Proposals for Mixed Use Regeneration

140-146 CAMDEN STREET
LONDON NW1 9PF

Planning Report

Air Quality Assessment

Prepared by:

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Air Quality Assessment:
140 – 146 Camden Street, Camden

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Experts in air quality
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1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed mixed-use development at 140-146 Camden Street, London NW1 9PF. The assessment has been carried out by Air Quality Consultants Ltd on behalf of CgMs.

1.2 The initial assessment was undertaken in June 2013 based on site plans D-CSC2-A113, D-CSC2-A115, D-CSC2-311, and D-CSC2-312. Since completion the following changes have been made to the development proposals:

- commercial floorspace has increased from 1,803 m^2 to 1,959 m^2;
- the mezzanine level has been removed and floor height increased from 2,650 mm to 3,550 mm;
- the number of residential units has decreased from 62 to 53;
- block C has been reduced from 9 to 8 storeys;
- block B remains at 5 storeys but has decreased in height by 200 mm;
- the three ground-floor and mezzanine-level maisonettes have been removed; and
- the wheelchair-accessible maisonette occupies a ground-floor location approximately 12 m closer to Camden Street.

1.3 The proposed development lies within an Air Quality Management Area (AQMA) declared by the London Borough (LB) of Camden for exceedences of the annual mean nitrogen dioxide objective. The proposed development provides no on-site parking apart from one EV charging bay and a disabled parking space, and therefore it is anticipated that there will be no significant increase in traffic on local roads. The new residential properties will, however, be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.4 This report describes existing local air quality conditions (2012), and the predicted air quality in the future. The assessment of traffic-related impacts focuses on 2016, which is the anticipated year of opening.

1.5 This report has been prepared taking into account all relevant local and national guidance and regulations in effect in 2013, and follows a methodology agreed with the LB of Camden at that time.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) provides the policy framework (Defra, 2007) for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Planning Policy

National Policies

2.2 The National Planning Policy Framework (NPPF) (2012) introduced in March 2012 now sets out planning policy for the UK in one place. It replaces previous Planning Policy Statements, including PPS23 on Planning and Pollution Control. The NPPF contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account, as well as the EU limit values or national objectives for pollutants, the presence of any AQMAs and the appropriateness of both the development for the site, and the site for the development.

2.3 The NPPF places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should *"contribute to…reducing pollution"*. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the effects of pollution on health and the sensitivity of the area and the development should be taken into account.

2.4 The need for compliance with any statutory air quality limit values and objectives is stressed, and the presence of AQMAs must be accounted for in terms of the cumulative impacts on air quality from individual sites in local areas. New developments in AQMAs should be consistent with local air quality action plans.

The London Plan

2.5 The London Plan 2011 (GLA, 2011) sets out the spatial development strategy for London. It brings together all relevant strategies, including those relating to air quality.

2.6 Policy 7.14, 'Improving Air Quality', addresses the spatial implications of the Mayor's Air Quality Strategy and how development and land use can help achieve its objectives. It recognises that Boroughs should have policies in place to reduce pollutant concentrations, having regard to the Mayor's Air Quality Strategy. Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

The Mayor's Air Quality Strategy

2.7 The revised Mayor's Air Quality Strategy (MAQS) was published in December 2010 (GLA, 2010). The overarching aim of the Strategy is to reduce pollution concentrations in London to achieve compliance with the EU limit values as soon as possible. The Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures. These additional measures and the role of the Low Emission Zone are described in Appendix A1.

Local Transport Plan

2.8 Objective 1 of the LB of Camden's Transport Strategy 2011 is to:

"Reduce motor traffic levels and vehicle emissions to improve air quality, mitigate climate change and contribute to making Camden a 'low carbon and low waste borough'."

2.9 There are three polices that refer specifically to air quality to help achieve this objective these are:

"Policy 1.2 – The Council will continue to encourage travel by sustainable modes, reduce motor vehicle dependency and the dominance of motor traffic in the borough. The Council will aim to increase the permeability of streets and remove one-way gyratories.

Policy 1.4 – Camden will continue to promote Low Emission Vehicles and support the staged introduction of the Low Emissions Zone in London. The Council would also like to see further development of national policy to support local level efforts to improve air quality and tackle climate change.

Policy 1.5 – For essential car journeys, Camden will encourage more residents and businesses to change to electric vehicles, (with electricity generated by renewable sources), to help reduce air and noise pollution…."

Local Policies

2.10 Changes to the planning legislation require the Council to replace the Development Plan with a Local Development Framework (LDF). The LDF is a portfolio of planning documents, individually known as Local Development Documents, which will deliver the spatial development strategy for the LB of Camden and build upon existing local and regional strategies and initiatives.

2.11 The LB of Camden's Core Strategy 2010 – 2025 includes four policies which refer to air quality:

- *"Policy CS5 Managing the impact of growth and development: … Protecting and enhancing our environment…*
- *Policy CS9 Achieving a successful Central London:…k) continue to designate Central London as a Clear Zone Region to reduce congestion, promote walking and cycling and improve air quality…*
- *Policy CS11 Promoting sustainable and efficient travel. The Council will promote the delivery of transport infrastructure and the availability of sustainable transport choices in order to support Camden's growth, reduce the environmental impact of travel, and relieve pressure on the borough's transport network.*
- *Policy CS16 Improving Camden's health and well-being: recognise the impact of poor air quality on health and implement Camden's Air Quality Action Plan which aims to reduce air pollution levels."*

2.12 There are also two development policies referring to air quality:

- *"DP22 Promoting sustainable design and construction: The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaption measures such as: i) reducing air pollution.*
- *DP32 Air quality and Camden's clear zone: 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…"*

2.13 The LB of Camden has also prepared a Supplementary Planning Document – Camden Planning Guidance (CPG) 6 Amenity (London Borough of Camden, 2011), which provides further guidance on air quality. It includes information on when an air quality assessment will be required, what an air quality assessment should cover and what measures can reduce air quality emissions and protect public exposure. It lists criteria where an air quality assessment would be required, and includes (amongst others) developments:

- *"Where people will be exposed to poor air quality for significant periods of the day, in particular developments located on busy roads …"*

Air Quality Action Plan

2.14 The LB of Camden has declared an AQMA for nitrogen dioxide that covers the whole Borough. The Council has since developed an Air Quality Action Plan (London Borough of Camden, 2009). There are four main objectives focused on in the plan these are:

- "*Reducing transport emissions including: encouraging the use of sustainable transport and low emission vehicles, encouraging changes in driver behaviour and supporting initiatives introduced by the Mayor.*
- *Reducing emissions associated with new development including: controlling emissions from construction sites, measures to reduce transport and gas boiler emissions.*
- *Reducing emissions from gas boilers and industrial processes including: reducing the Council's gas boiler emission and controlling air pollution form small industrial processes.*
- *Air quality awareness raising initiatives including: provision of air quality information and strengthening promotional work relating to air pollution and health.*"

2.15 The LB of Camden has produced an update to the action plan which covers the period 2013-2015 (London Borough of Camden, 2013). This is currently a draft consultation document, the plan focuses on five sections:

1. *"Reducing transport emissions.*
2. *Reducing emissions associated with new development.*
3. *Reducing emissions from gas boilers and industrial processes.*
4. *Air quality awareness raising initiatives.*
5. *Lobbying and partnership working."*

2.16 The Air Quality Action Plan is also linked with the LB of Camden's Environmental Sustainability Plan (London Borough of Camden, 2011) which aims to:

- *"Reduce levels of NO_2 by up to 50% by 2015 on our most polluted roads, in partnership with regional and national government, to achieve the NO_2 air quality objectives.*
- *Continue to comply with the air quality objectives for PM_{10} concentrations and endeavour to reduce these in the long term in order to protect public health."*

This will be achieved by:

- *"Lower levels of road traffic and increased use of sustainable transport*
- *Higher proportion of low emissions vehicles on our roads such as biomethane, electric, hybrid*

- *Reduced energy use from gas boilers*
- *Improved awareness of the sources and health impacts of air pollution and how to avoid generating pollution."*

Assessment Criteria

2.17 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations, 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.18 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2009). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level.

2.19 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2009). The annual mean objectives for nitrogen dioxide and PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc. The 24-hour objective for PM_{10} is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.

2.20 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. Achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). The limit values for nitrogen dioxide are the same levels as the UK objectives, but applied from 2010 (The Air Quality Standards Regulations (No. 1001), 2010). The limit values for PM_{10} and $PM_{2.5}$ are also the same level as the UK statutory objectives, but applied from 2005 for PM_{10} and will apply from 2015 for $PM_{2.5}$.

2.21 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles (PM_{10})	24-hour Mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles ($PM_{2.5}$) [a]	Annual Mean	25 $\mu g/m^3$

[a] The $PM_{2.5}$ objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it. The EU limit value is the same, but is to be met by 2015.

Descriptors for Air Quality Impacts and Assessment of Significance

2.22 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. The approach developed by the IAQM[1] (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's (EPUK) guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. This approach includes elements of professional judgement. Full details of this approach are provided in Appendix A2, with the professional experience of the consultants preparing the report set out in Appendix A3.

[1] The IAQM is the professional body for air quality practitioners in the UK.

3 Assessment Approach

Consultation

3.1 The assessment follows a methodology agreed with the LB of Camden via emails between Nick Humfrey (Sustainability Officer at LB of Camden) and Imogen Heard (Air Quality Consultants) on 2nd and 8th October 2013.

Existing Conditions

3.2 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2013c) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2013). Local sources have also been identified through discussion with the LB of Camden's Air Quality Team, as well as through examination of the Council's Air Quality Review and Assessment reports.

3.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers nearby sites and is used to provide context for the assessment. The background concentrations across the study area have been defined using the national pollution maps published by Defra (2013a). These cover the whole country on a 1x1 km grid.

Road Traffic Impacts

Sensitive Locations

3.4 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations within the proposed development. Receptors have been identified to represent worst-case exposure within these locations.

3.5 Receptor locations have been identified within the new development across seven floors, which represent exposure to existing traffic sources. These 13 locations are at the façades of the proposed residential units and are described in Table 2 and shown in Figure 1. Although the plans (shown in Appendix A5) have changed slightly since the modelling was carried out, most of these positions are still representative of worst-case relevant exposure within the development. The exceptions are Receptor A_0, which will underestimate exposure, and C_7, which will overestimate exposure. In addition, concentrations have been modelled at the diffusion tube monitoring site located on Camden Road, in order to verify the modelled results (see Appendix A4 for verification method).

Table 2: Description of Receptor Locations

Receptor [a]	Description	Height above Camden Street (m)
Receptor A_0	Building façade - Ground floor wheelchair-accessible maisonette	0.3
Receptor B_1	Building façade - First floor flat	3.3
Receptor B_2	Building façade - Second floor flat	6.2
Receptor B_3	Building façade - Third floor flat	9.2
Receptor C_1	Building façade - First floor flat	6.0
Receptor C_2	Building façade - Second floor flat	8.9
Receptor C_3	Building façade - Third floor flat	11.9
Receptor C_4	Building façade - Fourth floor flat	14.8
Receptor C_5	Building façade - Fifth floor flat	17.8
Receptor C_6	Building façade - Sixth floor flat	20.7
Receptor C_7	Building façade - Seventh floor flat	23.7
Receptor D_1	Building façade - First floor flat	5.6
Receptor D_2	Building façade - Second floor flat	8.6

[a] The number denotes the floor that the receptor is on.

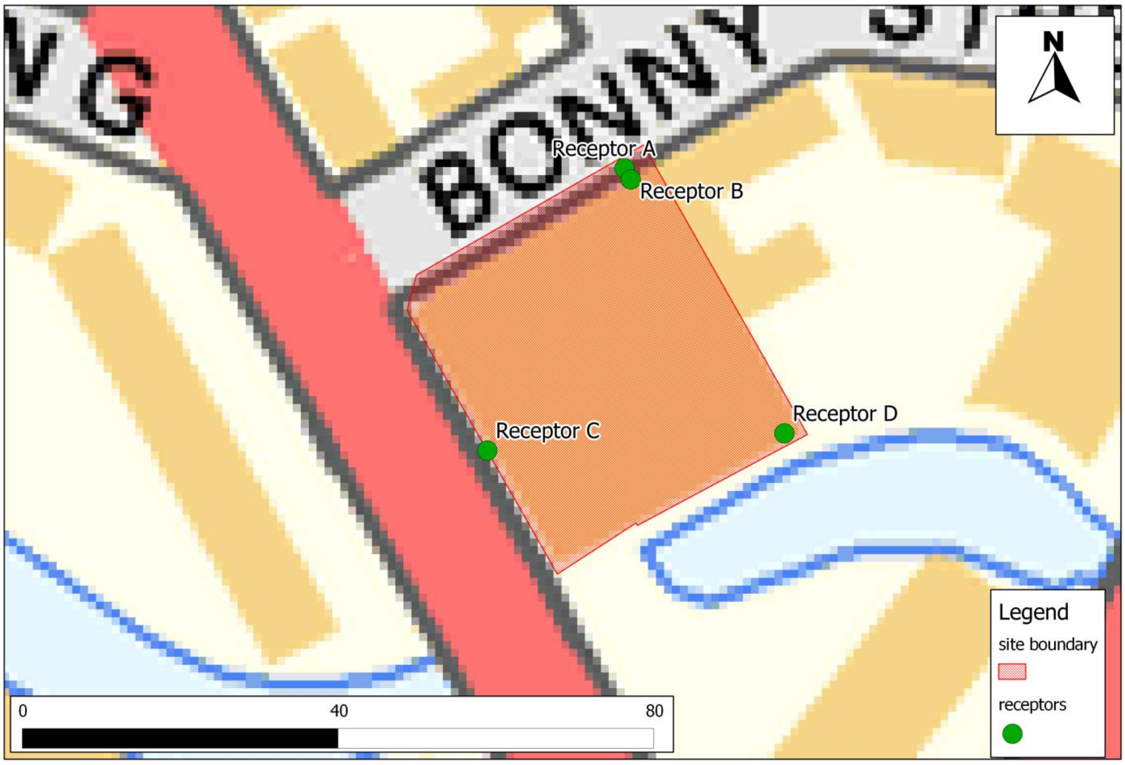

Figure 1: Receptor Locations

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Assessment Scenarios

3.6 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2012), and the proposed year of opening (2016). A further 2016 sensitivity test has been carried out for nitrogen dioxide that involves assuming no reduction in emission factors for road traffic from the baseline year. This is to address the issue identified by Defra (Carslaw et al., 2011) that road traffic emissions have not been declining as expected (see later section on uncertainty). Nitrogen dioxide concentrations in 2016 are thus presented for two scenarios: 'With Emissions Reduction' and 'Without Emissions Reduction'.

Modelling Methodology

3.7 Concentrations have been predicted for the baseline and future years using the ADMS-Roads dispersion model. Details of the model inputs and the model verification are provided in Appendix A4, together with the method used to derive current and future year background nitrogen dioxide concentrations.

4 Site Description and Baseline Conditions

4.1 The proposed development site is located approximately 1 km to the northeast of Regent's Park. The site is bounded by Camden Street to the west, Bonny Street to the north and Regent's Canal to the south. It currently consists of commercial properties, with residential properties in the immediate, surrounding area.

Industrial sources

4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2013c) and Environment Agency's 'what's in your backyard' (Environment Agency, 2013) websites did not identify any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality.

Air Quality Review and Assessment

4.3 The LB of Camden has investigated air quality within its area as part of its responsibilities under the LAQM regime. In 2000, an Air Quality Management Area (AQMA) was declared across the whole borough for exceedences of the annual mean nitrogen dioxide and daily mean PM_{10} objectives.

Local Air Quality Monitoring

4.4 LB of Camden operates four automatic monitoring stations within its area. None of these are in close proximity to the proposed development site. The Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Gradko Environmental (using the 50% TEA in acetone method). These include one deployed on Camden Road approximately 75 m east of the proposed development. Up until 2010 there was also a diffusion tube located on Inverness Street, approximately 320 m south-west of the proposed development. Data for these sites have been provided by the LB of Camden. Results for Camden Road for the years 2008 to 2012 are summarised in Table 3. The results for Inverness Street from 2007 to 2010 are also presented for information. The monitoring locations are shown in Figure 2.

Table 3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2007-2012) [a]

Site No.	Site Type	Location	2007	2008	2009	2010	2011	2012
Diffusion Tubes - Annual Mean (µg/m^3) [b]								
CA19	Roadside	Inverness Street	**52.6**	**41.5**	**45.7**	**55.0**	-	-
CA20	Roadside	Camden Road	-	**66.5**	**73.0**	**84.0**	**72.2**	**67.4**
Objective			40					

[a] Exceedences of the objectives are shown in bold

[b] Data for Inverness Street have been taken from the 2010 Air Quality Progress Report (The London Borough of Camden, September 2011) and data for Camden Road have been taken from the 2013 Air Quality Progress Report (The London Borough of Camden, July 2013). All results adjusted for diffusion tube bias by LB of Camden.

4.5 Concentrations at both Inverness Street (CA19) and Camden Road (CA20) have exceeded the annual mean nitrogen dioxide objective in all years presented. Although the Camden Road site is within 100 m of the proposed development, concentrations are expected to be lower across the development site because the volume of traffic along Camden Street is lower than on Camden Road.

4.6 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 are discussed in Section 5 of this report.

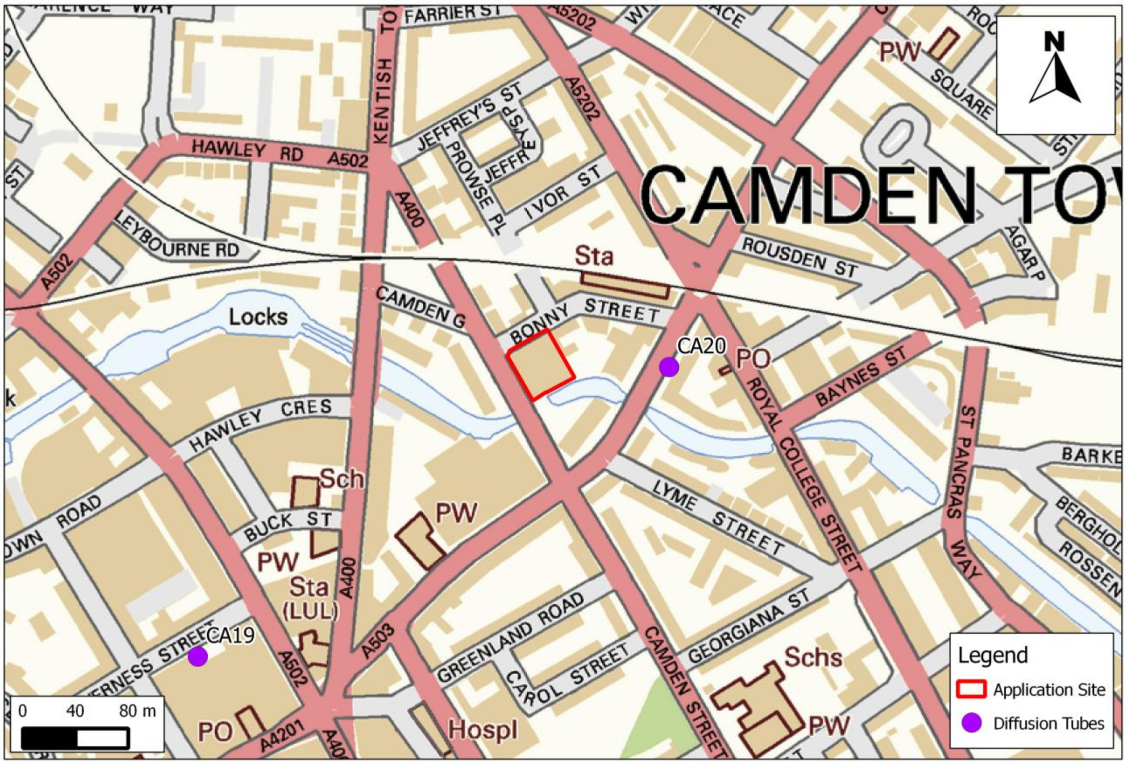

Figure 2: **Monitoring Locations**

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4.7 There are no monitors measuring PM_{10} and $PM_{2.5}$ concentrations close to the proposed development site.

Background Concentrations

National Background Pollution Maps

4.8 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2012 and the opening year 2016 (Table 4). In the case of nitrogen dioxide, two sets of future-year backgrounds are presented to take into account uncertainty in future year vehicle emission factors. The derivation of background concentrations is described in Appendix A4. The background concentrations are all below the objectives although, in the case of nitrogen dioxide, the concentration is very close to the objective in 2012.

Table 4: Estimated Annual Mean Background Pollutant Concentrations in 2012 and 2016 ($\mu g/m^3$)

Year	NO_2	PM_{10}	$PM_{2.5}$
2012 [a]	39.3	21.8	15.3
2016 – Without Reductions in Traffic Emissions [b]	37.8	n/a	n/a
2016 – With Reductions in Traffic Emissions [c]	34.6	20.7	14.2
Objectives	**40**	**40**	**25**

n/a = not applicable

[a] This assumes that road vehicle emission factors in 2012 remain the same as in 2010 (See Appendix A4).

[b] This assumes that road vehicle emission factors in 2016 remain the same as in 2010.

[c] This assumes that road vehicle emission factors reduce between 2012 and 2016 at the current 'official' rates.

5 Impact Assessment

5.1 The predicted impacts of existing traffic sources on air quality conditions for residents occupying the new residential units in the proposed development are set out in Table 5 (see Table 2 and Figure 1 for receptor locations). For nitrogen dioxide, results are presented for two scenarios to reflect current uncertainty in Defra's future-year vehicle emission factors. All the values for PM_{10} and $PM_{2.5}$ are below the objectives.

5.2 There is a risk of exceedences of the annual mean nitrogen dioxide objective up to the fifth floor if vehicle emissions do not decline as expected. Predicted concentrations at the fifth floor level are only marginally above the objective assuming no reduction in emissions. There are no predicted exceedences of the annual mean nitrogen dioxide objective on the sixth and seventh floors. If vehicle emissions decrease as expected there is predicted to be a risk of exceedence of the annual mean nitrogen dioxide objective up to the second floor.

5.3 If the assessment were to be carried out using the updated tools (vehicle emission factors (v6.0.2) and estimated background concentrations) it would not significantly alter these conclusions, with concentrations likely to lie between the with and without emissions reductions scenarios.

Table 5: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in the Development Site

Receptor [d]	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [a]		$PM_{2.5}$ (µg/m^3)
	With 'Official' Emissions Reduction [b]	Without Emissions Reduction [c]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Receptor A_0	**43.3**	**48.0**	21.5	6	14.7
Receptor B_1	**42.9**	**47.5**	21.5	5	14.7
Receptor B_2	**41.9**	**46.3**	21.4	5	14.6
Receptor B_3	**40.5**	**44.8**	21.3	5	14.5
Receptor C_1	**46.9**	**51.9**	21.9	6	14.9
Receptor C_2	**41.5**	**45.8**	21.4	5	14.6
Receptor C_3	39.1	**43.1**	21.1	5	14.4
Receptor C_4	37.8	**41.6**	21.0	5	14.4
Receptor C_5	37.0	**40.6**	20.9	5	14.3
Receptor C_6	36.4	39.9	20.9	5	14.3
Receptor C_7	36.0	39.4	20.8	4	14.2
Receptor D_1	**43.5**	**48.1**	21.6	6	14.7
Receptor D_2	**41.9**	**46.3**	21.4	5	14.6
Objectives	**40**		**40**	**35**	**25**

[a] The numbers of days with PM_{10} concentrations greater than 50 µg/m^3 have been estimated from the relationship with the annual mean concentration described in LAQM.TG (09) (Defra, 2009).

[b] This assumes that road vehicle emission factors reduce between 2012 and 2016 at the current 'official' rates.

[c] This assumes that road vehicle emission factors in 2016 will remain the same as in 2012.

[d] The number denotes the floor that the receptor is on.

Uncertainty in Road Traffic Modelling Predictions

5.4 There are many components that contribute to the uncertainty of modelling predictions. The model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as the model is required to simplify real-world conditions into a series of algorithms. An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A4). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2012) concentrations.

5.5 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations, and vehicle emissions. A disparity between the road transport emission projections and measured annual mean concentrations of nitrogen oxides and nitrogen dioxide has been identified by Defra (Carslaw et al., 2011). This is evident across the UK, although the effect appears to be greatest in inner London; there is also considerable inter-site variation. Whilst the emission projections suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase.

5.6 This disparity led to a detailed review of the emission factors and fleet mix for UK conditions, and in July 2012, Defra issued a revised Emissions Factors Toolkit (ETFv5.1.3). This has since been updated to version EFTv5.2c, which has undergone some further, more minor, revisions. EFTv5.2c utilises revised nitrogen oxides emissions factors and also incorporates revised vehicle fleet composition data (Defra, 2012). It goes some way to addressing the disparity between air quality measurements and emissions, but does not fully address it, and it is recognised that the forecast reductions may still be optimistic in the near-term (i.e. the next five years or so).

5.7 The reason for the disparity is thought to relate to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles is often no better than that of earlier models (Carslaw et al., 2011). The best current evidence is that, where previous standards have had limited on-road success, the ‘Euro VI’ and ‘Euro 6’ standards that new vehicles will have to comply with from 2013/15[2] will achieve the expected on-road improvements, as, for the first time, they will require compliance with the World Harmonized Test Cycle, which better represents real-world driving conditions and includes a separate slow-speed cycle for heavy duty vehicles.

5.8 As noted above, the new forecast reductions in nitrogen oxides emissions may still be optimistic in the near-term. To account for this uncertainty, a sensitivity test has been conducted assuming that the future (2016) road traffic emissions per vehicle are unchanged from 2012 values. The predictions within this sensitivity test are likely to be over-pessimistic, as new, lower-emission Euro VI and Euro 6 vehicles will be on the road from 2013/15; by 2016 it is forecast that there will be a roughly 30-50% penetration of Euro VI heavy duty vehicles (HDVs) and a roughly 15-20%

[2] Euro VI refers to heavy duty vehicles, while Euro 6 refers to light duty vehicles. The timings for meeting the standards vary with vehicle type and whether the vehicle is a new model or existing model.

penetration of Euro 6 light duty vehicles (LDVs). These new vehicles are expected to deliver real on-road reductions in nitrogen oxides emissions.

Significance of Operational Air Quality Impacts

5.9 The operational air quality impacts are judged to be *moderate adverse*. This professional judgement is made in accordance with the methodology set out in Appendix A2 taking into account the factors set out in Table 6, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. The latter has been addressed by giving consideration to both sets of modelled results for nitrogen dioxide; those with and without reductions in traffic emissions. It is to be expected that concentrations will fall in the range between the two sets of results.

5.10 More specifically, the judgement that the air quality impacts will be *moderate adverse* takes account of the assessment that concentrations are predicted to remain above the annual mean nitrogen dioxide objective at receptors up to the fifth floor, assuming no emissions reduction.

Table 6: Factors Taken into Account in Determining the Overall Significance of the Scheme on Local Air Quality

Factors	Outcome of Assessment
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.	There will be introduction of a number of people exposed to exceedences of the objectives.
Uncertainty, including the extent to which worst-case assumptions have been made.	The inclusion of the two scenarios for nitrogen dioxide covers the uncertainty over vehicle emission factors.
The extent to which an objective or limit value is exceeded.	The annual mean nitrogen dioxide objective is exceeded at multiple receptors.

6 Mitigation

6.1 The assessment has demonstrated that the scheme will introduce new residential accommodation into an area where the annual mean nitrogen dioxide objective is likely to be exceeded. It is recommended that mitigation be applied in the form of mechanical ventilation for dwellings located on the ground to the fourth floors. The predicted exceedences at the fifth floor are marginal and are based on the overly-conservative assumption that there will be no reductions in emissions by 2016. In reality, it is expected that the introduction of Euro 6/VI vehicles will deliver some benefits, and the levels predicted under the “no emissions reduction” scenario are overstated.

6.2 Clean air for the residential units in the block adjacent to Camden Street can be drawn from the roof at the rear of the building, where annual mean nitrogen dioxide concentrations are below the objective.

6.3 Concentrations at the roof-top level of the lower level blocks to the rear of the scheme, adjacent to the Regent’s Canal in the vicinity of receptor D, exceeds the annual mean nitrogen dioxide objective; it is thus recommended that a NOx scrubbing system is installed at the ventilation intake. Air filtration systems typically have an efficiency of 75%. Any air filtration units would need to be routinely checked and maintained to ensure that they continue to operate effectively.

6.4 Mitigation measures to reduce pollutant emissions from road traffic are also being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation.

7 Residual Impacts

7.1 An indication of how the proposed mitigation is likely to reduce concentrations of nitrogen dioxide at each receptor is shown in Table 7, which draws upon the data in Table 5. The results describe the predicted nitrogen dioxide concentrations assuming that ventilated air is drawn from the roof at the rear of the building in line with the approximate location of receptor C_7 for use in the block adjacent to Camden Street, and that ventilated air is drawn in from the building façade at the remaining residential units and filtered (assuming 75% efficiency) for use in the blocks to the rear of the scheme. Although the location of receptor A_0 no longer represents worst case exposure, with mitigation in place air quality at all locations will be acceptable.

7.2 With mechanical ventilation, and use of air filtration where highlighted, air quality will be acceptable for all residents of the proposed scheme, and the air quality impact is judged to be *insignificant*. This professional judgement is made in accordance with the methodology set out in in Appendix A2 taking into account the factors set out in Table 8.

Table 7: Predicted Concentrations of Nitrogen Dioxide (NO_2) in 2016 for New Receptors in the Development Site With and Without Mitigation

Receptor [c]	Annual Mean NO_2 ($\mu g/m^3$)			
	Without ventilation		With ventilation	
	With 'Official' Emissions Reduction [a]	Without Emissions Reduction [b]	With 'Official' Emissions Reduction [a]	Without Emissions Reduction [b]
Receptor A_0	**43.3**	**48.0**	10.8 [d]	12.0 [d]
Receptor B_1	**42.9**	**47.5**	10.7 [d]	11.9 [d]
Receptor B_2	**41.9**	**46.3**	10.5 [d]	11.6 [d]
Receptor B_3	**40.5**	**44.8**	10.1 [d]	11.2 [d]
Receptor C_1	**46.9**	**51.9**	36.0	39.4
Receptor C_2	**41.5**	**45.8**	36.0	39.4
Receptor C_3	39.1	**43.1**	36.0	39.4
Receptor C_4	37.8	**41.6**	36.0	39.4
Receptor C_5	37.0	**40.6**	36.0	39.4
Receptor C_6	36.4	39.9	36.4	39.9
Receptor C_7	36.0	39.4	36.0	39.4
Receptor D_1	**43.5**	**48.1**	10.9 [d]	12.0 [d]
Receptor D_2	**41.9**	**46.3**	10.5 [d]	11.6 [d]
Objectives	**40**			

[a] This assumes that road vehicle emission factors reduce between 2012 and 2016 at the current 'official' rates.

[b] This assumes that road vehicle emission factors in 2016 will remain the same as in 2012.

[c] The number denotes the floor that the receptor is on.

[d] Assuming 75% reduction due to air filtration.

Table 8: Factors Taken into Account in Determining the Overall Significance of the Scheme on Local Air Quality with Mitigation

Factors	Outcome of Assessment
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.	No residents of the scheme will be exposed to exceedences of the objectives.
Uncertainty, including the extent to which worst-case assumptions have been made.	The inclusion of the two scenarios for nitrogen dioxide covers the uncertainty over vehicle emission factors.
The extent to which an objective or limit value is exceeded.	Unfiltered, ventilated air from the roof will provide acceptable air quality for future residents of the scheme. Filtered, ventilated air will provide future residents of the scheme with clean air, with concentrations well below the annual mean nitrogen dioxide objective.

8 Summary and Conclusions

8.1 The air quality impacts associated with the proposed mixed-use development at 140-146 Camden Street have been assessed. Existing conditions within the study area show poor air quality, with concentrations of nitrogen dioxide exceeding the annual mean objective along Camden Road and Camden Street near to the development site. An AQMA has been declared for this area.

8.2 The impacts of traffic from local roads on the air quality for future residents have been assessed at 13 worst-case locations within the new development itself. In the case of nitrogen dioxide, the modelling has been carried out assuming both that vehicle emissions decrease (using 'official' emission factors), and that they do not decrease in future years. This is to allow for current uncertainty over emission factors for nitrogen oxides that has been identified by Defra (Carslaw et al., 2011).

8.3 It is concluded that concentrations of PM_{10} and $PM_{2.5}$ will remain below the objectives at all new receptors in 2016.

8.4 In the case of nitrogen dioxide, there is a risk that annual mean concentrations will exceed the objective at receptors up to the fourth floor.

8.5 The overall operational air quality impacts of the development without mitigation are judged to be *moderate*. This conclusion, which takes account of the uncertainties in future projections, in particular for nitrogen dioxide, is based on the concentrations being above the objectives at the majority of receptors. The conclusions would not be significantly different, if the modelling was repeated with the most recent versions of the emission factor toolkit and background pollutant concentration maps.

8.6 Mitigation is to be applied in the form of mechanical ventilation, with air filtration where necessary, for dwellings located up to and including the fourth floor. With this mitigation it is concluded that road traffic emissions do not provide any constraints to the proposed scheme and the operational impacts are judged to be insignificant.

8.7 The proposed development is consistent with the NPPF. Furthermore, the scheme does not conflict with the requirements of policies related to air quality outlined in the Core Strategy and the London Plan.

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10 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
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
LAEI	London Atmospheric Emissions Inventory
LAQM	Local Air Quality Management
LB	London Borough
LDF	Local Development Framework
LDV	Light Duty Vehicles (<3.5 tonnes)
LEZ	Low Emission Zone
$\mu g/m^3$	Microgrammes per cubic metre
MAQS	Mayor's Air Quality Strategy
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
TEA	Triethanolamine – used to absorb nitrogen dioxide

11 Appendices

A1 Extracts from the London Plan and Mayor's Air Quality Strategy, and Description of the Low Emission Zone (LEZ)

London Plan

A1.1 The London Plan sets out the following points in relation to planning decisions:

"Development proposals should:

a) minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within AQMAs or 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 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 form 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 made to reduce emissions from a development, these usually are made on site. Where it can be demonstrated that on-sire provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches;

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

The Mayor's Air Quality Strategy

A1.2 The Mayor's Air Quality Strategy commits to the continuation of measures identified in the 2002 MAQS, and sets out a series of additional measures, including:

Policy 1 – Encouraging smarter choices and sustainable travel;

Measures to reduce emissions from idling vehicles focusing on buses, taxis, coaches, taxis, PHVs and delivery vehicles;

Using spatial planning powers to support a shift to public transport;

Supporting car free developments.

Policy 2 – Promoting technological change and cleaner vehicles:

Supporting the uptake of cleaner vehicles.

Policy 4 – Reducing emissions from public transport:

Introducing age limits for taxis and PHVs.

Policy 5 – Schemes that control emissions to air:

Implementing Phases 3 and 4 of the LEZ from January 2012

Introducing a NOx emissions standard (Euro IV) into the LEZ for Heavy Goods Vehicles (HGVs), buses and coaches, from 2015.

Policy 7 – Using the planning process to improve air quality:

Minimising increased exposure to poor air quality, particularly within AQMAs or where a development is likely to be used by a large number of people who are particularly vulnerable to air quality;

Ensuring air quality benefits are realised through planning conditions and section 106 agreements and Community Infrastructure Levy.

Policy 8 – Creating opportunities between low to zero carbon energy supply for London and air quality impacts:

Applying emissions limits for biomass boilers across London;

Requiring an emissions assessment to be included at the planning application stage.

Low Emission Zone (LEZ)

A1.3 A key measure to improve air quality in Greater London is the Low Emission Zone (LEZ). This entails charges for vehicles entering Greater London not meeting certain emissions criteria, and affects older, diesel-engined lorries, buses, coaches, large vans, minibuses and other specialist vehicles derived from lorries and vans. The LEZ was introduced on 4th February 2008, and was phased in through to January 2012. From January 2012 a standard of Euro IV was implemented for lorries and other specialist diesel vehicles over 3.5 tonnes, and buses and coaches over 5 tonnes. Cars and lighter Light Goods Vehicles (LGVs) are excluded. The third phase of the LEZ, which applies to larger vans, minibuses and other specialist diesel vehicles, was also implemented in January 2012. As set out in the 2010 MAQS, a NOx emissions standard (Euro IV) will be included into the LEZ for HGVs, buses and coaches, from 2015.

A2 Assessment of Significance

Assessment of Significance

A2.1 There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by the Institute of Air Quality Management[3] (Institute of Air Quality Management, 2009), and incorporated in Environmental Protection UK's guidance document on planning and air quality (Environmental Protection UK, 2010), has therefore been used. The guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either, *insignificant*, *minor*, *moderate* or *major*. In drawing this conclusion, the factors set out in Table A2.1 should be taken into account. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A3.

Table A2.1: Factors Taken into Account in Determining Air Quality Significance

Factors
The number of people exposed to levels above the objective or limit value, where new exposure is being introduced.
Uncertainty, including the extent to which worst-case assumptions have been made.
The extent to which an objective or limit value is exceeded, e.g. an annual mean NO_2 of 41 $\mu g/m^3$ should attract less significance than an annual mean of 51 $\mu g/m^3$.

3 The IAQM is the professional body for air quality practitioners in the UK.

A3 Professional Experience

Penny Wilson, BSc (Hons) CSci MIEnvSc MIAQM

Ms Wilson is a Principal Consultant with AQC, with more than thirteen years' relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is a Chartered Scientist and Member of the Institute of Air Quality Management.

Caroline Odbert, BA (Hons) MSc MIEnvSc MIAQM

Ms Odbert is a Senior Consultant with AQC with over seven years' relevant experience. She is involved in the preparation of air quality assessments for a range of development projects. She has been responsible for a wide range of air quality projects covering impact assessments for new residential and commercial developments, local air quality management, ambient air quality monitoring of nitrogen dioxide and sulphur dioxide and the assessment of nuisance odours. She has extensive modeling experience for road traffic and has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. She is a Member of the Institute of Air Quality Management.

Dr Imogen Heard, BSc (Hons) MSc PhD

Dr Heard is a Consultant with AQC. Prior to joining she worked as a scientist in the Atmospheric Dispersion and Air Quality area at the UK Met Office for four years, modeling the dispersion of a range of pollutants over varying spatial and temporal scales. She now works in the field of air quality assessment and is involved in a range of development projects that include using the ADMS-Roads dispersion model to study nitrogen dioxide, PM_{10}, and $PM_{2.5}$, and the preparation of air quality assessment reports.

Full CVs are available at www.aqconsultants.co.uk.

A4 Modelling Methodology

Background Concentrations

A4.1 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2013a). These cover the whole country on a 1x1 km grid and are published for each year from 2010 until 2025. The maps include the influence of emissions from a range of different sources; one of which is road traffic. As noted in Paragraph 3.6, there are some concerns that Defra may have over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2010 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2010. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

A4.2 Background concentrations in 2012 have been calculated for the development site and in order to carry out the verification process, see next section on Model Verification, and to calculate the 'with emissions reduction' background concentrations for 2016. To do this, it has been assumed that there was no reduction in the road traffic component of backgrounds between 2010[4] and 2012. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2013a). For each grid square, the road traffic component has been held constant at 2010 levels, while 2012 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2013a) publishes to accompany the maps. The result is a set of 'adjusted 2012 background' concentrations.

A4.3 As an additional step, the background maps have been calibrated against national measurements made as part of the AURN during 2012. The published background maps were calibrated against 2010 monitoring data. 2010 was identified as a 'high pollution' year, as a result the background maps may over predict the local background concentrations. Therefore a comparison between the 2012 annual mean nitrogen dioxide concentration at all background monitoring sites within the AURN and the background mapped concentrations has been carried out (see Figure A4.1). Based on the 62 sites with more than 75% data capture for 2012, the maps over-predict the background concentrations by 1.9%, on average. This has been allowed for in production of the calibrated 'adjusted' 2012 background concentrations.

[4] This approach assumes that has been no reduction in emissions per vehicle but also that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. Overall, this discrepancy is unlikely to influence the overall conclusions of the assessment.

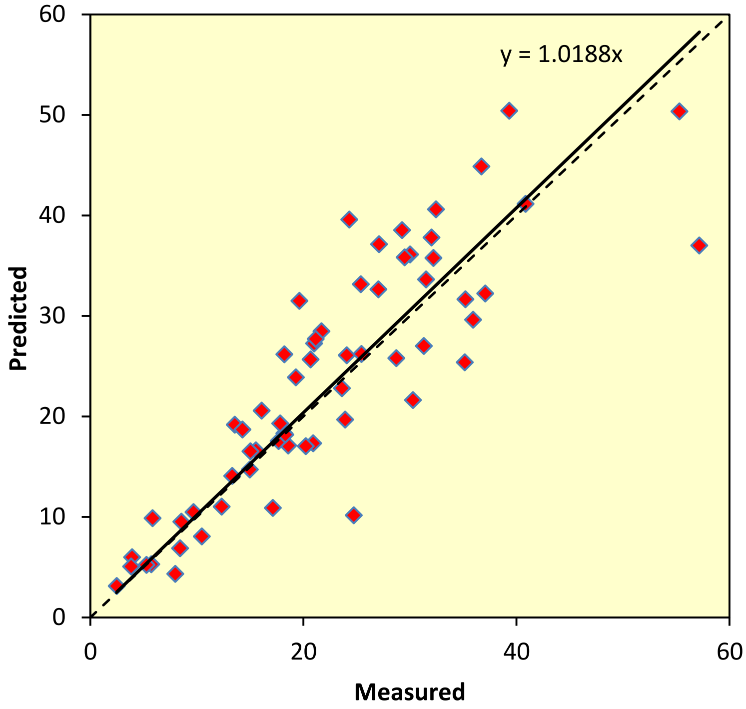

Figure A4.1: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2012

A4.4 Two separate sets of 2016 background nitrogen dioxide and nitrogen oxides concentrations have been used for the future-year assessment. The 2016 background 'without emissions reduction' has been calculated using the same approach as described for the 2012 data: the road traffic component of background nitrogen oxides has been held constant at 2010 values, while 2016 data are taken for the other components. Nitrogen dioxide has then been calculated using Defra's background nitrogen dioxide calculator. The 2016 background 'with emissions reduction' assumes that Defra's predicted reductions occur from 2012 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2016 to the unadjusted mapped value for 2012. This ratio has then been applied to the adjusted 2012 value (as derived in Paragraph A4.2).

A4.5 For PM_{10} and $PM_{2.5}$, there is no strong evidence that Defra's predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

Model Inputs

Roads

A4.6 Predictions have been carried out using the ADMS-Roads dispersion model (v3.1). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristic (including road width and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed using the Emission

Factor Toolkit (Version 5.2c) published by Defra (2013a). For nitrogen dioxide future-year concentrations have been predicted once using year-specific emission factors from the EFT and once using emission factors for 2012[5] which is the year for which the model has been verified.

A4.7 The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2012). The meteorological data has been taken from the monitoring station located at Heathrow Airport, which is considered suitable for this area.

A4.8 Traffic data for Camden Street, Camden Road, Kentish Town Road and Royal College Street have been taken from the London Atmospheric Emissions Inventory (LAEI) (GLA, 2013). Traffic speeds were based on those presented in the LAEI, taking into account the proximity to a junction. The traffic data used in this assessment are summarised in Table A4.1.

Table A4.1: Summary of Traffic Data used in the Assessment (AADT)

Road Link	2012	2016	% HDV
Camden Street north of Camden Road	17,333	17,521	12
Camden Street south of Camden Road	20,247	20,537	3
Camden Road east of Royal College Street	27,352	27,747	7
Camden Road between Camden Street and Royal College Street	27,474	27,772	8
Camden Road west of Camden Street	24,101	24,449	14
Kentish Town Road	8,508	8,600	10
Royal College Street north of Camden Road	8,018	8,134	7
Royal College Street south of Camden Road	11,081	11,202	7

A4.9 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (DfT, 2011).

A4.10 Figure A4.2 shows the road network included within the model and defines the study area.

5 i.e. combining current-year emission factors with future-year traffic data.

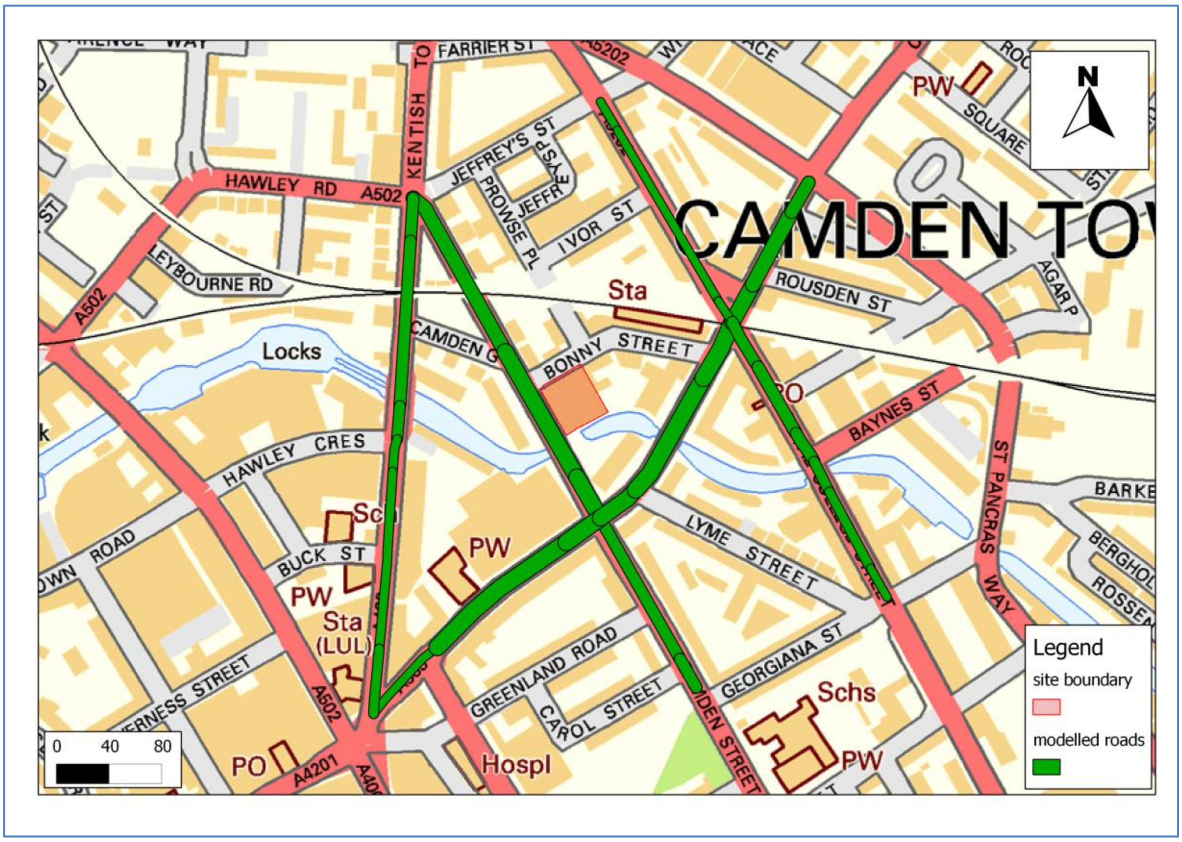

Figure A4.2: Modelled Road Network

Model Verification

A4.11 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The verification methodology is described below.

A4.12 Most nitrogen dioxide (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 annual mean NOx concentrations during 2012 at the Camden Road diffusion tube monitoring site. Concentrations have been modelled at 2.5 m, the height of the diffusion tube.

A4.13 The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx was calculated from the measured NO_2 concentration and the predicted background NO_2 concentration using the NOx from NO_2 calculator available on the Defra LAQM Support website (Defra, 2013a).

A4.14 An adjustment factor was determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor was then applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-

NOx concentrations with the predicted background NO_2 concentration within the NOx from NO_2 calculator (Defra, 2013a).

A4.15 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 67.4 µg/m^3
- Background NO_2 : 39.3 µg/m^3
- 'Measured' road-NOx (from NOx to NO_2 calculator): 78.3 µg/m^3
- Modelled road-NOx = 45.4 µg/m^3
- Road-NOx adjustment factor: 78.3/45.4 = **1.7**

A4.16 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_{10} and $PM_{2.5}$

A4.17 There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the primary adjustment factor calculated for road NO_x.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

A4.18 The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the primary adjustment factor, which, along with the background NO_2, is processed through the NOx from NO_2 calculator available on the Defra LAQM Support website (Defra, 2013b). The traffic mix within the calculator was set to "All London traffic", which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2. This is then adjusted by the secondary adjustment factor to provide the final predicted concentrations.

PM_{10} and $PM_{2.5}$

A4.19 The number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration has been calculated from the adjusted-modelled total annual mean concentration following the relationship advised by (Defra, 2009):

$$A = -18.5 + 0.00145\,B^3 + 206/B$$

where A is the number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration and B is the annual mean PM_{10} concentration. The relationship is only applied to annual mean concentrations greater than 16.5 μg/m^3, below this concentration, the number of 24-hour exceedences is assumed to be zero.

A5 Site Plans

A5.1 Plans of the proposed development are provided below.

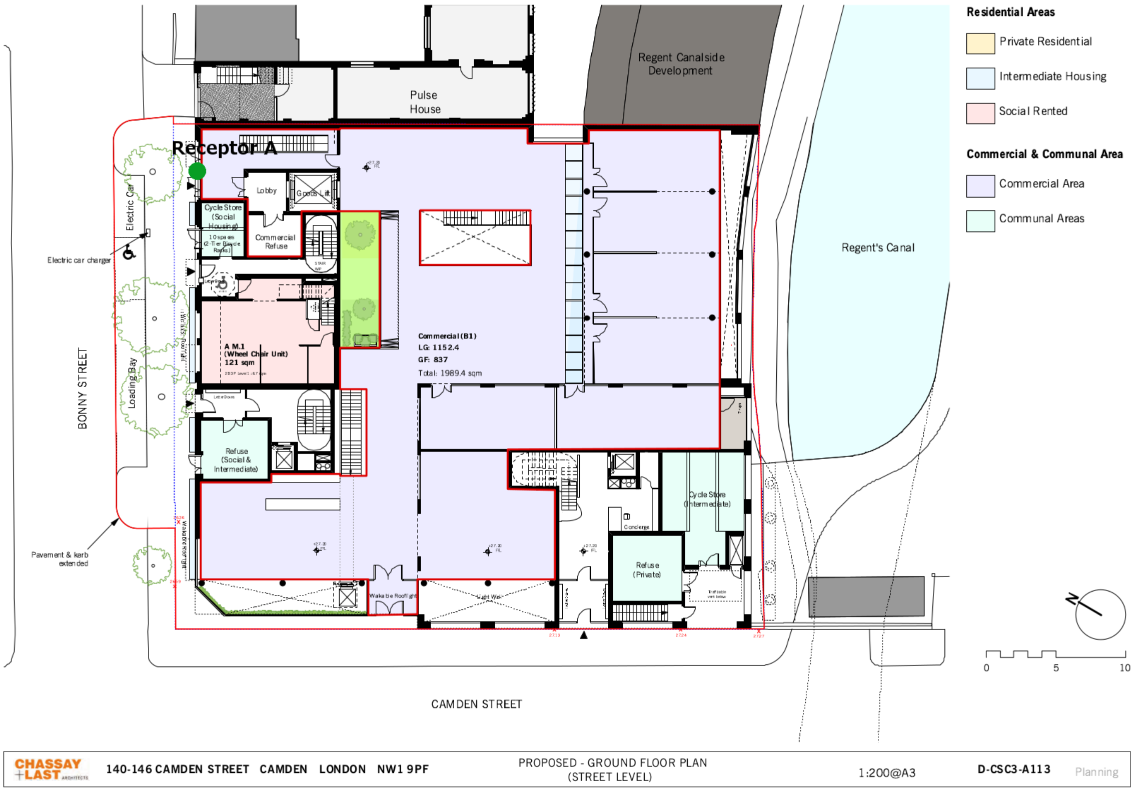

Figure A5.1: Ground Floor Plan

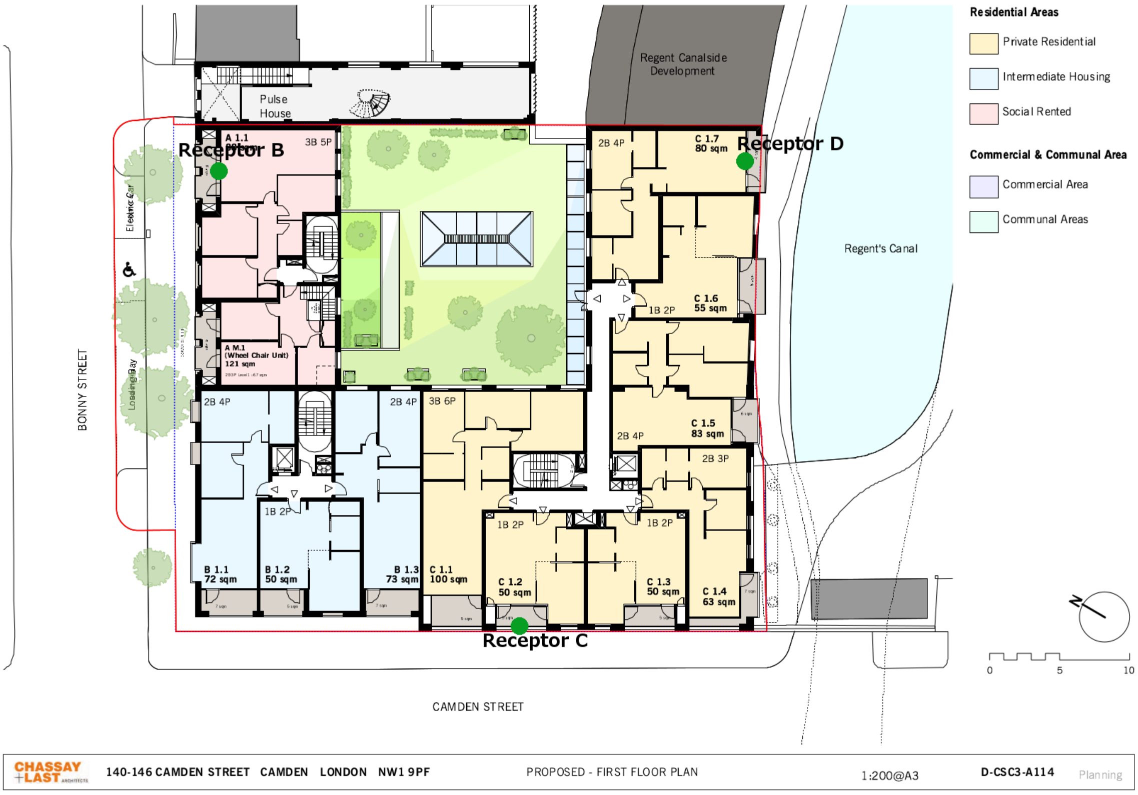

Figure A5.2: First Floor Plan

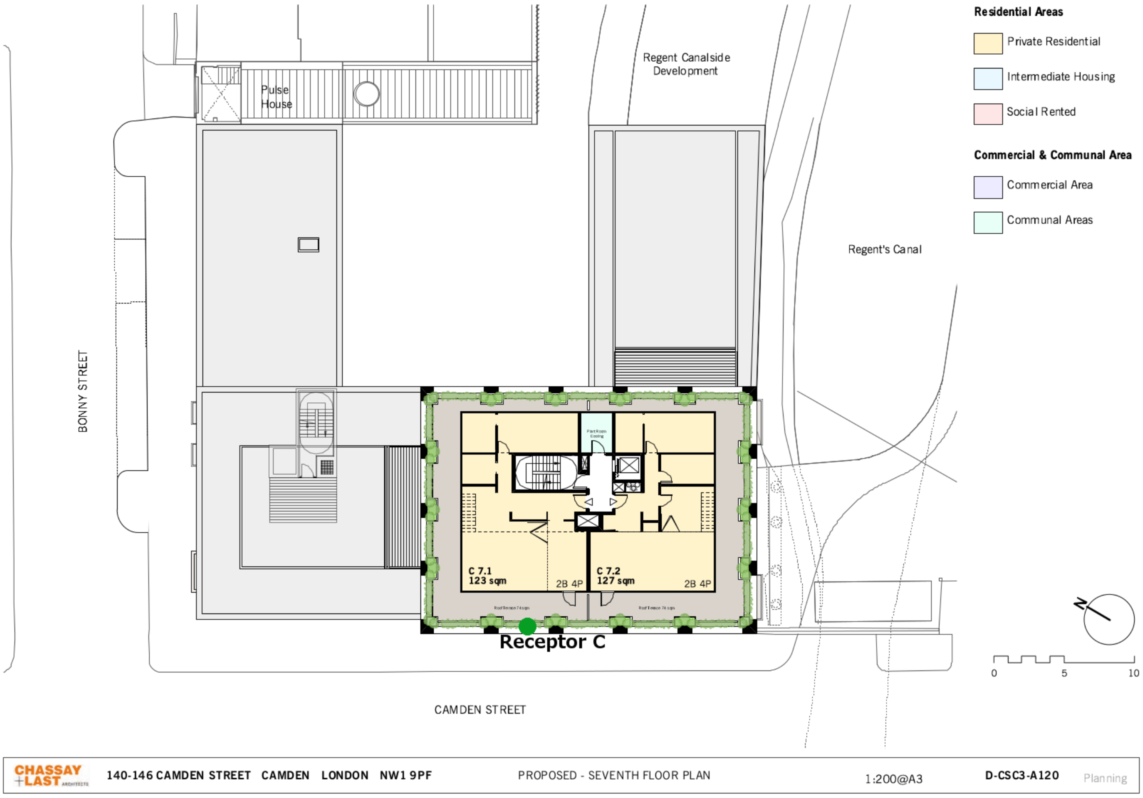

Figure A5.3: Seventh Floor Plan