Air Quality Assessment	
77 Castle Road, Camden	
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Contents

1 Introduction

1.1. Proposed Development

1.1.1 Air Quality Assessments Ltd (AQA) has been commissioned by McGrath Davies Property Services Limited to undertake an air quality assessment for the proposed redevelopment of the upper floors of the Tapping the Admiral public house at 77 Castle Road, London NW1 8SU. The proposed development will convert the upper floors to residential use comprising three flats.

1.1.2 The application site lies within the London Borough of Camden, the entirety of which has been declared an Air Quality Management Area (AQMA) for exceedences of the annual mean nitrogen dioxide (NO_2) objective and the 24-hour mean fine particulate matter (PM_{10}) objective.

1.2. Scope of Assessment

1.2.1 This report describes the existing air quality conditions in proximity to the site. The scale of the development is such that it will not significantly increase traffic on local roads; however, the new residential properties will be subject to the impacts of emissions from the local road network and diesel engines using the adjacent railway line. The main air pollutants of concern related to road traffic and rail emissions are NO_2 and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.2.2 The assessment has been prepared taking into account all relevant local and national guidance and regulations.

1.2.3 The references and a glossary of common air quality terminology used in this assessment are shown in **Section 10** and **Section 11** respectively.

2 Air Quality Legislation and Policy

2.1. EU Limit Values

2.1.1 The European Union's Directive on ambient air quality and cleaner air for Europe (European Parliament, Council of the European Union, 2008) set legally binding limit values for NO_2, PM_{10} and $PM_{2.5}$. The Air Quality Standards Regulations 2010 (The Stationary Office, 2010) implement the EU Directive limit values in English legislation. Achievement of the limit values is a national obligation rather than a local one.

2.1.2 The limit values are the same as the objective values (see **Table 1**); however, the compliance dates differ, and the limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway). The PM_{10} and NO_2 limit value applied from 2005 and 2010 respectively, whereas the $PM_{2.5}$ limit value applied from 2015.

2.2. The Air Quality Strategy

2.2.1 Part IV of The Environment Act 1995 required the UK Government to prepare an Air Quality Strategy. The Air Quality Strategy (Defra, 2007), provides an overview and outline of ambient air quality policy in the UK and the devolved administrations. The strategy sets out air quality standards and objectives intended to protect human health and the environment.

2.2.2 Standards are the concentrations of pollutants in the atmosphere, below which there is a minimum risk of health effects or ecosystem damage; they are set with regard to scientific and medical evidence. Objectives are the policy targets set by the Government, taking account of economic efficiency, practicability, technical feasibility and timescale, where the standards are expected to be achieved by a certain date.

2.2.3 The Air Quality Strategy also describes the system of Local Air Quality Management (LAQM), introduced in Part IV of the Environment Act 1995, which requires every local authority to carry out regular review and assessments of air quality in its area. Where an objective has not been, or is unlikely to be achieved, the local authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which sets out appropriate measures to be introduced in pursuit of the objectives.

2.2.4 The objectives for NO_2 and PM_{10}, as prescribed by the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 (The Stationary Office, 2000; The Stationary Office, 2002), are shown in **Table 1**. The objectives for PM_{10} and NO_2 were to have been achieved by 2004 and 2005 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective, also shown in **Table 1**, is to be achieved by 2020; however, although local authorities in London have a flexible role in working towards reducing emissions and concentrations of $PM_{2.5}$, there is no obligation for local authorities to try to meet the $PM_{2.5}$ objective, and it is not included in the Regulations.

Table 1: The Objectives for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Concentration Measured As	Objective
NO_2	1-hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
PM_{10}	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
$PM_{2.5}$	Annual Mean	25 µg/m^3

2.2.5 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Examples of where the objectives should apply are provided in the London Local Air Quality Management Technical Guidance (Mayor of London, 2016). The annual mean NO_2 and PM_{10} objectives should apply at the building façades of residential properties, schools, hospitals, care homes etc.; they should not apply at the building façades of places of work, hotels, gardens or kerbside sites. The 24-hour mean PM_{10} objective should apply at all locations where the annual mean objective applies, as well as the gardens of residential properties and hotels. The 1-hour mean NO_2 objective should apply at all locations where the annual and 24-hour mean objectives apply, as well as at kerbside sites where the public have regular access, e.g. the pavements of busy shopping streets.

2.3. Planning Policy

National Policies

2.3.1 The National Planning Policy Framework (NPPF) (DCLG, 2012) sets out planning policy for England and acts as guidance for local planning authorities in drawing up plans and as a material consideration in determining applications. It places a general presumption in favour of sustainable development, stressing that the planning system should perform an environmental role to minimise pollution.

2.3.2 The NPPF states that:

"The planning system should contribute to conserving and enhancing the environment and reducing pollution by: preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability."

2.3.3 The NPPF goes on the say that:

"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural

environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account."

2.3.4 With specific reference to air quality, the NPPF states that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.3.5 The NPPF is supported by Planning Practice Guidance (PPG) (DCLG, 2014). The PPG states that:

"Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit."

2.3.6 The PPG goes on to state 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 (including that applicable to wildlife)."

2.3.7 The PPG also sets out the information that may be required in an air quality assessment, stating that:

"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality."

2.3.8 It also provides guidance on options for mitigating air quality impacts, and makes clear that:

"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact."

Regional Policies

2.3.9 The London Plan (GLA, 2016a) sets out the spatial development strategy for London and presents a London-wide policy framework, including Policy 7.14 Improving Air Quality, which states that development proposals should:

"a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3);

b) promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition';

c) be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as Air Quality Management Areas (AQMAs));

d) ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches; and

e) where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."

2.3.10 The London Plan is supported by Supplementary Planning Guidance, (SPG) on Sustainable Design and Construction (GLA, 2014a) and The Control of Dust and Emissions during Construction and Demolition (GLA, 2014b). The SPGs include criteria that require an air quality neutral and a dust risk assessment for all major developments in London, a major residential development being defined in the London Plan as having 10 or more dwellings. The proposed development falls below the criteria requiring an air quality neutral and dust risk assessment.

2.3.11 The Mayor's Air Quality Strategy (GLA, 2010) explains the actions that the Mayor will take to improve air quality in London, with the aim of achieving compliance with the EU limit values as soon as possible. The Strategy includes a number of measures to improve air quality, including those that encourage the use of sustainable transport modes, promote the use of cleaner vehicles, improve traffic management and use the planning process to improve air quality.

Local Policies

2.3.12 Camden Council's Local Development Framework (LDF) includes Camden Development Policies 2010-2025 (Camden Council, 2010), which sets out the detailed planning policies that the Council will use when determining applications for planning permission. Policy DP32 Air Quality and Camden's Clear Zone states:

"The Council will require air quality assessments where development could potentially cause significant harm to air quality. Mitigation measures will be expected in developments that are located in areas of poor air quality."

2.3.13 Camden Council also publishes online guidance on when an air quality assessment is required (Camden Council, 2015a). A basic assessment is required for:

"Developments where local residents will be exposed to poor air quality (due to its location next to a busy road/diesel railway lines or in a generally congested area)."

Air Quality Action Plan

2.3.14 Camden Council has developed a Clean Air Action Plan for the AQMA (Camden Council, 2016). The Action Plan sets out measures that the council intends to implement in order to help meet the objectives. Overall, the measures aim to continue monitoring air quality in Camden, reduce emissions from transport, buildings and new development, raise awareness of air quality and promote lobbying and partnership working.

3 Methodology

3.1. Existing Conditions

3.1.1 Information on existing air quality within the study area has been collated from the following sources:

- The results of monitoring and the LAQM review and assessment reports undertaken by Camden Council;
- Maps of roadside concentrations published by Defra (Defra, 2017a) have been used to identify current exceedences of the annual mean NO_2 EU limit value[1];
- Background pollutant concentration maps published by Defra (Defra, 2017b); and
- Defra's Pollutant Release and Transfer Register (Defra, 2017c) and the Environment Agency's 'What's in your backyard' website (Environment Agency, 2017) have been used to screen for local industrial and waste management sources.

3.2. Road Traffic Impacts

Sensitive Locations

3.2.1 Receptors have been located at the application site boundary of the proposed development, where the impacts from local sources are likely to be greatest. The receptors are described in **Table 2** and are shown in **Figure 1**. Concentrations have been modelled at heights of 1.5m, 4.5m, 7.5m and 10.5m to represent exposure at the ground floor, first floor, second floor and third floor levels.

Table 2: Description of Receptors

Receptor	Location	x	y
R1	Application site boundary	528633.6	184572.4
R2	Application site boundary	528635.8	184562.3
R3	Application site boundary	528638.1	184552.2
R4	Application site boundary	528646.9	184553.9
R5	Application site boundary	528653.9	184555.4
R6	Application site boundary	528652.3	184564.3
R7	Application site boundary	528643.1	184568.9

[1] There are no exceedences of the PM_{10} limit values.

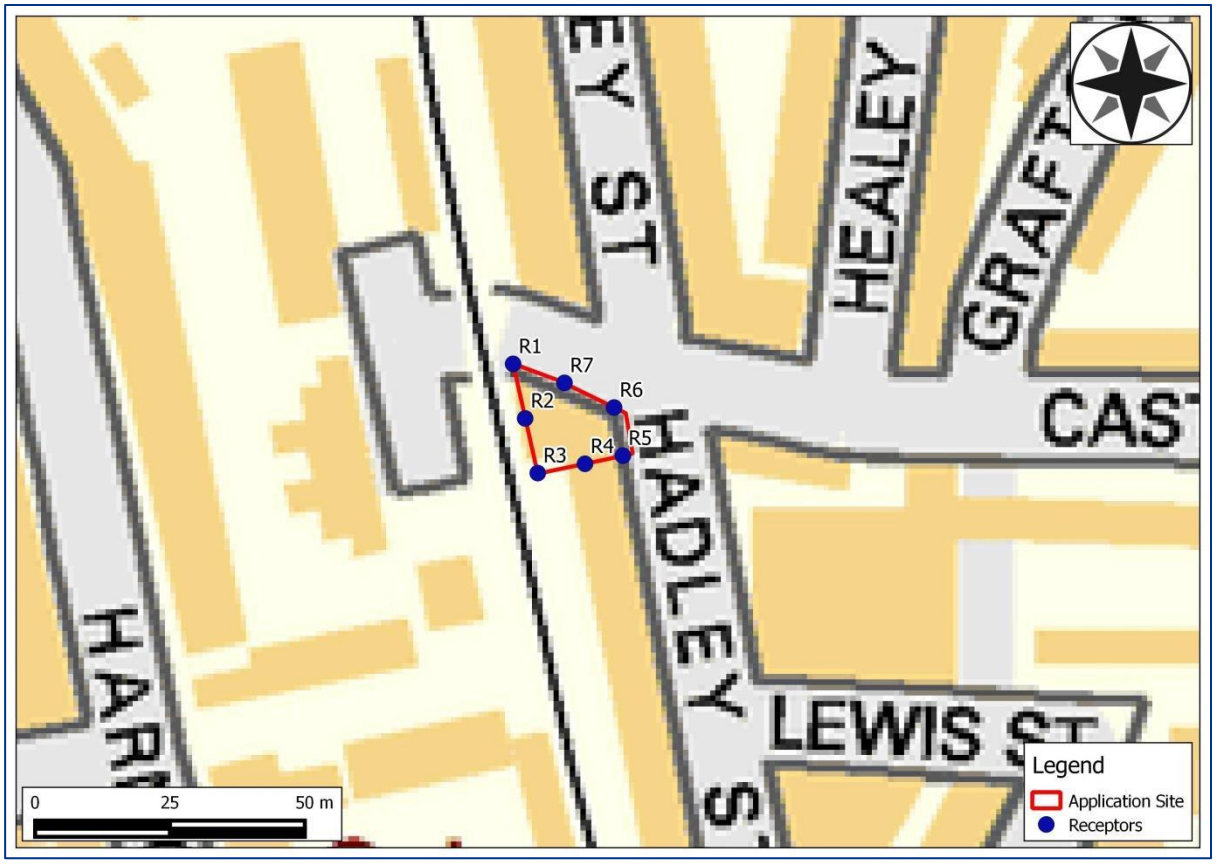

Figure 1: Location of Receptors
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Assessment Scenarios

3.2.2 Concentrations of NO_2 and $PM_{2.5}$ have been predicted at the receptors assuming an opening year of 2017.

3.2.3 In addition to predictions using emissions data published by Defra, a sensitivity analysis has been undertaken that assumes higher NOx emissions from diesel vehicles. This sensitivity analysis provides a worst-case assessment of future impacts (see section on uncertainty below).

Modelling Methodology

3.2.4 Concentrations have been predicted using the ADMS Roads (v4.0.1.0) dispersion model. The model requires the input of a range of data, details of which are provided in **Appendix A1**, along with details of the model verification calculations.

3.3. Uncertainty

3.3.1 There are many factors that contribute to uncertainty when predicting pollutant concentrations. The emission factors utilised in the air quality model are dependent on traffic data, which have inherent uncertainties associated with them. There are also uncertainties associated with the model itself, which simplifies real world conditions into a series of algorithms. The model verification process, as described in **Appendix A1**, minimises the uncertainties; however, future year predictions use

projected traffic data, emissions data, and background concentrations. The most recent emission factors and background data have been used in this assessment; however, there are still uncertainties associated with this data.

3.3.2 Analysis has shown a disparity between historical monitoring data and the projected background concentrations published by Defra (Carslaw et al., 2011). Overall, there is little evidence of the consistent downward trend in NO_2 and NOx concentrations suggested by the emission inventory estimates.

3.3.3 This disparity is believed to be due to the actual on-road performance of diesel vehicles when compared with calculations based on the Euro standards. Therefore, forecast reductions in the road traffic component of background concentrations are also likely to be over optimistic in the near-term. There is no evidence that the contribution to background concentrations from non-traffic sources should not behave as forecast.

3.3.4 To account for this uncertainty a sensitivity analysis has been undertaken using emissions from the Calculator Using Realistic Emissions for Diesels (CURED) tool (V2A), developed by Air Quality Consultants Ltd (AQC) (AQC, 2016a). The tool applies adjustments to diesel emission factors in the Emissions Factor Toolkit (EFT) to account for discrepancies between the emissions in the EFT and real world emissions data from diesel vehicles (AQC, 2016b). The CURED emissions are likely to be higher than actual emissions from future diesel vehicles, and thus provide a worst-case assessment.

3.3.5 The road traffic components of NOx and NO_2 in the Defra background maps have also been adjusted to produce background concentrations for the sensitivity test following the methodology recommended by AQC (AQC, 2016c).

3.4. Assessment Criteria and Significance

Health Criteria

3.4.1 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. The approach suggested by Environmental Protection UK (EPUK) and the IAQM in guidance on Land-Use Planning & Development Control: Planning for Air Quality (EPUK and IAQM, 2015) has been used for this assessment.

3.4.2 The predicted concentrations at each receptor have been compared with the objectives shown in **Table 1**. Where an exceedence of the objectives occurs, the effect is judged as significant, unless provision is met to reduce exposure by some means. Predicted concentrations below the air quality objectives will be considered as insignificant.

3.4.3 The EPUK/IAQM guidance recommends the use of the annual mean $PM_{2.5}$ objective when assessing impacts due to particulates as it is more conservative than the objectives for PM_{10}, and most of the particulate emissions from combustion sources, including traffic, occur in the $PM_{2.5}$ fraction.

3.4.4 The determination of the significance of the effects includes elements of professional judgement and the professional experience of the consultant preparing the report is set out in **Appendix A2**.

4 Baseline Conditions

4.1. Industrial Sources

4.1.1 The search of the UK Pollutant Release and Transfer Register, and Environment Agency's 'What's in your backyard?' websites did not identify any significant industrial or waste management sources that are likely to affect air quality at the application site.

4.2. EU Limit Values

4.2.1 There are no AURN monitoring sites located within the study area. None of the roads adjacent to the application site are included in modelling undertaken by Defra.

4.3. LAQM Review and Assessment

4.3.1 Camden Council has declared the entire borough an AQMA for exceedences of the annual mean NO_2 objective and the 24-hour mean PM_{10} objective.

4.4. Local Air Quality Monitoring

4.4.1 Camden Council currently operates four automatic monitoring sites within its area; however, none of these sites are within the study area. The council also operates a number of diffusion tube monitoring sites. None of these monitoring sites are located within the study area; however, data from a diffusion tube monitoring site located on Kentish Town Road, approximately 650m northeast of the application site, has been used for model verification (see **Appendix A1**). Measured annual mean concentrations from the Kentish Town Road monitoring site are shown in **Table 3**, and the monitoring locations are shown in **Figure 2**.

4.4.2 Annual mean concentrations at the Kentish Town Road site are very high, ranging from 57.2 to 74 µg/m^3 between 2010 and 2014. Data from the Kentish Town Road monitoring site is not representative of air quality at the application site. Kentish Town Road is a heavily trafficked, congested A-road, with canyon like features. Castle Road and Hadley Street, adjacent to the application site, are very lightly trafficked due to restrictions to vehicle movements in the area and air quality at the application site is likely to be close to background levels (see **Table 4**).

Table 3: Measured Annual Mean NO_2 Concentrations (2010 to 2014) [a]

Site ID	Location	Site Type	Annual Mean (µg/m^3)				
			2010	2011	2012	2013	2014
CA16	Kentish Town Road	Roadside	**74**	**57.2**	**59.0**	**65.3**	**57.8**
Objective			**40**				

a Exceedences are shown in bold. Data taken from the 2015 Updating and Screening Assessment (Camden Council, 2015b).

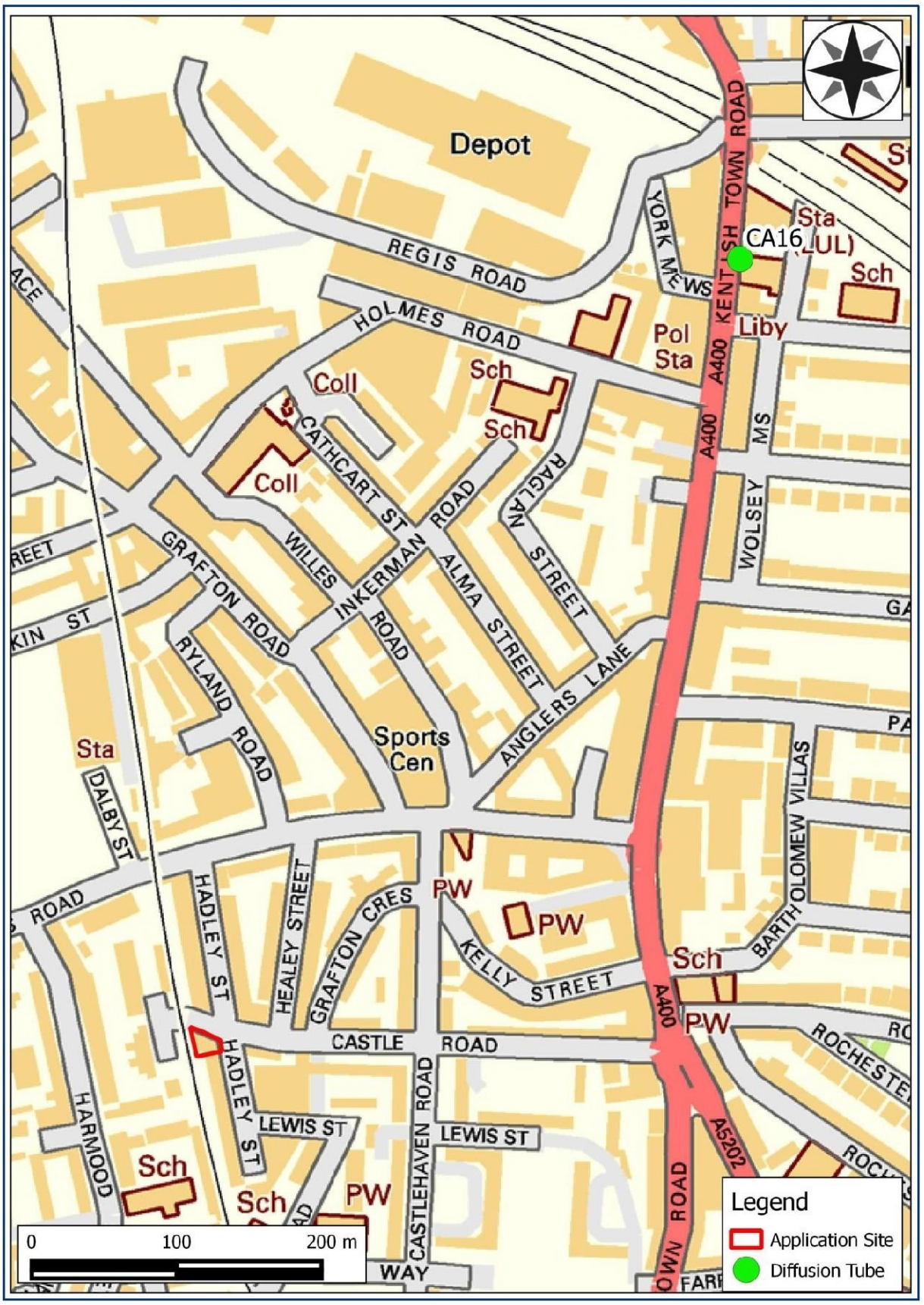

Figure 2: Air Quality Monitoring Site

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4.4.3 There are no clear trends in monitoring results for the past five years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards. The implications of this have been discussed in the section on uncertainty above (see **Page 8**).

4.5. Background Concentrations

4.5.1 Estimated background concentrations at the application site are shown in **Table 4**. The background concentrations are all below the objectives.

Table 4: Estimated Annual Mean Background Concentrations in 2014 and 2018 (µg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2014	63.7	36.8	20.6	14.8
2018	55.6	32.7	19.9	14.1
2018 CURED	57.5	33.7	-	-
Objective	**-**	**40**	**40**	**25**

5 Road and Rail Impacts

5.1. Impacts on the Development

5.1.1 Predicted concentrations at the application site boundary are shown in **Table 5**. All the values are below the objectives; therefore, air quality for future residents at the proposed development will be acceptable.

Table 5: Predicted Impacts on the Development in 2018

Receptor	Annual Mean (µg/m^3)		
	NO_2		$PM_{2.5}$
	EFT	CURED	
Ground Floor (1.5m)			
R1	33.8	34.8	14.2
R2	33.8	34.8	14.1
R3	33.7	34.7	14.1
R4	33.8	34.9	14.2
R5	33.9	34.9	14.2
R6	33.9	34.9	14.2
R7	33.9	34.9	14.2
First Floor (4.5m)			
R1	34.2	35.2	14.2
R2	34.2	35.2	14.2
R3	34.2	35.2	14.2
R4	34.2	35.2	14.2
R5	34.1	35.1	14.2
R6	34.1	35.1	14.2
R7	34.3	35.3	14.2
Second Floor (7.5m)			
R1	36.5	37.5	14.3
R2	36.4	37.4	14.3
R3	36.3	37.3	14.3
R4	34.6	35.7	14.2
R5	34.2	35.2	14.2
R6	34.2	35.2	14.2
R7	34.7	35.8	14.2

Receptor	Annual Mean (µg/m^3)		
	NO_2		$PM_{2.5}$
	EFT	CURED	
Third Floor (10.5m)			
R1	35.3	36.4	14.2
R2	35.3	36.3	14.2
R3	35.3	36.3	14.2
R4	34.4	35.4	14.2
R5	34.1	35.1	14.2
R6	34.1	35.1	14.2
R7	34.5	35.5	14.2
Objective	**40**		**25**

6 Mitigation

6.1.1 The assessment has demonstrated that the scheme will not introduce receptors into an area where the objectives are exceeded. Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation. It is not considered appropriate to propose further mitigation measures for this scheme.

7 Residual Impacts

7.1.1 The residual impacts will be the same as those identified in **Section 5**.

8 Conclusions

8.1.1 The impacts due to emissions from local rail and road traffic on the air quality for residents living in the proposed development have been shown to be acceptable at the worst-case locations assessed, with concentrations being below the air quality objectives at the application site boundary.

8.1.2 The overall operational air quality impacts on the development are judged to be *insignificant*. This conclusion, which takes account of the uncertainties in future projections, in particular for NO_2, is based on the predicted concentrations being below the objectives at all of the receptors.

8.1.3 The proposed development is consistent with:

- The NPPF;
- The London Plan; and
- Policy DP32 of Camden Development Policies 2010-2025.

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10 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System
AQAL	Air quality assessment level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
EPUK	Environmental Protection UK
Exceedence	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDF	Local Development Framework
LDV	Light Duty Vehicles (<3.5 tonnes)
µg/m^3	Microgrammes per cubic metre
NAEI	National Atmospheric Emissions Inventory
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

11 Appendices

A1 Modelling Methodology

A1.1. Model Inputs

Traffic Data

A1.1.1 AADT flows, vehicle fleet composition data and average traffic speeds have been derived from the 2013 and 2020 data in the London Atmospheric Emissions Inventory (LAEI) (GLA, 2016b). The traffic data are shown in **Table A1** and the modelled road network is shown in **Figure 3**. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2016b).

Table A1: Summary of Traffic Data used in the Assessment

LAEI Object ID	AADT		2017 Fleet Composition (%)								2017 Speed (km/h)
	2014	2017	Petrol Car	Diesel Car	Taxi	LGV	Rigid HGV	Artic HGV	Bus	MC	
162373	2,950	2,952	45.0	32.7	3.1	8.7	5.1	1.1	2.9	1.5	13.0
179315	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	24.4
179323	7,695	7,701	46.9	34.1	3.2	9.0	3.5	0.8	1.1	1.5	13.0
179288	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	24.9
179290	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	29.0
179291	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	31.9
179338	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	16.8
196183	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	18.2
196129	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	31.6
196171	7,695	7,701	46.9	34.1	3.2	9.0	3.5	0.8	1.1	1.5	13.0
205791	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	29.6
205809	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	23.6
205814	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	17.2
225245	2,950	2,952	45.0	32.7	3.1	8.7	5.1	1.1	2.9	1.5	13.0
297806	7,327	7,332	46.0	33.4	3.1	8.8	4.1	0.9	2.3	1.5	17.7
304980	7,327	7,332	46.0	33.4	3.1	8.8	4.1	0.9	2.3	1.5	17.7
304978	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	17.5
304979	13,586	13,617	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	12.1
310103	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	16.5
368945	5,188	5,193	48.0	34.9	3.3	9.2	2.5	0.6	0.0	1.5	20.8
366736	5,188	5,193	48.0	34.9	3.3	9.2	2.5	0.6	0.0	1.5	20.8
370042	5,188	5,193	48.0	34.9	3.3	9.2	2.5	0.6	0.0	1.5	20.8
370087	5,188	5,193	48.0	34.9	3.3	9.2	2.5	0.6	0.0	1.5	20.8
482431	3,664	3,666	46.0	33.4	3.1	8.8	4.1	0.9	2.3	1.5	17.7
482432	3,664	3,666	46.0	33.4	3.1	8.8	4.1	0.9	2.3	1.5	17.7
481916	7,327	7,332	46.0	33.4	3.1	8.8	4.1	0.9	2.3	1.5	17.7
482405	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	20.6
481827	13,756	13,788	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	14.1
481915	13,586	13,617	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	14.4
482414	6,878	6,894	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	16.2
482415	6,878	6,894	32.6	23.7	3.8	13.7	4.4	0.4	12.1	9.3	16.2
482416	6,793	6,808	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	17.2
482417	6,793	6,808	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	17.2
482421	13,586	13,617	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	22.1
515803	9,986	9,997	46.3	33.6	3.2	8.8	2.8	0.6	3.2	1.5	29.6
515804	9,986	9,997	46.3	33.6	3.2	8.8	2.8	0.6	3.2	1.5	7.1
515843	6,795	6,810	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.4	10.5
515844	6,792	6,807	33.0	24.0	3.9	13.9	4.4	0.4	11.0	9.5	20.2
515878	12,721	12,743	35.3	25.6	4.1	14.8	4.7	0.4	4.9	10.1	27.8
516367	12,947	12,971	34.7	25.2	4.1	14.6	4.6	0.4	6.5	9.9	18.9
529619	10,203	10,210	44.7	32.4	3.1	8.5	4.9	1.1	3.7	1.4	30.4

A1.1.2 Traffic data for Castle Road and Hadley Street are not included in the LAEI. Both roads are very lightly trafficked residential streets with vehicle movement restrictions in place; therefore, the contribution to emissions from traffic using these roads will be very small, and is not considered significant.

Emissions

A1.1.3 Road traffic emissions were calculated using the most recent version of the Emissions Factor Toolkit (EFT) v7.0 (Defra, 2017b). The traffic data were entered into the EFT in order to calculate a combined emission rate for each of the road links in the modelled network.

A1.1.4 The road traffic emissions for the sensitivity analysis were calculated using the Calculator Using Realistic Emissions for Diesels (CURED) tool (V2A) (AQC, 2016a).

A1.1.5 Emissions from diesel engines using the railway line between Camden Road Junction and Kentish Town West were taken from the LAEI and are shown in **Table A2**. The railway line has been included in the model as a road source, modelled at a height of 7.5m, which is equivalent to the modelled height of the second floor receptors.

Table A2: Railway Emissions

LAEI Link	Total Emissions (g/km/s)	
	NO_2	PM
313	0.081049	0.001719

Meteorological Data

A1.1.6 The model has been run using the full year of meteorological data that corresponds with the most recent set of NO_2 monitoring data (2014). The meteorological data has been taken from the monitoring station located at Heathrow Airport, which is considered suitable for the area.

A1.2. Background Concentrations

A1.2.1 Background concentrations have been assumed to be the same as those published by Defra (Defra, 2017b). These cover the whole country on a 1 km by 1 km grid and are published for each year from 2013 to 2030. The current maps have been verified against measurements undertaken during 2013. The Defra NOx and NO_2 maps have been adjusted based on a comparison between the mapped data and measured data from background AURN monitoring sites (AQC, 2016c).

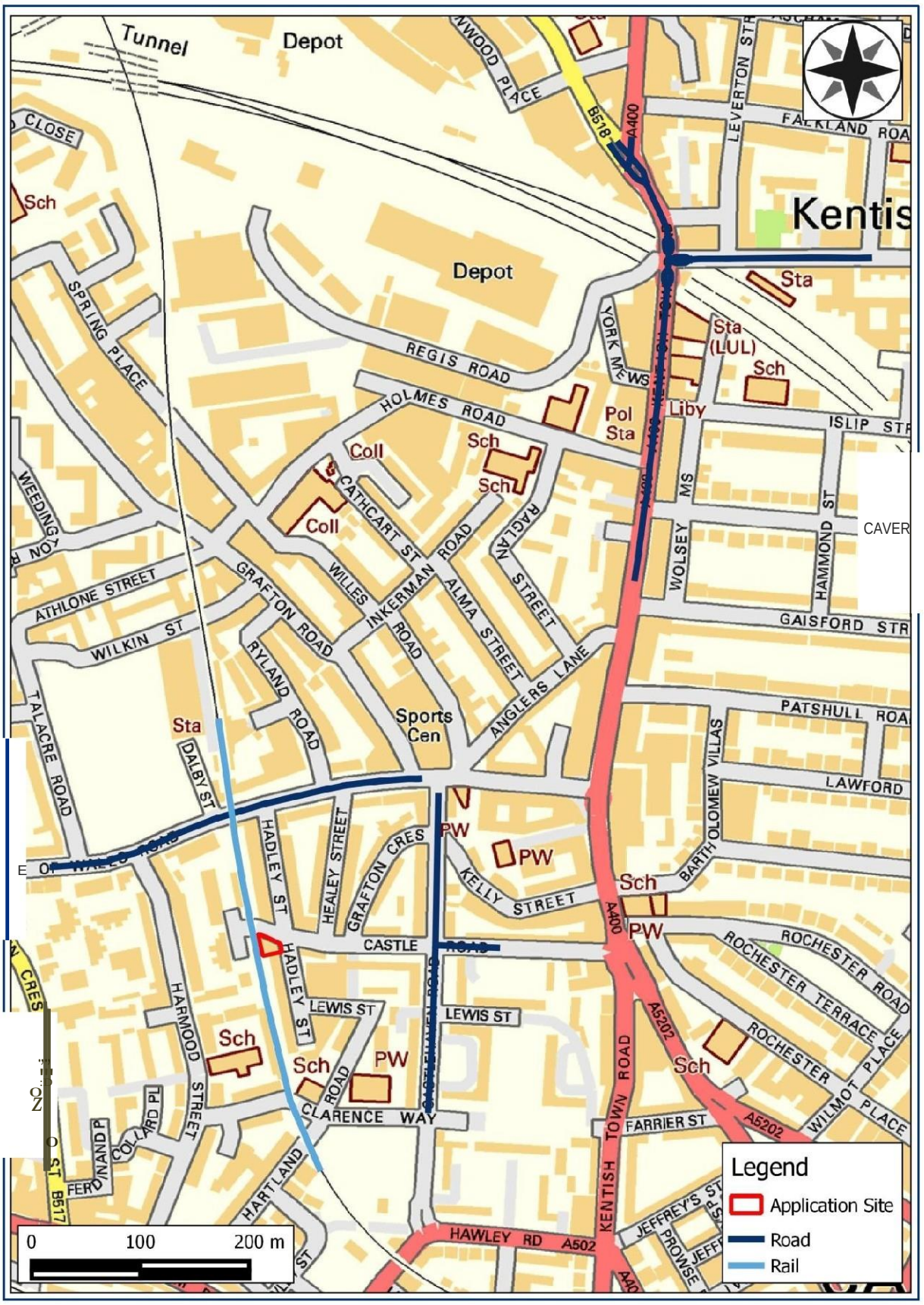

Figure 3: Modelled Roads/Rail

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A1.3. Verification

A1.3.1 The verification process seeks to minimise uncertainties associated with the air quality model by comparing the model output with locally measured concentrations. The verification methodology is described below.

NO_2

A1.3.2 Most NO_2 is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). The model has been run to predict the 2014 annual mean NOx concentrations at the Kentish Town Road diffusion tube monitoring site (as described in **Table 3**, and shown in **Figure 2**).

A1.3.3 The model output of road-NOx has been compared with the 'measured' road-NOx, calculated from the measured annual mean NO_2 concentration and the background concentration using the NOx from NO_2 calculator v5.1 published by Defra (Defra, 2017b).

A1.3.4 An adjustment factor has been determined as the ratio of the 'measured' road-NOx contribution and the model derived road-NOx contribution. This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total NO_2 concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with background NO_2 concentrations within the NOx to NO_2 calculator.

A1.3.5 The data used to calculate the adjustment factor are provided below:

- Measured NO_2: 57.8 µg/m^3
- Background NO_2: 39.3 µg/m^3
- 'Measured' road-NOx (from NOx from NO_2 calculator): 47.4 µg/m^3
- Modelled road-NOx = 42.7 µg/m^3
- Road-NOx adjustment factor: 47.4/42.7 = 1.1099

A1.3.6 The factor implies that the unadjusted model is under-predicting the road-NOx contribution. This is a common experience with this and most other models.

$PM_{2.5}$

A1.3.7 The model outputs of road-$PM_{2.5}$ have been adjusted by applying the adjustment factor calculated for road NO_x.

A1.4. Model Post-processing

NO_2

A1.4.1 The NOx to NO_2 calculator v5.1 published by Defra (Defra, 2017b) has been used to convert the modelled, verified road-NOx output for each receptor to road-NO_2. The background NO_2 concentrations have then been added to the predicted road-NO_2 concentrations and adjusted using the secondary verification factor to give the final predicted concentrations.

$PM_{2.5}$

A1.4.2 The verified road-$PM_{2.5}$ outputs need no further processing, and have been added to the background concentrations to give the final predicted concentrations.

A2 Professional Experience

Bob Thomas, BSc (Hons) PgDip MSc MIEnvSc MIAQM CSci

Bob Thomas is a Director at AQA, with over nine years' experience in the field of air quality management and assessment. He has carried out air quality assessments for a wide range of developments, including residential, commercial, industrial, minerals and waste developments. He has been responsible for air quality projects that include ambient air quality monitoring of nitrogen dioxide, dust and fine particulate matter (PM_{10}), the assessment of nuisance odours and dust, and the preparation of Review and Assessment reports for local authorities. He has extensive dispersion modelling experience for road traffic, energy centre and industrial sources, and has completed many stand-alone reports and chapters for inclusion within an Environmental Statement. Bob has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers, architects and process operators, and has provided expert witness services at public inquiry. He is a Chartered Scientist, a Member of the Institute of Air Quality Management and a Member of the Institution of Environmental Sciences.

A full CV for Bob Thomas is available at http://aqassessments.co.uk/about