NO_x benchmark emissions, which are target emissions as defined by the GLA Guidance[9]. The development scenario is representative of the annual NO_x emissions from the operation of the proposed development only.

The following emission source was considered during the assessment:

- Road vehicles travelling to and from the application site
- On-site energy generation

3.3.2 Road Vehicle Exhaust Emissions

9 Air Quality Neutral Planning Support: GLA 80371, Air Quality Consultants Ltd in association with ENVIRON UK Ltd, 2014.

The proposed development has the potential to cause variations in exhaust emissions associated with vehicles travelling to and from the site. These were assessed by calculating annual emissions based on the anticipated traffic generated by the site and standard emission factors provided in the Air Quality Neutral Planning Support GLA 80371[9], as shown in Table 11.

Table 11 Air Quality Neutral Road Transport Emission Factors

Pollutant	g/vehicle-km in Outer London
NO_x	0.37
PM_{10}	0.0665

3.3.3 Energy Emissions

The proposed redevelopment has the potential to change NO_x emissions as a result of variations in CHP and boiler technologies used in the provision of heating and hot water. This was assessed by calculating annual emissions based on the anticipated energy usage of the site and standard release rates provided by the Air Quality Neutral Planning Support GLA 80371[9].

4. BASELINE

Existing air quality conditions in the vicinity of the proposed development site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

4.1 Local Air Quality Management

As required by the Environment Act (1995), LBoC has undertaken Review and Assessment of air quality within their area of administration. This process has indicated that annual mean concentrations of NO_2 and 24-hour PM_{10} concentrations are above their relevant AQOs throughout the borough. As such, an AQMA has been declared, described as:

"London Borough of Camden AQMA - The whole borough"

The proposed development is located within the LBoC AQMA. As such, there is the potential for future residents to be exposed to elevated pollutant concentrations, as well as the potential to cause impacts to air quality within this area. This has been considered within this report.

LBoC have concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs and as such no further AQMAs have been designated.

4.2 Air Quality Monitoring

LBoC undertakes monitoring of pollutant concentrations using passive diffusion tubes throughout the borough. A review of the most recent Air Quality Annual Status Report[10] indicated one diffusion tube in the vicinity of the site, which would provide a true representation of NO_2 concentrations across the site. The most recent monitoring results are indicated in Table 12, with exceedances of the relevant AQO highlighted in **bold.**

Table 12 Diffusion Tube Monitoring Results

Site ID	Location	Type	NGR (m)		Annual Mean NO_2 Concentration ($\mu g/m^3$)		
			X	Y	2014	2015	2016
CA17	47 Fitzjohn's Road	Roadside	526547	185125	**60.30**	**55.80**	**56.38**

As indicated in Table 12, the annual mean AQO for NO2 was exceeded at the monitoring site in recent years. This is due to its roadside location within an AQMA in London. Reference should be made to Figure 2 within Appendix I for a graphical representation of the monitoring locations.

Although, recent data was not available for location CA17, is considered the most representative site in context of the proposed development site. Therefore, in the absence of 2017 data, 2016 data was utilised throughout the assessment. This assessment approach has been scoped with LBoC.

[10] London Borough of Camden, Air Quality Annual Status Report for 2017

4.3 Background Pollutant Concentrations

Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The proposed development site is located in grid square NGR: 526500, 185500. Data for this location was downloaded from the DEFRA website[11] for the purpose of this assessment and is summarised in Table 13 for the verification year (2016) and the predicted development opening year (2022).

Table 13 Predicted Background Concentrations

Pollutant	Predicted Background Concentration (µg/m^3)	
	2016	2022
NO_x	47.34	36.99
NO_2	29.41	24.05
PM_{10}	18.86	18.02
$PM_{2.5}$	13.53	12.74

**Used for calculation purposes only, there is no associated AQO.*

As shown in Table 13, background concentrations of PM_{10}, $PM_{2.5}$ and NO_2 did not exceed the relevant AQOs. Comparison with the monitoring results indicates the impact that vehicle exhaust emissions from the highway network have on pollutant concentrations at roadside locations.

4.4 Construction Phase Sensitive Receptors

Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350m from the development boundary. These are summarised in Table 14.

Table 14 Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Less than 20	10 -100	0
20 - 50	More than 100	0
50 - 100	More than 100	-
100 - 350	More than 100	-

Reference should be made to Figure 3 within Appendix I for a graphical representation of earthworks and construction dust buffer zones.

Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of

[11] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.

the area up to 50m from the road network within 500m of the site access route. These are summarised in Table 15. The exact construction vehicle access routes were not available for the purpose of this assessment as they will depend on sourcing of materials. This is likely to be decided by the contractor. However, it was assumed construction traffic would access the site from Rosslyn Hill to ensure the maximum potential trackout distance was considered.

Table 15 Trackout Dust Sensitive Receptors

Distance from Site Access Route (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Less than 20	More than 100	0
20 - 50	More than 100	0

Reference should be made to Figure 4 within Appendix I for a graphical representation of trackout dust buffer zones.

There are no ecological receptors within 50m of the site or trackout boundary. As such, ecological impacts have not been assessed further within this report.

A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 16.

Table 16 Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The proposal is located in a residential and commercial area. As such, there is likely to have been a history of dust generating activities due to redevelopment in the locality, as well as dust generated from commuting activities.
The likelihood of concurrent dust generating activity on nearby sites	A review of the London Development database indicated that there are a number of planning applications for minor residential developments within 500m of the development site. As such, there is the potential for concurrent dust generation if the construction phases overlap
Pre-existing screening between the source and the receptors	There is vegetation present along the northern and eastern boundaries of the site. If retained, this may provide some pre-existing screening to receptors in these directions
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the south-west of the development, as shown in Figure 5 within Appendix I. As such, properties to the north-east of the proposed development would be most affected by dust emissions

Guidance	Comment
Conclusions drawn from local topography	The topography of the area appears to be predominantly flat. As such, there are no constraints to dust dispersion
Duration of the potential impact, as a receptor may become more sensitive over time	Currently it is unclear as to the duration of the construction phase. However, given the predicted 2022 opening year it is likely to extend over one year
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline

Based on the criteria shown in Table 4, the sensitivity of the receiving environment to potential dust impacts was considered to be **high**. This was because users would expect to enjoy a reasonable level of amenity, aesthetics or value of their property could be diminished by soiling and people would be expected to be present for extended periods of time e.g. residential properties.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria shown in Section 3.1.2 is shown in Table 17.

Table 17 Sensitivity of the Surrounding Area

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

5. ASSESSMENT

There is the potential for air quality impacts as a result of the construction phase of the development in addition to the exposure of future site users to elevated pollution levels. These are assessed in the following Sections.

5.1 Construction Phase Assessment

5.1.1 Step 1

The undertaking of activities such as demolition, excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 350m of the site boundary. As such, a detailed assessment of potential dust impacts was required.

5.1.2 Step 2

Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. Information on soil type was not available for the purpose of this assessment. As such, the soil type was considered to be potentially dusty in order to provide a worst-case scenario.

The proposed development site is estimated to cover a total area less than 2,500m^2. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from earthworks is therefore **small**.

Table 17 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8 the development is considered to be a **low** risk site for dust soiling as a result of earthworks activities.

Table 17 indicates the sensitivity of the area to human health is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **negligible** risk site for human health as a result of earthwork activities.

Construction

Due to the size of the development site the total building volume is likely to be less than 25,000m^3. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from construction is therefore **small**.

Table 17 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 8, the development is considered to be a **low** risk site for dust soiling as a result of construction activities.

Table 17 indicates the sensitivity of the area to human health is **low**. In accordance with the criteria outlined in Table 8, the development is considered to be a **negligible** risk site for human health as a result of construction activities.

Trackout

Information on the number of HDV trips to be generated during the construction phase of the development was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known at this stage of the project.

Based on the site area, it is anticipated that the unpaved road length is likely to be less than 50m. In accordance with the criteria outlined in Table 3, the magnitude of potential dust emissions from trackout is therefore **small**.

Table 17 indicates the sensitivity of the area to dust soiling effects to people and property is **high**. In accordance with the criteria outlined in Table 9, the development is considered to be a **low** risk site for dust soiling as a result of trackout activities.

Table 17 indicates the sensitivity of the area to human health is **medium**. In accordance with the criteria outlined in Table 9, the development is considered to be a **negligible** risk site for human health as a result of trackout activities.

Summary of the Risk of Dust Effects

A summary of the risk from each dust generating activity is provided in Table 18.

Table 18 Summary of Potential Unmitigated Dust Risks

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

As indicated in Table 18, the potential risk of dust soiling is **low** from earthworks, construction and trackout activities. The potential risk of human health impacts is **negligible** from earthworks, construction and trackout activities.

It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

5.1.3 Step 3

The GLA guidance[6] provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the development site as summarised in Table 19. The mitigation measures outlined in Table 19 can be reviewed prior to the commencement of construction works and incorporated into the existing strategies as applicable.

Table 19 Fugitive Dust Mitigation Measures

Issue	Control Measure
Site Management	• Display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary • Display the head or regional office contact information • Record and respond to all dust and air quality pollutant emissions complaints • Make a complaint log available to the local authority when asked. • Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority when asked. • Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry or windy conditions • Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.
Preparing and Maintaining the Site	• Plan site layout so that machinery and dust causing activities are located away from receptors • Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site • Fully enclose site or specific operations where there is a high potential for dust production and the site as actives for an extensive period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods • Remove materials that have a potential to produce dust from site as soon as possible

Issue	Control Measure
Operating Vehicle/ Machinery and Sustainable Travel	• Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone • Ensure all non-road mobile machinery (NRMM) comply with the standards set within this guidance. • Ensure all vehicles to switch off engines - no idling vehicles • Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where possible • Impose and signpost a maximum-speed-limit of 10mph on surfaced haul routes and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate). • Implement a Travel Plan that supports and encourages sustainable travel
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems • Ensure an adequate water supply on the site for effective dust/particulate matter mitigation (using recycled water where possible). • Use enclosed chutes, conveyors and covered skips • Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
Waste Management	• Reuse and recycle waste to reduce dust from waste materials • Avoid bonfires and burning of waste materials
Construction	• Avoid scabbling (roughening of concrete surfaces) if possible • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place
Trackout	• Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport. • Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)

5.1.4 Step 4

Assuming the relevant mitigation measures outlined in Table 19 are implemented, the residual effect from all dust generating activities is predicted to be **not significan**t, in accordance with the GLA guidance[6].

5.2 Operational Phase Assessment

The proposed development has the potential to expose future users to elevated pollution levels. This was assessed through dispersion modelling, with the results presented in the following Sections.

Reference should be made to Appendix II for full assessment input details.

5.2.1 Nitrogen Dioxide - Annual Mean

Annual mean NO_2 concentrations were predicted across development site at ground floor (1.5m) and first floor (4.7m) level for the development opening year (2022), as shown in Figure 6 and Figure 7 within Appendix I.

Annual mean NO_2 concentrations across the development site are summarised in Table 20.

Table 20 Predicted Annual Mean NO_2 Concentrations

Floor	Predicted 2022 Annual Mean NO_2 Concentration Range ($\mu g/m^3$)	APEC Category
Ground Floor (1.5m)	34.07 – **45.10**	A-C
First Floor (4.7m)	33.70 – 39.15	A-B

Table 20 indicates that predicted NO_2 concentrations exceeded the annual mean AQO across the proposed development site on the ground floor level (1.5m). In accordance with the London Councils Air Quality and Planning Guidance[7] the implementation of suitable mitigation measures is required to protect future site users from poor air quality. Further details on the requirement of protective mitigation techniques are detailed in Section 6.

Predicted concentrations across sensitive uses on the first-floor level and above were predicted to be classified as APEC A, and as such there is no requirement for mitigation measures. It is considered that background NO_2 levels are likely to be lower at heights above the first-floor level due to increased distance from emission sources, such as the local road network. Therefore, predicted concentrations at heights above ground floor level are deemed to be acceptable in relation to pollutant exposure and have not been considered further.

Predictions of 1-hour NO_2 concentrations were not produced as part of the dispersion modelling assessment. However, as stated in LLAQM (TG16)[2] if annual mean NO_2 concentrations are below $60\mu g/m^3$ then it is unlikely that the 1-hour AQO will be exceeded. As such based on the results it is not predicted that concentrations will exceed the 1 hour mean AQO for NO_2 across the development site.

Pollutants concentrations at the location of the proposed outdoor space (playground) have predicted annual mean NO_2 concentrations to range from 34.34 – **40.03**$\mu g/m^3$. The predicted exceedance is marginally above the annual mean AQO and is localised to the corner of the school building by the student entrance. However, it should be noted that playground areas are not sensitive to long-term exposure, as indicated in Table 2. With regards to the short-term objective (1-hour mean) limit value, which is more appropriate to exposure at a playground, concentrations are not expected to exceed the limit value in line with LLAQM (TG16)[2] as detailed above.

It should be further noted that the assessment is considered conservative in its assumptions; where emissions rates and background concentrations used have not been forecast to improve in future years. This is in-line with industry standard practice.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for the proposed use, subject to the implementation of mitigation techniques to protect future site users from elevated NO_2 concentrations.

5.2.2 Particulate Matter (PM_{10}) - Annual Mean

Annual Mean PM_{10} concentrations were modelled across the development site at ground floor (1.5m) level for the development opening year (2022), as shown in Figure 7 within Appendix I.

The predicted concentrations for the development opening year across the development site are summarised in Table 21.

Table 21 Predicted Annual Mean PM_{10} Concentrations

Floor	Predicted 2022 Annual Mean PM_{10} Concentration Range ($\mu g/m^3$)	APEC Category
Ground Floor (1.5m)	20.31- 23.85	A

As indicated in Table 21 there were no predicted exceedances of the annual mean AQO for PM_{10} across the proposed development at the ground floor level and is classified as APEC - A as in accordance with the London Councils Air Quality and Planning Guidance[7].

Similar to NO_2, it is considered that PM_{10} concentrations are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at elevations above the ground floor level have not been included within this assessment.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect future site users from annual mean PM_{10} concentrations.

5.2.3 Particulate Matter ($PM_{2.5}$) – Annual Mean

Annual Mean $PM_{2.5}$ concentrations were modelled across the development site at ground floor (1.5m) level for the development opening year (2022), as shown in Figure 8 within Appendix I.

The predicted concentrations for the development opening year across the development site are summarised in Table 22.

Table 22 Modelling Results - Annual Mean $PM_{2.5}$

Elevation (m)	Predicted 2022 Annual Mean $PM_{2.5}$ Concentration Range ($\mu g/m^3$)
Ground Floor (1.5m)	14.43 – 16.66

The predicted concentrations shown in Table 22 indicate that there were no exceedances of the AQO across the proposed development site. As such, there is predicted to be no risk of exceedance of the annual mean AQO for $PM_{2.5}$ at the proposed educational units on floor levels above the ground floor.

Similar to NO_2 and PM_{10}, it is considered that $PM_{2.5}$ concentrations are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at elevations above the ground floor level have not been included within this assessment.

Based on the results of the dispersion modelling assessment, the site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect future site users from elevated $PM_{2.5}$ concentrations.

5.2.4 Road Traffic Exhaust Emissions

Any additional vehicle movements associated with the proposed development will generate exhaust emissions, such as NO_2, PM_{10} and $PM_{2.5}$ on the local and regional road networks. Paul Mew Associates, the Transport Consultants for the project, indicated that the proposals are anticipated to produce a maximum of 44 trips on the local network per day.

Based on this information, the development will not result in a change of AADT movements of more than 100, produce over 25 HDV movements per day or significantly affect average speeds on the local road network. Additionally, it is unlikely that the proposed development will generate or increase traffic congestion, give rise to a significant change in AADT or peak traffic flows or in vehicle speed, significantly alter the traffic composition on local roads or include significant new car parking. As such, potential air quality impacts associated with operational phase road vehicle exhaust emissions are predicted to be **negligible**, in accordance with the EPUK and IAQM[8] screening criteria shown in Section. 3.2.2.

5.2.5 Combustion Emissions

The development has the provision for on-site energy generating facilities in the form of 4 gas condensing boilers, which may have the potential to impact on existing air quality. Details on the proposed equipment specified by the mechanical engineer is listed below:

- 3No. Mikrofill Ethos 130 Gas Condensing Boilers – Rated at 134.3kW
    - *NOx emissions 33Mg/kWh or 1.231mg/s (3.692mg/s combined)*
- 1No. Greenstar i Gas Condensing Boiler – Rated at 21.5kW
    - *NOx emissions 49Mg/kWh or 0.293mg/s (max)*

As a result, the proposals will provide a combined combustion plant with a total NO_x emission rate of **3.985mg/s.** Following the indicative criteria presented in the IAQM guidance[8] impacts associated with the operation of the gas condensing boilers can be deemed **not significant** given that the NO_x emission rate is below the suggest threshold of **5.0mg/s**. It should also be noted this calculation is based on a

worst-case scenario, considering the maximum combined capacity of the 4 boiler units referred to above.

Further indication of the assessment non significance, relates to the existing NO_2 concentrations which are also relatively low in the vicinity of the site. As such an emission rate in excess of **5.0mg/s** may be considered acceptable.

5.3 Air Quality Neutral Assessment

The Transport Emissions Benchmark (TEB) has been calculated using the GLA Air Quality Neutral Planning Support Guidance document based on the land-use class of the proposed development. The floor area for the school was provided by Ridge & Partners LLP. The TEBs are those provided in the GLA Air Quality Neutral Planning Support document and are detailed in Table 23 below.

It should be noted that assumptions were made regarding the land use category. This is because there are no TEBs available for the school land use category and as such, the TEB for the B1 (Office) land use category has been utilised, as stated within the GLA Air Quality Neutral Planning Support document. This is due to similar peak period movements in traffic between an Office unit and a School.

Table 23 Transport Emission Benchmarks

Land Use	Quantity (m^2 or number of dwellings)	NO_x		PM_{10}	
		TEB ((NO_x (g/m^2/year) /(g/dwelling/ year))	NO_x per Land Use (kg/year)	TEB ((PM_{10} (g/m^2/year) /(g/dwelling/ year))	PM_{10} per Land Use (kg/year)
B1 - Office	2,187	11.4	24.9	2.1	4.5
Total	**-**	**11.4**	**24.9**	**2.1**	**4.5**

As indicated in Table 23, the total annual NO_x emission TEB is 24.9kg/year and the total annual PM_{10} emission TEB is 4.5kg/year.

Development Emissions

Estimated development road transport emissions were calculated using traffic data provided by Paul Mew Associates. As schools are not operational throughout the entirety of the year, the AADT was calculated based on a 190-day school year, as indicated in The School Day and Year (England) briefing document[12]. The number of daily trips was used to calculate annual NOx and PM_{10} based on emission factors provided in the GLA Air Quality Neutral Planning Support document, as shown in Table 24. A summary of the traffic data used in the assessment is provided in Table 24. In the absences of a TEB for D1 use, B1 – Office was considered the most appropriate given the AM/PM peak traffic generation.

[12] House of Commons Library Briefing Paper 07148, The School Day and Year (England), 2016

Table 24 Development Emissions - Traffic Data

Land use	24-hour AADT Flow	Road Type	Average Distance (km/m^2/annum) or (km/dwelling/annum)
B1 - Office	23	London - Inner	7.7

The inputs outlined in Table 23 and Table 24 were utilised to calculate development road vehicle exhaust emissions. This is summarised in Table 25.

Table 25 Development Emissions - Road Vehicle Exhaust Emissions

Land Use	NO_x Emission (kg/year)	PM_{10} Emission (kg/year)
B1 - Office	23.9	4.3
Total	**23.9**	**4.3**

The TEB and development road traffic exhaust emissions were calculated using the inputs and methodology outlined in Section 3.2.2. These are summarised in Table 26.

Table 26 Development Road Vehicle Exhaust Emissions

Scenario	NO_x Emission (kg/year)	PM_{10} Emission (kg/year)
TEB	24.9	4.5
Development Emissions	23.9	4.3
Difference	**-1.01**	**-0.18**

As indicated in Table 26, annual NO_x and PM_{10} road vehicle exhaust emissions are below the TEB by 1.19kg/year.

5.3.1 Energy Emissions

Similar to the TEB, the Building Emissions Benchmark (BEB) has been calculated using the GLA Air Quality Neutral Planning Support[9] guidance document based on the land-use class of the proposed development.

The floor area was provided by Ridge & Partners LLP. The BEBs are those provided in the GLA Air Quality Neutral Planning Support document. This is detailed in Table 27. In this case a BEB for D1 (c-h) Schools was available.

Table 27 Energy Emission Benchmarks

Land Use	Quantity (m^2)	NO_x	
		BEB (NO_x ($(g/m^2/year)$)	NO_x per Land Use (kg/year)
D1 (c-h) - Schools	2,187.0	31.0	67.8
Total	**2,187.0**	**31.0**	**67.8**

As indicated in Table 27, the total annual NO_x emission BEB is 67.8kg/year.

Development Emissions

Development energy emissions were calculated using emission rates for the proposed gas boilers and CHP. Anticipated annual operational hours for the boiler units were provided by Ridge & Partners LLP, indicating a maximum annual operational period of 1800 hours. The relevant input data is outlined in Table 28.

Table 28 Development Energy Emissions

Source	NO_x emissions (kg/yr)
Boilers (combined)	25.8
Total	**25.8**

The BEB and development energy emissions were calculated using the inputs and methodology outlined in Sections a 3.3.3. These are summarised in Table 29.

Table 29 Energy Emissions

Scenario	NO_x Emission (kg/year)
BEB	67.8
Development Emissions	25.8
Difference	**-42.0**

As indicated in Table 29, annual development NO_x emissions from the energy provision are below the BEB by 42.0kg/year.

5.3.2 Air Quality Neutral Assessment Summary

Overall comparison of the TEB and BEB with the development emissions are summarised in Table 30.

Table 30 Benchmark vs. Development Emissions

Scenario	Source	Annual NO_x Emissions (kg/yr)	Annual Total NO_x Emissions (kg/yr)	Annual PM_{10} Emissions (kg/yr)	Annual Total PM_{10} Emissions (kg/yr)
Benchmark	Road Vehicles	24.9	92.7	4.5	4.5
	Energy	67.8		-	
Development Emissions	Road Vehicles	23.9	49.7	4.3	4.3
	Energy	25.8		-	
Difference	**Road Vehicles**	**-1.0**	**-43.0**	**-0.2**	**-0.2**
	Energy	**-42.0**		**-**	

As indicated in Table 30, annual NO_x and PM_{10} emissions and annual NO_x emissions from energy emissions are predicted to be below the TEB and BEB. As such, the development is considered to be **Air Quality Neutral** in accordance with the GLA guidance[9].

6. MITIGATION

There are a number of air quality mitigation options available to reduce potential exposure of future site users to elevated pollutant concentrations. However, all techniques have financial implications and therefore, may affect scheme viability. As such, they should only be included if necessary.

6.1 Construction Phase

The GLA guidance provides a number of potential mitigation measures to reduce potential impacts from the construction phase. As a low risk of dust impacts as a result of earthworks, construction and trackout activities was identified mitigation measures are required. These have been adapted for the development site as summarised in Table 19. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan if required by LBoC.

6.2 Operational Phase

Detailed dispersion modelling undertaken at heights equivalent to the proposed building floor levels indicated that classrooms on the proposed lower ground floor (Reception, Year 1 and Year 2) may be exposed to concentrations of NO_2 between 5% below or above the annual mean AQO, and were subsequently classified as APEC – B.

The London Councils Air Quality and Planning Guidance[7] states that mitigation measures must be considered for such areas of exposure. Therefore, in accordance with the guidance, the inclusion of appropriate mitigation measures at specific classrooms (Reception, Year 1 and Year 2), as indicated in Figure 6 within Appendix I, is recommended in order to reduce the potential for exposure of future users to elevated pollutant concentrations.

It is proposed to include mechanical ventilation within the building design for the Reception, Year 1 and Year 2 classrooms across the proposed ground floor level. The air inlet should be located at the highest and farthest from the road possible location in an area with NO_2 concentrations below 38µg/m^3. Alternatively, the air inlet can be located at lower levels, at areas above 38µg/m^3, if required by design, providing a NO_x filtration system is included to the ventilation system.

Additionally, a high specification of air tightness on the windows and doors should be incorporated at the Reception, Year 1 and Year 2 classroom facades across ground floor level. The high specification of air tightness will also ensure the classrooms will be well ventilated by the mechanical ventilation system.

All classrooms on the first-floor level and above are classified as APEC – A and as such no mitigation is required for the classrooms located on these floor levels.

It should be noted that mitigation is not required for the proposed staff work room, office or toilets on the first-floor, as they are not considered a sensitive land use in the context of the annual mean exposure, as detailed in Table 2.

7. CONCLUSION

REC Ltd was commissioned by Ridge and Partners on behalf of the Department for Education to undertake an Air Quality Assessment in support of the proposed development at the former Hampstead Police Station, London.

The proposals comprise the redevelopment of the site to provide a primary school.

The site is located within the LBoC AQMA and as such, there is the potential to introduce future users to elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations, as well as to cause adverse impacts during the operational and construction phases. As such, an Air Quality Assessment was required to quantify pollution levels across the site, consider its suitability for the proposed end-use and assess potential impacts as a result of the development.

During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the GLA methodology. Assuming good practice dust control measures are implemented, the residual potential air quality impacts from dust generated by earthworks, construction and trackout activities was predicted to be **not significant**.

Dispersion modelling was undertaken in order to quantify pollutant concentrations at the site and assess potential exposure of future users. Concentrations of annual mean NO_2, PM_{10} and $PM_{2.5}$ were predicted across the development site and were subsequently verified using local monitoring results obtained from the LBoC.

Exceedances of the annual mean AQO for NO_2 were predicted across areas of sensitive use on the ground floor level. The modelling indicated classrooms on the ground floor (Reception, Year 1 and Year 2) were classified as APEC - B for predicted annual mean NO_2 concentrations. As such specific mitigation techniques will be required to protect future users from elevated concentrations at specified locations across the ground floor level. The annual mean AQO for PM_{10} was not exceeded at any location, and subsequently classified as APEC - A.

For the operational phase of the development, potential impacts may occur as a result of road traffic exhaust emissions associated with vehicles travelling to and from the site as well as combustion emission associated with the proposed CHP and boiler units. An assessment was therefore undertaken using the EPUK and IAQM[8] screening criteria to determine the potential for emissions generated by the development to affect local air quality. This indicated that impacts associated with vehicles travelling to and from the site were predicted to be **not significant**.

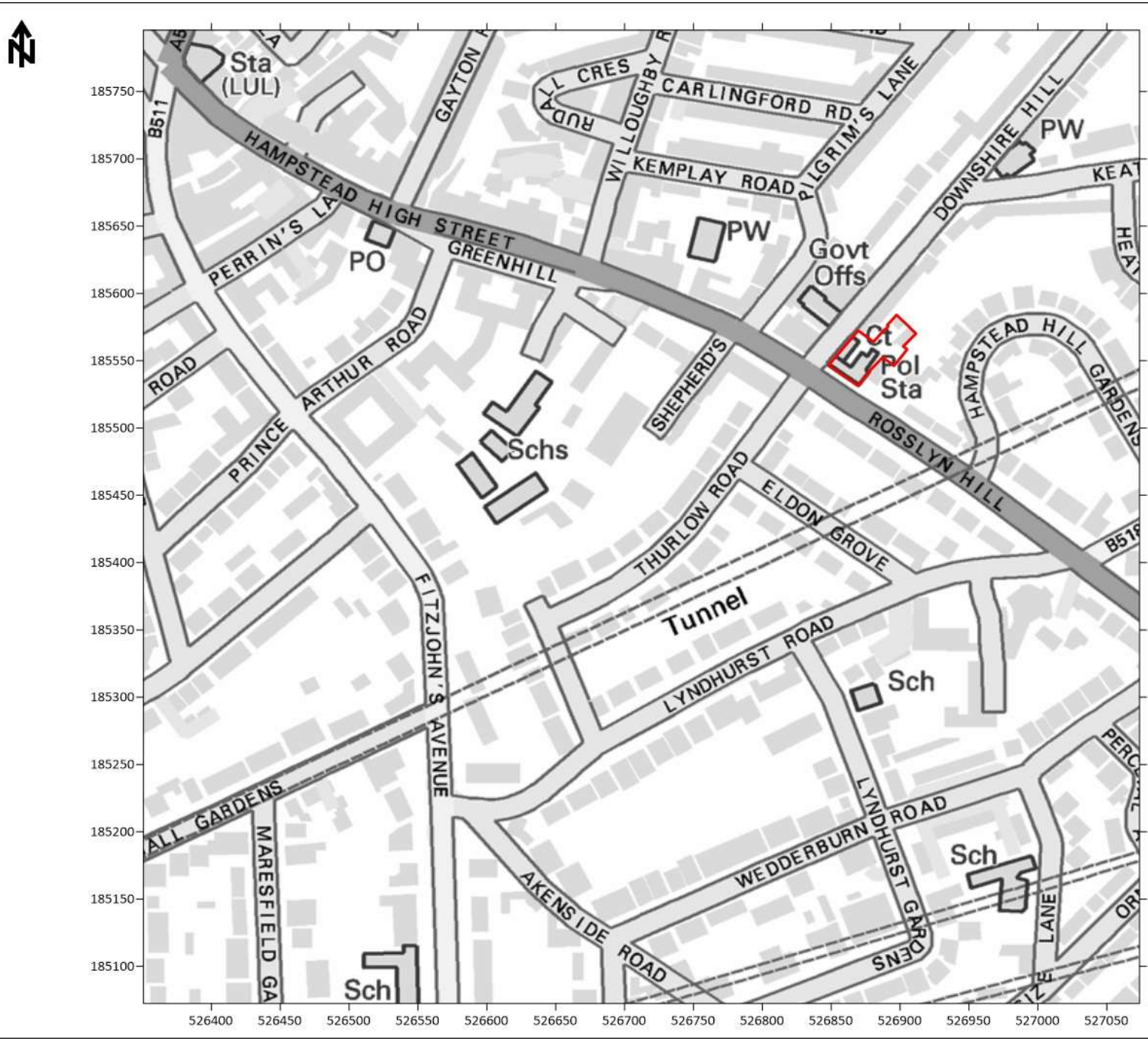
The GLA states that new developments must be considered Air Quality Neutral. Pollutant emissions associated with anticipated traffic flow were compared to relevant benchmarks. This indicated that NO_x and PM_{10} emissions were below the benchmarks and the proposed development can be considered as **Air Quality Neutral** and as such, no further action will be required to offset the development associated emissions.

Based on the assessment results the site is considered suitable for the proposed end use and complies with the London Plan, the LBoC Local Plan and relevant legislation.

8. ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objectives
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EPUK	Environmental Protection UK
EU	European Union
GLA	Greater London Authority
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LBoC	London Borough of Camden
LLAQM	London Local Air Quality Management
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
REC	Resource and Environmental Consultants
TEB	Transport Emission Benchmark
TEMPRO	Trip End Model Presentation Program
z_0	Roughness Length

APPENDIX I FIGURES



Legend

Site Boundary

Title

Figure 1

Site Location

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

AQ106285

Client

Ridge and Partners on behalf of the Department for Education

REC
Resource and Environmental Consultants Ltd
Osprey House, Broadway, Manchester M50 2UE
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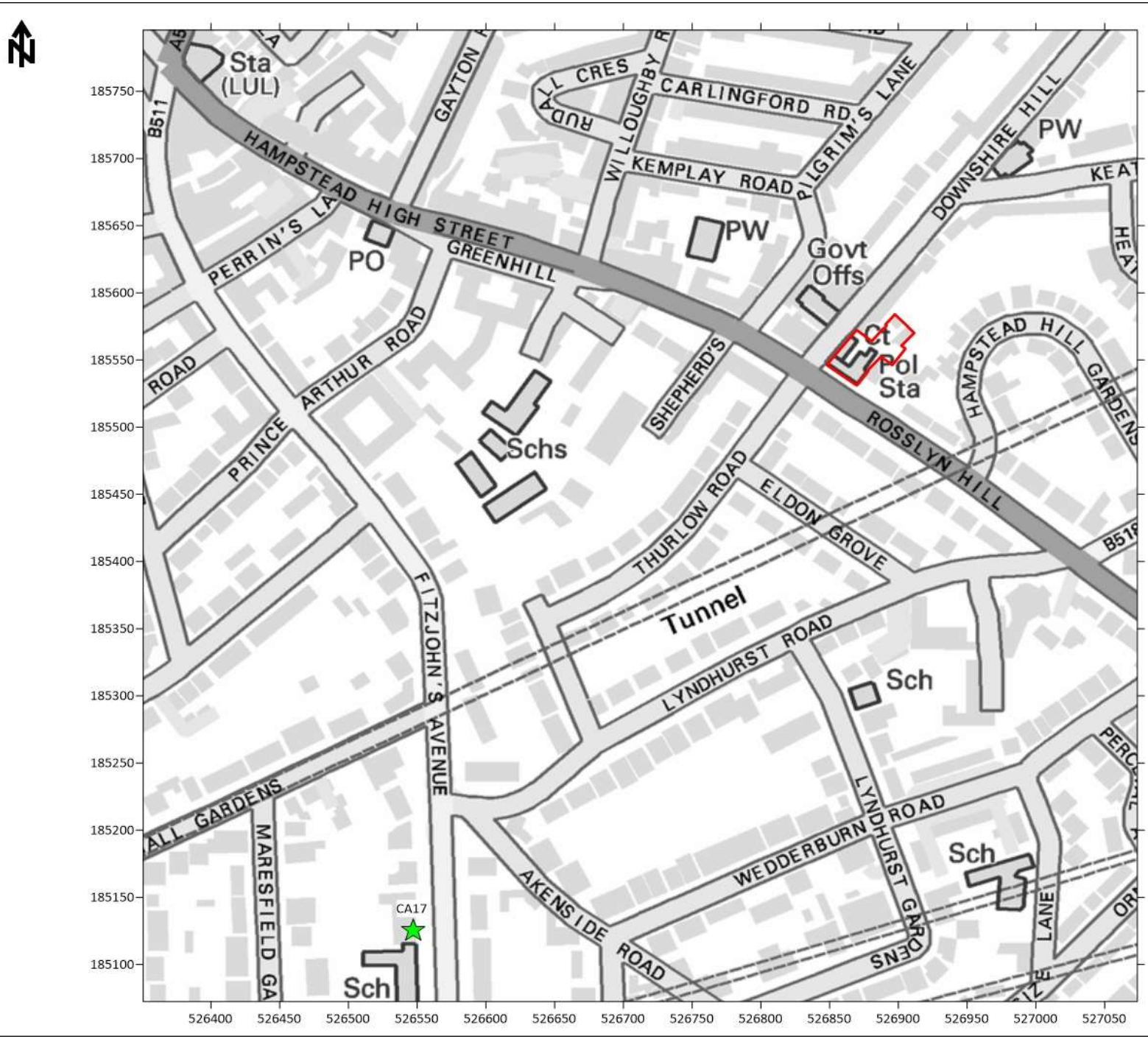

Legend

Site Boundary

Diffusion Tube Monitoring Locations

Title

Figure 2

Diffusion Tube Monitoring Locations

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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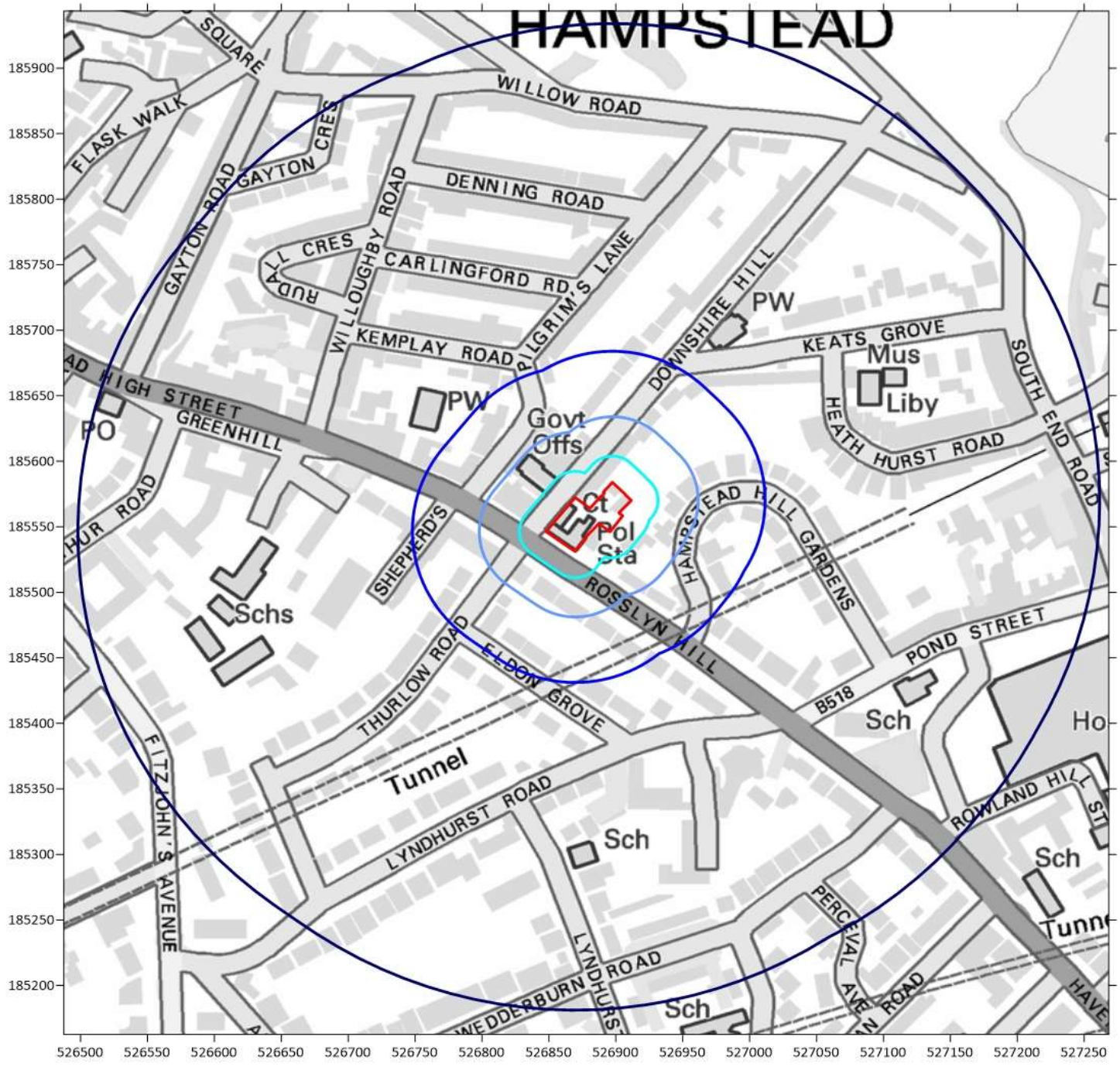

Legend

- Site Boundary
- 20m from Site Boundary
- 50m from Site Boundary
- 100m from Site Boundary
- 350m from Site Boundary

Title

Figure 3

Earthworks and Construction
Dust Buffer Zones

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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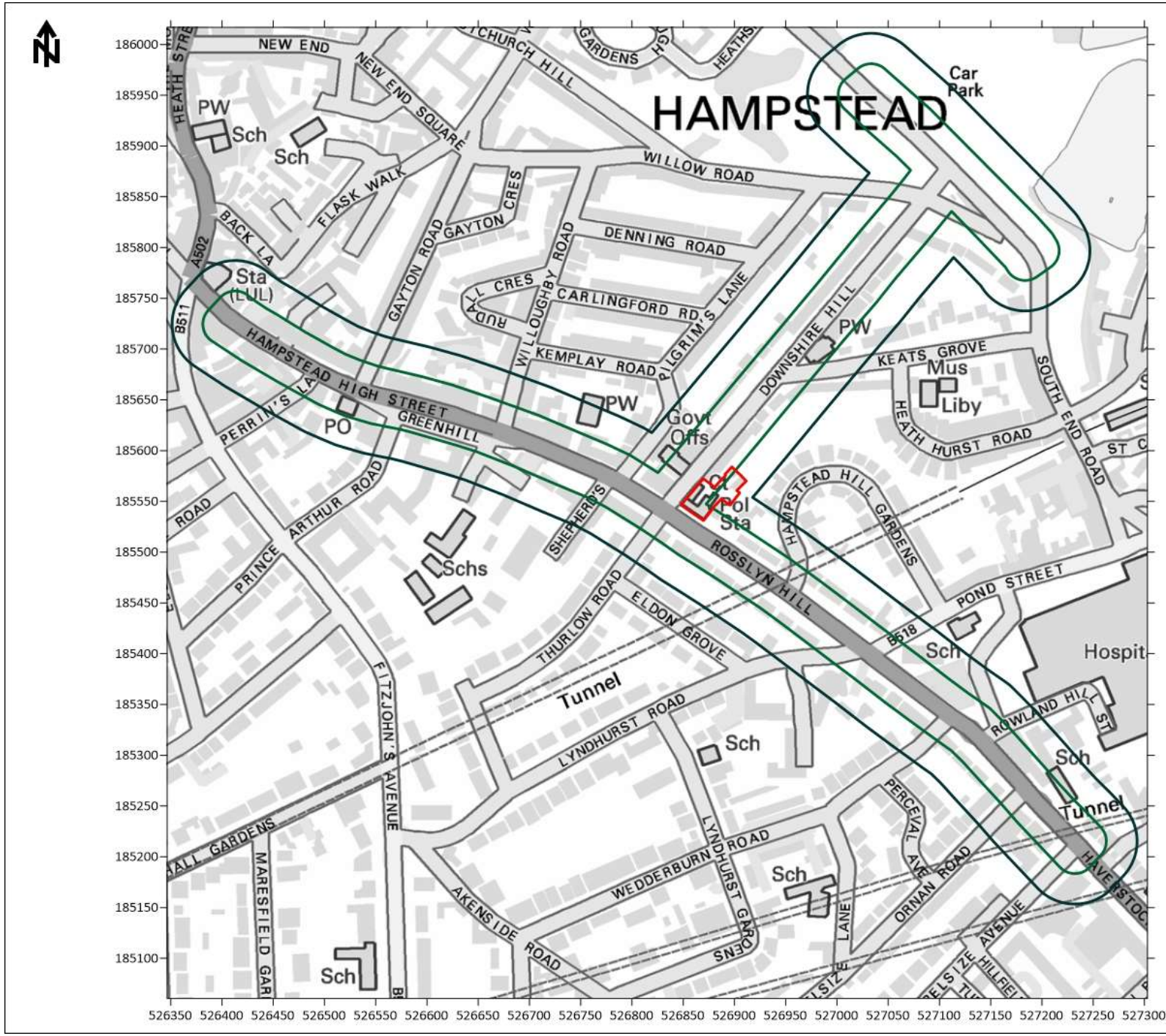

Legend

- Site Boundary
- 20m from Site Access Route
- 50m from Site Access Route

Title

Figure 4

Trackout Dust Buffer Zones

Project

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Hampstead Police Station, London

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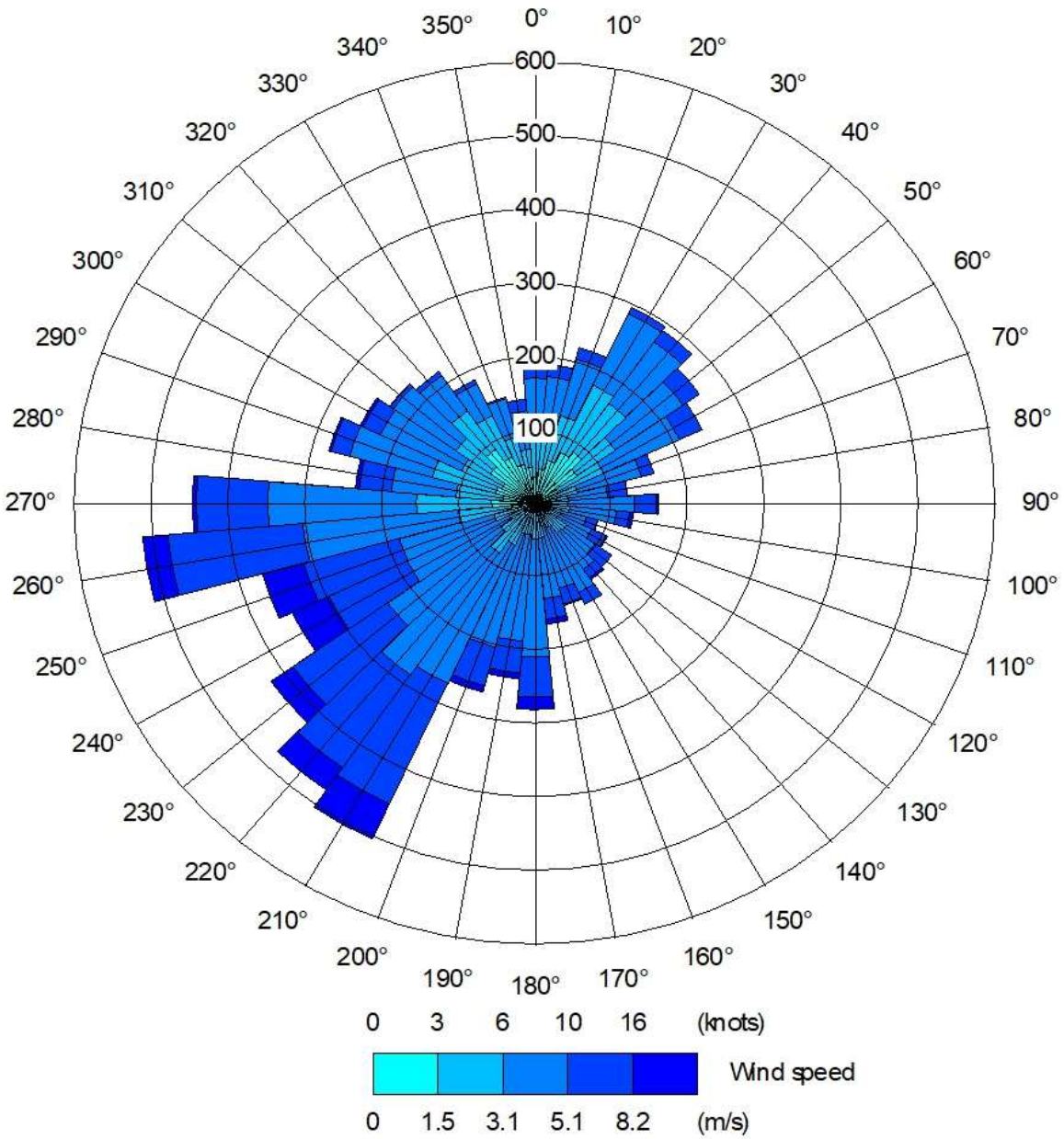

Title

Figure 5

Wind Rose Heathrow
Meteorological Station 2016

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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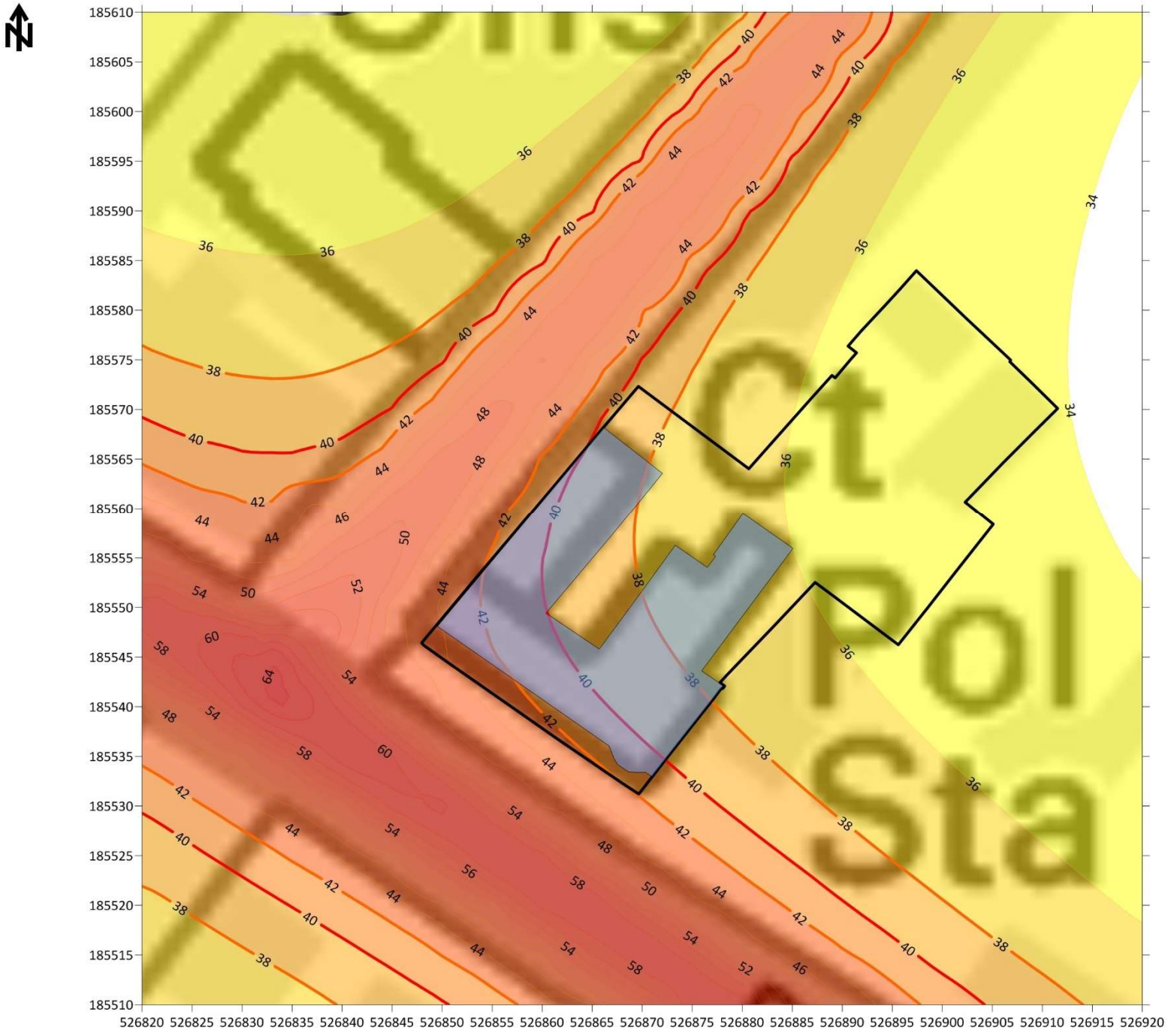

Legend

Site Boundary

Proposed School Layout

Predicted Annual Mean NO_2 Concentration (µg/m³)

62
58
54
50
46
42
38
34

Title

Figure 6

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2022

Ground Floor (z=1.5m)

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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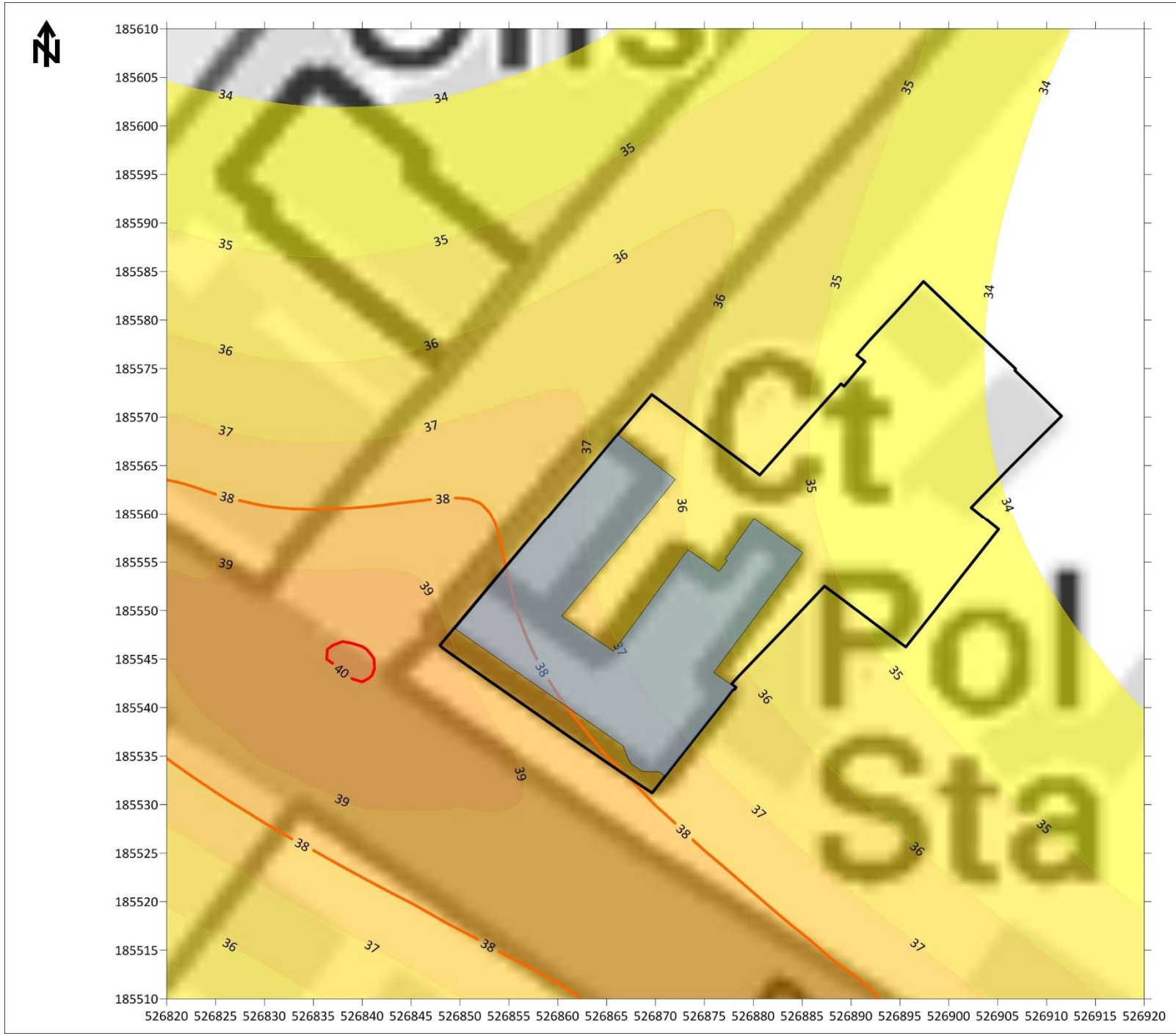

Legend

Site Boundary

Proposed School Layout

Predicted Annual Mean NO_2 Concentration (µg/m³)

40
39
38
37
36
35
34

Title

Figure 7

Predicted Annual Mean NO_2 Concentrations (µg/m³) 2022

First Floor (z=4.7m)

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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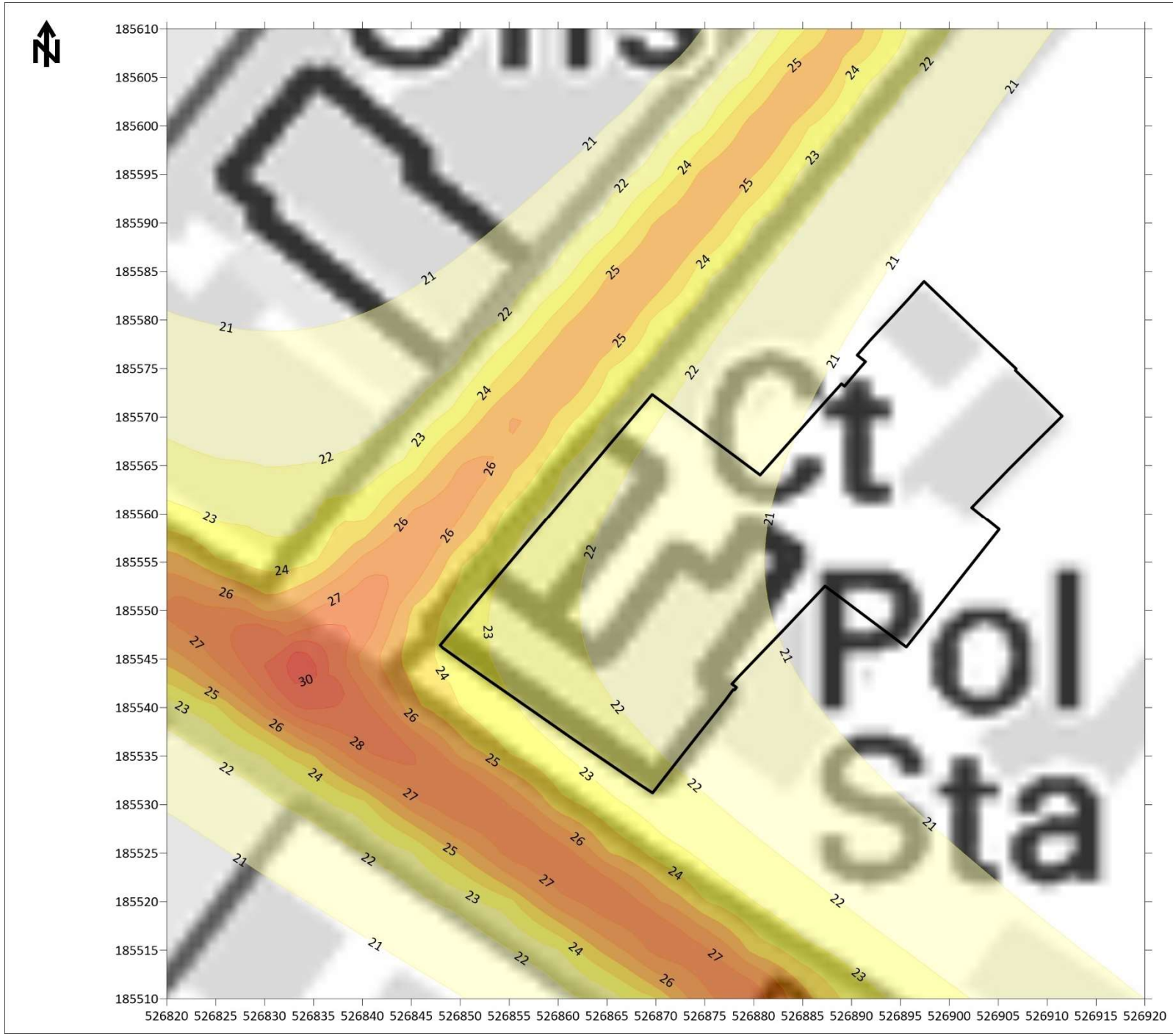

Legend

Site Boundary

31
30
29
28
27
26
25
24
23
22
21

Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)

Title

Figure 8

Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$) 2022 DS

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

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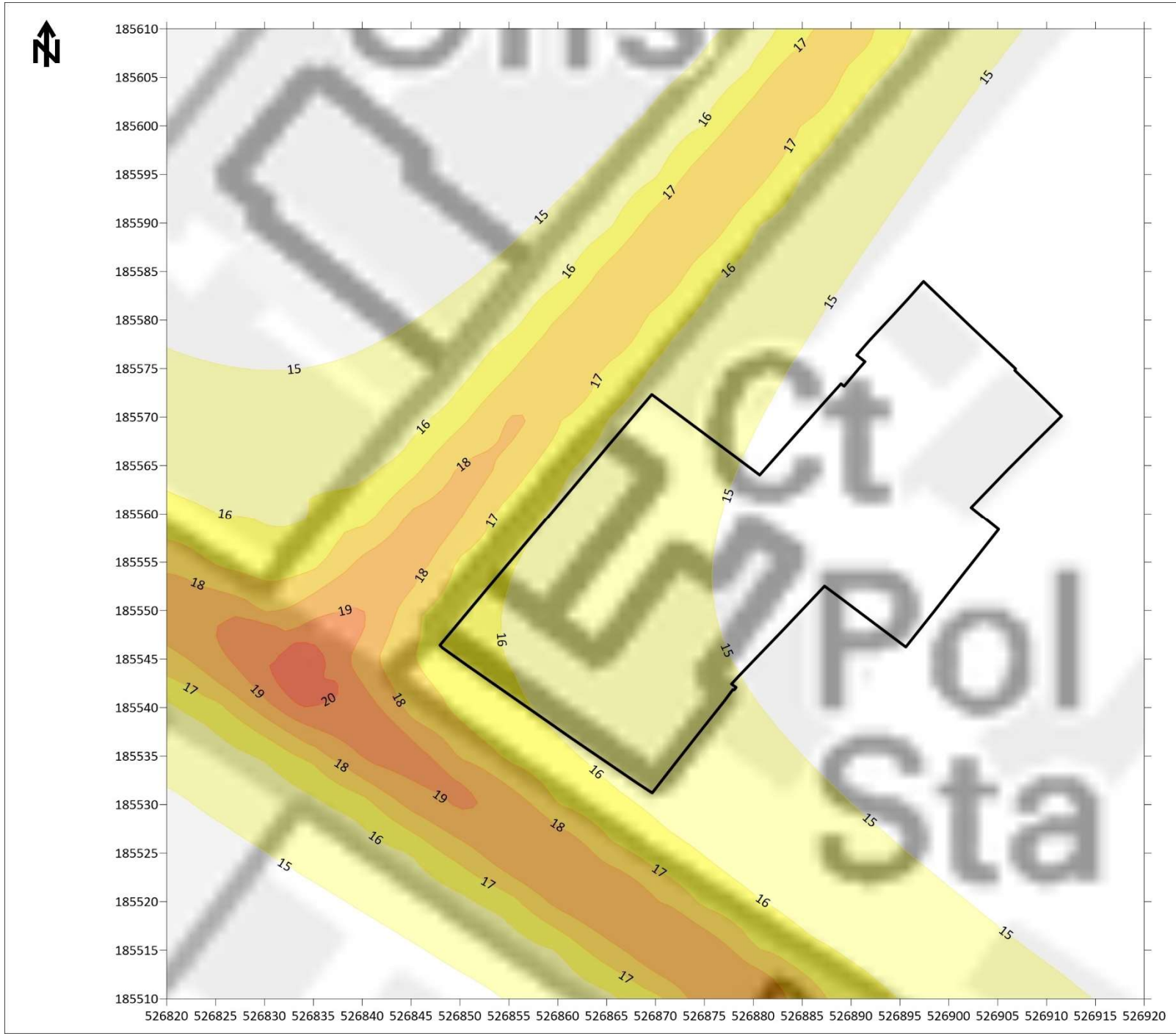

Legend

Site Boundary

21
20
19
18
17
16
15
14

Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)

Title

Figure 9

Predicted Annual Mean $PM_{2.5}$ Concentrations (µg/m³) 2022 DS

Project

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Hampstead Police Station, London

Project Number

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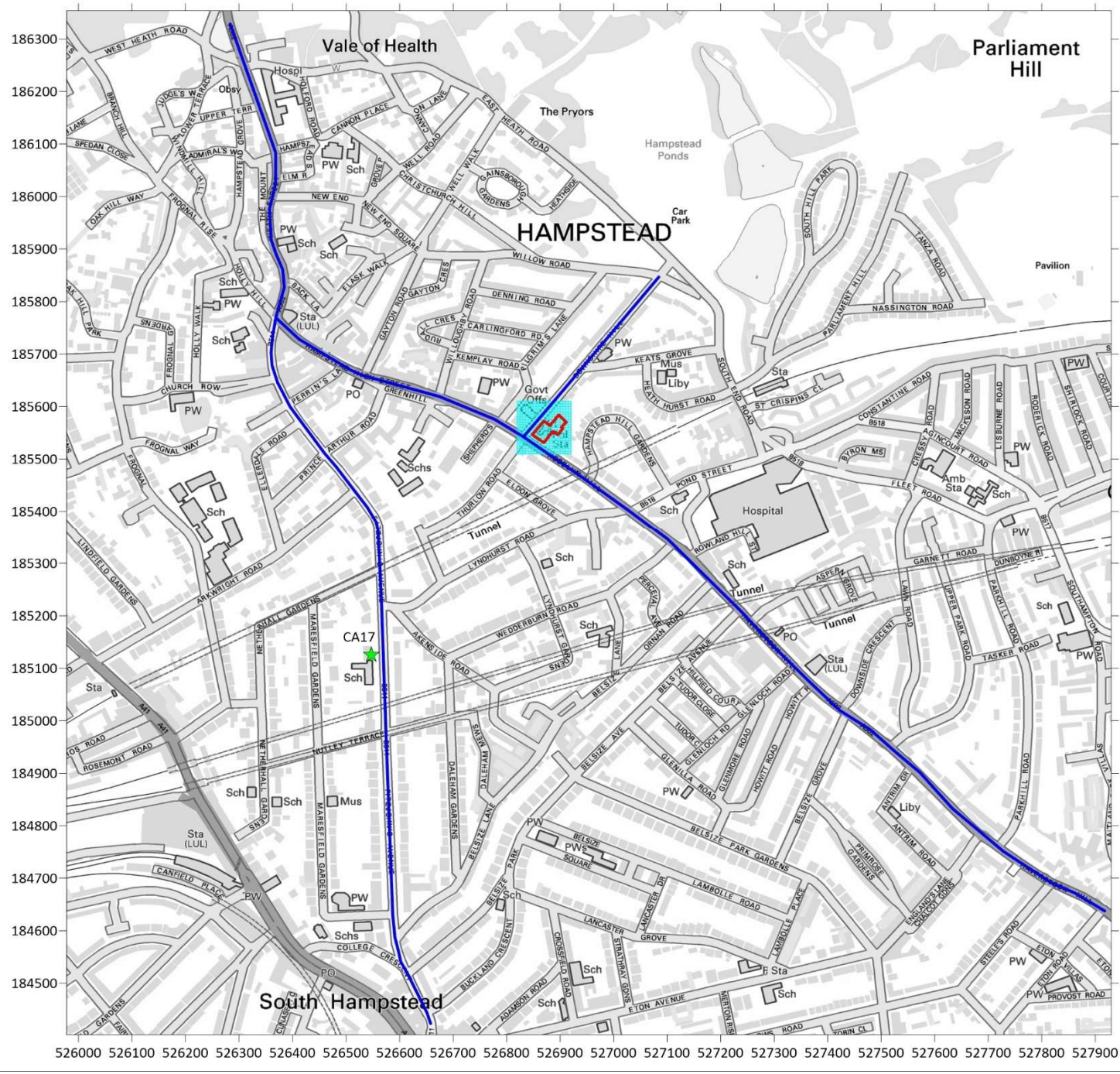

Legend

- Site Boundary
- Modelled Road Link
- Cartesian Grid
- Diffusion Tube Monitoirng Location

Title

Figure 10

ADMS-Roads Input

Project

Air Quality Assessment
Hampstead Police Station, London

Project Number

AQ106285

Client

Ridge and Partners on behalf of the Department for Education

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APPENDIX II ASSESSMENT INPUT DATA

ADMS-ROADS ASSESSMENT INPUTS

As the proposals are located within Camden AQMA there is the potential to expose future site users to elevated pollutant levels. Dispersion modelling utilising ADMS-Roads software was therefore undertaken to predict relevant NO_2, PM_{10} and $PM_{2.5}$ concentrations across the development site to assess site suitability for the proposed end-use.

The dispersion model requires input data that details the following parameters:

- Assessment area;
- Traffic and locomotive flow data;
- Vehicle and locomotive emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 4.0.1.0). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the area NGR: 526820, 185510 to 526920, 185610. One Cartesian grid at a height of 1.5m was used within the model to represent concentrations at ground floor level to produce data suitable for contour plotting using the Surfer software package.

Reference should be made to Figure 9 within Appendix I for a graphical representation of the assessment grid extents and ADMS-Road inputs for the operational year.

Traffic Flow Data

Traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition, was obtained from the London Atmospheric Emissions Inventory (LAEI). The updated version of the LAEI (2013) was released by the Greater London Authority (GLA) in 2016 and provides information on emissions from all sources of air pollutants in the Greater London area.

Growth factors provided by the Trip End Model Presentation Program (TEMPRO) software package were utilised to allow for conversion from the obtained 2013 traffic flow year to 2016, for model verification, and to 2022 which was used to represent the operational year of the proposed development.

Road widths were estimated from aerial photography and UK highway design standards. Reference should be made to Figure 9 within Appendix I for a graphical representation of the road link locations. Vehicle speeds were estimated based on the free flow potential of each link and local speed limits.

A summary of the traffic data used in for the road network modelled in the verification process and the road network modelled in the assessment area is provided in Table AII.1 and Table AII.2.

Table AII.1 2016 Verification Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop (%)	Mean Vehicle Speed (km/h)
L1	Hampstead High Street	8.9	15,492	4.82	32.2
L2	Downshire Hill Slowdown	6.5	10,040	7.08	24.1
L3	Downshire Hill	5.5	10,040	7.08	32.2
L4	Rosslyn Hill	7.2	15,492	4.82	32.2
L5	Hampstead High Street Slowdown	9.0	15,492	4.82	24.1
L6	Heath Street Slowdown	7.0	15,290	3.56	24.1
L7	Heath Street	6.6	15,290	3.56	32.2
L8	Heath Street Slowdown to Junction	9.8	15,290	3.56	40.2
L9	B511 Slowdown to Lights	7.9	25,939	7.50	24.1
L10	B511	7.5	25,939	7.50	32.2
L11	Fitzjohn's Avenue Slowdown	7.4	25,939	7.50	16.1
L12	Fitzjohn's Avenue	37.0	19,209	5.85	24.1
L13	Rosslyn Hill Slowdown	9.7	15,492	4.82	24.1
L14	Haverstock Hill	8.0	15,831	6.85	32.2
L15	Haverstock Hill Slowdown	9.1	15,831	6.85	24.1
L16	A502	9.5	15,599	5.47	32.2
L17	A502 Slowdown	9.4	15,599	5.47	24.1
L18	A502 Haverstock Hill	8.2	15,362	4.01	32.2

The road width and mean vehicle speeds shown in Table AII.2 remained the same for the 2022 scenario. A summary of the 2022 assessment area traffic data is shown in Table AII.2.

Table AII.2 2022 Assessment Area Traffic Data

Road Link		24-hour AADT Flow	HDV Prop. (%)
L1	Hampstead High Street	16,291	4.82
L2	Downshire Hill Slowdown	10,557	7.08
L3	Downshire Hill	10,557	7.08
L4	Rosslyn Hill	16,335	4.80
L5	Hampstead High Street Slowdown	16,291	4.82
L6	Heath Street Slowdown	16,078	3.56
L7	Heath Street	16,078	3.56
L8	Heath Street Slowdown to Junction	16,078	3.56
L9	B511 Slowdown to Lights	27,275	7.50
L10	B511	27,275	7.50
L11	Fitzjohn's Avenue Slowdown	27,275	7.50
L12	Fitzjohn's Avenue	20,198	5.85
L13	Rosslyn Hill Slowdown	16,335	4.80
L14	Haverstock Hill	16,690	6.83
L15	Haverstock Hill Slowdown	16,690	6.83
L16	A502	16,447	5.45
L17	A502 Slowdown	16,447	5.45
L18	A502 Haverstock Hill	16,197	4.00

Road Traffic Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 8.0.1) released in 2017, which incorporates updated COPERT5v11 vehicle emissions factors for NO_x and vehicle fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. Therefore, 2016 emission factors have been utilised for the prediction of pollution levels for all scenarios in preference to the development opening year in order to provide a robust assessment.

Meteorological Data

Meteorological data used in this assessment was taken from Heathrow meteorological station over

the period 1st January 2016 to 31st December 2016 (inclusive). Heathrow meteorological station is located at approximate NGR: 507060, 176500, which is approximately 22km west of the proposed development.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 5 within Appendix I for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 1m was used in this dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the assessment area and is suggested within ADMS-Roads as being suitable for 'Cities, woodlands'.

A z_0 of 0.5m was utilised to represent the morphology of the meteorological station location and is suggested as being suitable for 'Parkland, open suburbia'

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the morphology of the assessment area and the meteorological station and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

Background Concentrations

An annual mean NO_2 concentration of 29.41ug/m^3, PM_{10} concentration of 18.86µg/m^3, and $PM_{2.5}$ concentration of 13.53µg/m^3 predicted by DEFRA, was used in the dispersion modelling assessment to represent annual mean pollutant levels at the proposed development site.

Table AII.3 Background Pollutant Concentrations

Location	Grid Square	Pollutant	Predicted 2016 Annual Mean Background Concentration (µg/m^3)
Monitoring Location	526500, 185500	NO_x	47.34
		NO_2	29.41
		PM_{10}	18.86
		$PM_{2.5}$	13.53

Similar, to emission factors, background concentrations for 2016 were utilised in preference to the development opening year of 2022. This provided a robust assessment and is likely to overestimate actual pollutant concentrations during the operation of the proposals.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2

concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LLAQM.TG (16)[2].

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2016, using traffic data, meteorological data and monitoring results from this year.

LBoC undertakes monitoring of NO_2 concentrations at one monitoring location suitable for verification purposes within the assessment extents. The road contribution to total NO_x concentration was calculated from the monitored NO_2 result for use in the verification process. This was undertaken following the methodology contained within IAQM and EPUK guidance LLAQM (TG16)[2].

The dispersion model was run with the traffic input data previously detailed for 2016 to predict the NO_x concentration at the monitoring locations. The results are shown in Table AII.4.

Table AII.4 NO_x Verification Results

Site ID	Monitoring Location	Modelled Road NO_x Concentration ($\mu g/m^3$)	Monitored Road NO_x Concentration ($\mu g/m^3$)	Difference (%)
CA17	47 Fitzjohn's Road	19.32	69.89	261.75

The monitored and modelled NO_x road contribution concentrations indicated that a verification factor of **3.6175** was required to be applied to all NO_x modelling results, showing the model had a tendency to underestimate pollutant concentrations.

Table AII.5 presents the monitored annual mean NO_2 concentrations and the adjusted modelled total NO_2 concentration based on the above verification factor. Exceedances of the annual mean AQO for NO_2 are shown in **bold**.

Table AII.5 NO_2 Verification Results

Site ID	Monitoring Location	Monitored NO_2 Concentration ($\mu g/m^3$)	Adjusted Modelled Total NO_2 Concentration ($\mu g/m^3$)	Difference (%)
CA17	47 Fitzjohn's Road	**56.38**	**56.38**	0.00%

As PM_{10} monitoring is not undertaken within the assessment extents, the verification factor of **3.6175** was also used to adjust model predictions of this pollutant in accordance with the guidance provided within LLAQM (TG16)[2].

APPENDIX III ASSESSOR'S CURRICULUM VITAE

CONAL KEARNEY

Associate Director

BEng(Hons), MSc, MIAQM, MIEnvSc

KEY EXPERIENCE:

Conal is an Associate Director with specialist experience in the air quality and odour sector. His key capabilities include:

- Advanced atmospheric air dispersion modelling of road vehicle and industrial emissions using ADMS-ROADS and AIRVIRO.
- Preparation of factual and interpretative Air Quality Assessment reports and Air Quality Environmental Statement chapters in the vicinity of proposed schemes and developments in accordance with DEFRA, Environment Agency and Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) methodologies.
- Management and delivery of project work on key, land development and urban regeneration projects.
- Assessment of road vehicle exhaust emissions using the Design Manual for Roads and Bridges (DMRB) calculation spreadsheet.
- Assessment of dust impacts from construction sites to the Institute of Air Quality Management (IAQM) methodology.
- Dust and Odour impact assessments from minerals and waste sites
- Representing clients at public enquiries and planning hearings.

QUALIFICATIONS:

- Bachelor of Engineering
- Master of Science
- Member of Institute of Air Quality Management
- Member of the Institute of Environmental Science (IES)

SELECT PROJECTS SUMMARY:

Industrial Developments

Buck Park, Denholme - AQA and dust assessment for proposed mineral extraction and site restoration project.

Messingham Quarry, North Lincolnshire - AQA and dust impacts for proposed new sand extraction site.

Arden Quarry, Derbyshire - AQA for proposed mineral extraction and site restoration

Clayton Hall Landfill, Chorley - AQA and odour assessment for proposed landfill extension and mineral extraction.

Granta Park, Oxfordshire. Assessment of VOC fume emissions.

University of Birmingham. Permit application for CHP scheme.

Arbroath Road, Carnoustie. Odour and AQA for biogas CHP scheme.

Highways Developments

Alderley Edge Bypass, Cheshire - AQA for major new road scheme.

South Heywood – EIA for new link road and mixed use joint development

Residential Developments

Orchard Close, Knaresborough. AQA and public enquiry evidence.

Bredbury Curve, Stockport - AQA assessment for proposed residential development in AQMA.

Hollin Lane, Middlewich – AQA for large scale residential development.

Friars School, Southwark, London. School development for mixed use education and residential building in AQMA.

Abbotsford House, Bearsden, Scotland – AQA and dust assessment for residential development

Westcraig, Edinburgh - EIA chapter for residential development

Queensway, Lytham St Annes. Dust and odour assessment for development.

Manor Place, London. Road and energy generation emissions assessment

Craven Park, London. Mitigation statement and planning hearing expert opinion

Public Sector

Technical advisor on Manchester Airport Consultative Committee - advise members on environmental technical matters in relation to the airport's operations.

Cheshire County Council - compile AQ chapters for Local Transport Plan

Cheshire East Council - specialist AQ advice on highways, minerals and waste projects

Local Air Quality Management

Broughton Gyratory, Chester - dispersion model for City Centre detailed assessment report

Congleton town centre - dispersion modelling assessment for detailed and further assessment reports.

Disley - dispersion modelling assessment for detailed and further assessments

Holmes Chapel - dispersion modelling assessment for detailed and further assessment reports for road and rail sources.

Crewe - town centre dispersion modelling for detailed and further assessment reports.

Commercial Developments

Granta Park Daycare Centre, Oxfordshire. AQA for new build daycare centre adjacent to major road.

Curzon Cinema, Colchester. Air quality assessment for town centre new build cinema.

Newfoundland Circus, Bristol - AQA for hotel development in city centre

Salesians School, Chertsey - AQA for school extension near M25.

Cathedral Street and Thistle Street, Glasgow. University energy generation emission assessments.