New Homes on Regent's Park Estate

SD6 Air Quality Statement

May 2015

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Regent's Park Estate

Air Quality Statement

For

Camden

Project Number:

11775

May 2015

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Contents

Appendices

1.0 INTRODUCTION

1.1. Air Quality Consultants Ltd (AQC) were commissioned by Campbell Reith Hill LLP ('CampbellReith') on behalf of the London Borough of Camden to carry out a Baseline Air Quality Assessment which was required to support the planning application for the proposed replacement housing scheme in the Regent's Park Estate, London Borough of Camden.

1.2. The initial work recommended that a detailed Air Quality Assessment, Construction Dust Risk Assessment and Air Quality Neutral Assessment were prepared.

1.3. This report summarises the Baseline Air Quality Assessment (Ref: J2112/1/F2) (**Appendix 1**) and the Air Quality Assessment (Ref: J2112/2/F1) which is contained in **Appendix 2**.

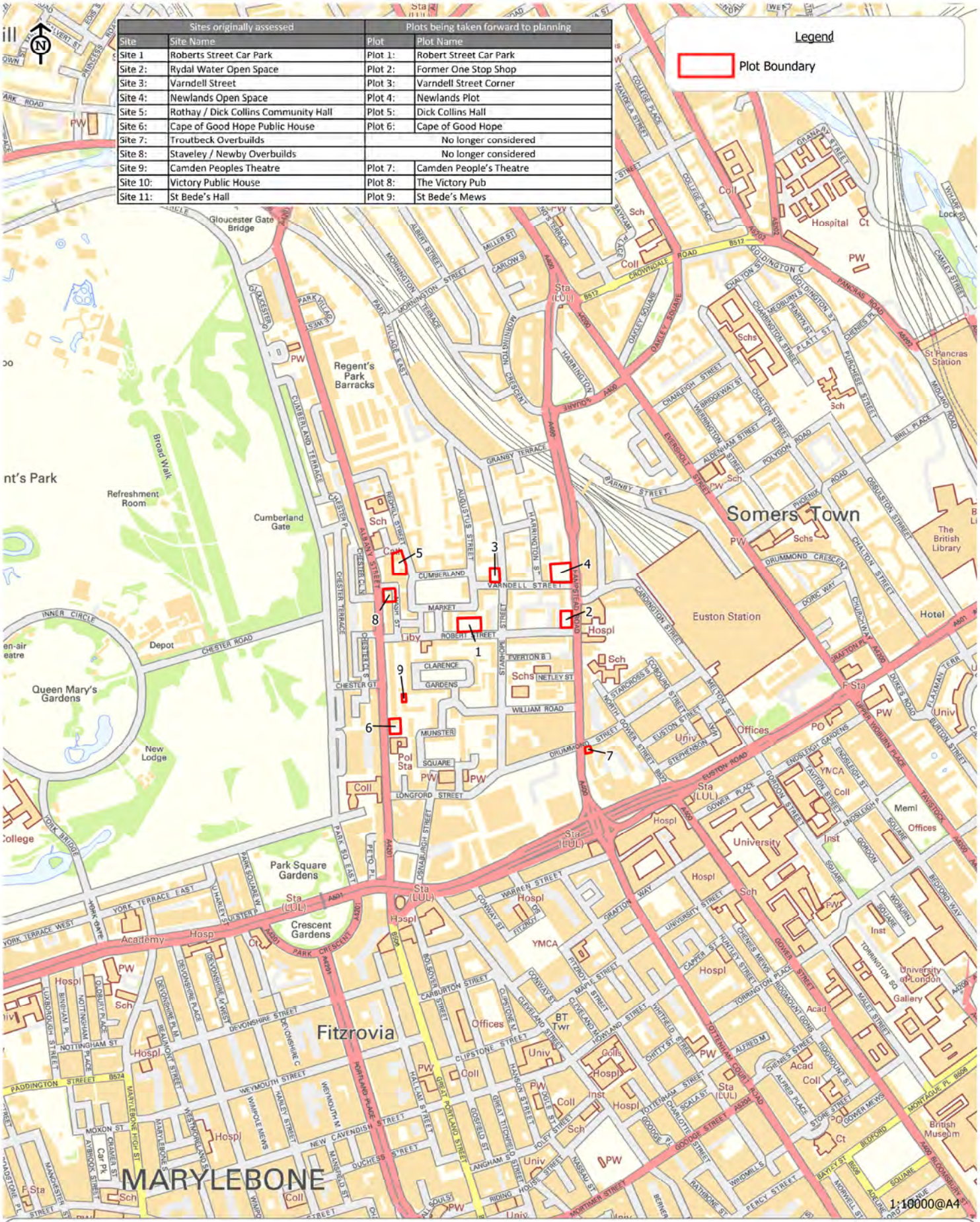
1.4. The eleven sites that were considered within this Air Quality Assessment are listed within the first two columns of **Table 1.1** below. However, since the assessment was undertaken, the sites are now referred to as 'Plots' and only 9 of the previously identified 11 sites are being taken forward to planning at this stage. The Plots that are being taken forward to planning are shown in **Table 1.1** and will be referred to within this document.

Table 1-1: Superseded site names and plots being taken forward to planning

Sites originally assessed		Plots being taken forward to planning	
Site	Site Name	Plot	Plot Name
Site 1	Roberts Street Car Park	Plot 1:	Robert Street Car Park
Site 2:	Rydal Water Open Space	Plot 2:	Former One Stop Shop
Site 3:	Varndell Street	Plot 3:	Varndell Street Corner
Site 4:	Newlands Open Space	Plot 4:	Newlands Plot
Site 5:	Rothay / Dick Collins Community Hall	Plot 5:	Dick Collins Hall
Site 6:	Cape of Good Hope Public House	Plot 6:	Cape of Good Hope
Site 7:	Troutbeck Overbuilds	No longer considered	
Site 8:	Staveley / Newby Overbuilds	No longer considered	
Site 9:	Camden Peoples Theatre	Plot 7:	Camden Peoples Theatre
Site 10:	Victory Public House	Plot 8:	The Victory Pub
Site 11:	St Bede's Hall	Plot 9:	St Bede's Mews

*Note that Plot 7 Camden Peoples Theatre will be applied for via a separate planning application

1.5. The locations of the 9 plots being taken forward to planning within the Regent's Park Estate are shown on **Figure 1**.



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Site 11:	St Bede's Hall	Plot 9:	St Bede's Mews

Regents Park Estate

Client: Camden

Figure 1.1:
Location of Plots within Regent's Park Estate

Scale: 1:10000@A4

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2.0 BASELINE CONDITIONS

2.1. Policy Context

2.1.1. The Baseline Air Quality Assessment was prepared taking into account all relevant local and national guidance and regulations which include:

- Air Quality Strategy (DEFRA);
- National Planning Policy Framework (March 2012);
- The London Plan 2011;
- The Major's Air Quality Strategy;
- The Local Development Framework (LDF) (London Borough of Camden, 2011);
- Air Quality Action Plan 2009 – 2012; and
- Assessment Criteria within the Air Quality (England) Regulations 2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002).

2.1.2. The Air Quality criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$ that is used within this assessment is shown in **Table 2.1**.

Table 2-1: Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time period	Objective
Nitrogen Dioxide	1 – hour Mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (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
Fine Particles ($PM_{2.5}$)*	Annual Mean	25 µg/m^3

*The $PM_{2.5}$ objective, which is to be met by 2020, is not regulations and there is no requirement for local authorities to meet it

2.2. Plot Descriptions

2.2.1. The Regent's Park Estate is located within the London Borough of Camden and is bounded by the A400 Hampstead Road to the east, William Road and Munster Square to the south, A4021 Albany Street to the west and Cumberland Market and Granary Terrace to the north.

2.2.2. The railway lines running north out of Euston national railway station are located to the north of Regent's Park Estate.

2.2.3. **Table 2.2** lists the nearby roads to each of the plots considered within this assessment.

Table 2-2: Roads in close proximity to each plot

Plot Number	Plot name	Nearby Roads
Plot 1:	Robert Street Car Park	Roberts Street

Plot Number	Plot name	Nearby Roads
Plot 2:	Former One Stop Shop	Robert Street/ Hampstead Road
Plot 3:	Varndell Street Corner	Varndell Street/Stanhope Street
Plot 4:	Newlands Plot	Varndell Street/Hampstead Road
Plot 5:	Dick Collins Hall	Redhill Street/Albany Street
Plot 6:	Cape of Good Hope	Albany Street
Plot 7:	Camden People's Theatre	Drummond Street/ Hampstead Road
Plot 8:	The Victory Pub	Nash Street/Albany Street
Plot 9:	St Bede's Mews	Clarence Gardens

2.3. Baseline Conditions

Industrial Sources

2.3.1. A search of the UK Pollutant Release and Transfer Register and Environment Agency's 'what's in your backyard' website did not identify any significant industrial or waste management sources that are likely to affect the existing regent's Park Estate in terms of air quality.

Air Quality Review and Assessment

2.3.2. The Regent's Park Estate lies within an Air Quality Management Area (AQMA) declared by Camden Council for exceedences of the nitrogen dioxide and PM_{10} objectives. The key source of emissions currently affecting existing residential properties of the Regent's Park Estate is from road traffic on the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

Local Air Quality Monitoring – Nitrogen Dioxide

2.3.3. In 2013 Camden Council operated four automatic monitoring stations within its area. Two of these, Bloomsbury and Euston Road are located less than 1 km from the Regent's Park Estate. A further automatic monitoring station, operated by the City of Westminster and located on Marylebone Road is also located within 1 km of the Regent's Park Estate. Camden Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared by Gradko International. One of the diffusion tube monitoring sites is located approximately 750 m to the northeast of the Regent's Park Estate, on Brill Place, near to St Pancras station.

2.3.4. Measured concentrations for the years 2009 to 2013 suggest air quality within the study area is poor. Concentrations at the roadside and kerbside monitoring locations on Euston Road and Marylebone Road are well in excess of the annual mean objective. Measured concentrations at these sites are more than double the annual mean nitrogen dioxide objective of 40µg/m^3. These analysers are located on more heavily trafficked and congested roads than those surrounding the Regent's Park Estate and therefore unlikely to be representative of air quality at the Regent's Park Estate. Measured concentrations at the Brill Place diffusion tube monitoring site and the urban background analyser at Bloomsbury, which are considered to be broadly representative of air quality conditions at the Regent's Park Estate, also exceed the annual mean objective by around 10µg/m^3. However, these concentrations are 40-50 µg/m^3 lower than those measured at Euston Road and Marylebone Road.

2.3.5. The short-term nitrogen dioxide objective is exceeded at the automatic analysers on Euston Road and Marylebone Road. The objective is achieved at the urban background automatic analyser at Bloomsbury, and as measured concentrations at the Brill Place diffusion tube monitoring site are below 60µg/m^3, it is also expected to be achieved at this location. It is considered likely, therefore, that the short-term objective will also be achieved at the Regent's Park Estate.

2.3.6. With respect to nitrogen dioxide, concentrations are likely to be above the annual mean objective at all 9 plots (i.e. above the annual mean nitrogen dioxide objective of 4µg/m^3).

Local Air Quality Monitoring – PM_{10} and $PM_{2.5}$

2.3.7. The automatic analysers at Bloomsbury and Marylebone Road also record PM_{10} for the period 2009 to 2013. In recent years, measured annual mean concentrations were below the annual mean objective at both Marylebone Road and Bloomsbury. The 24-hour mean objective was exceeded at Marylebone Road but achieved at Bloomsbury. Concentrations at the Regent's Park Estate are likely to be more similar to those at the urban background site, where the objectives are achieved.

2.3.8. There are no analysers in the study area which record $PM_{2.5}$.

Background Concentrations

2.3.9. Estimated background concentrations in the study area have been determined for 2013 and 2015. In the case of nitrogen dioxide, the mapped concentrations exceed the annual mean objective in 2013 and 2015, with or without emissions reduction. The mapped PM_{10} and $PM_{2.5}$ background concentrations are well below the objectives.

Background Concentrations at Individual Plots

2.3.10. It is expected that the PM10 and PM2.5 concentrations will be achieved at the plots within the Regent's Park Estate, but that the annual mean nitrogen dioxide objective is likely to be exceeded. The short-term nitrogen dioxide objective is likely to be achieved.

2.3.11. The Regent's Park Estate is bounded by two main roads, A4021 Albany Street to the west and A404 Hampstead Road to the east. These main roads will experience more traffic and have higher emissions than the other smaller roads running through the Regent's Park Estate. It is expected that the pollutant concentrations will be higher at locations near to these roads than locations further from them. Pollutant concentrations are expected to be higher at the following sites:

- Plot 2: Former One Stop Shop (formally Site 2)
- Plot 4: Varndell Street Corner (formally Site 4)
- Plot 7: Camden People's Theatre (formally Site 9)
- Plot 8: The Victory Pub (formally Site 10)

3.0 DETAILED AIR QUALITY ASSESSMENT

3.1. Introduction

3.1.1. The proposed development comprises new build residential accommodation across 8 plots with three of the plots also including ground floor commercial space, and one plot including a replacement community hall. In addition, one further plot, Plot 7 Camden People's Theatre (subject to a separate planning application) is for the conversion of the upper floors of an existing building to residential use, with an existing theatre in the ground and lower floors to be retained. Whilst being proposed as new housing it is intended that the majority of these new homes (94 of 116 homes) are used as replacement housing for residents that will be displaced by the High Speed Rail (HS2) project, with an additional 22 new homes proposed.

3.1.2. The plots lie within an Air Quality Management Area (AQMA) declared by the London Borough of Camden for exceedences of the nitrogen dioxide and PM_{10} objectives. As the proposals are for replacement housing they do not represent additional development in the area. The exception to this is new commercial space at some of the plots, although this is proposed on a car-free basis. The development of the plots will therefore not significantly increase 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 $PM_{2.5}$).

3.1.3. Plot 2 Former One Stop Shop (formally Site 2) and Plot 4 Newlands Plot (formally Site 4) will include centralised energy plant (natural gas boilers). Plot 7 Camden People's Theatre (formally Site 9) (not included in this planning application) will be served by an existing centralised boiler plant and dwellings within the remaining six plots will be served by individual gas boilers. Emissions from the two new centralised energy plant could impact upon air quality at existing residential properties, as well as the new residential properties within the developments themselves. The main air pollutant of concern related to boiler plant is nitrogen dioxide.

3.1.4. The closest plot to railway lines at Euston National Railway Station is approximately 100 m away. Defra guidance (Defra, 2009) outlines an approach to assess the potential for exceedences of the annual mean nitrogen dioxide objective as a result of emissions from diesel locomotives. The guidance outlines that there is only the potential for an exceedence where there is long-term exposure within 30m, and the annual mean background concentration of nitrogen dioxide is above 25µg/m_3. All nine plots fall outside these criteria and thus the impact of emissions from railway locomotives on nitrogen dioxide concentrations are not considered further.

3.1.5. The air quality neutrality of the proposed development has also been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

3.1.6. The GLA has also released Supplementary Planning Guidance (SPG) on the Control of Dust and Emissions from Construction and Demolition. The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will need to be applied. A construction dust assessment for each of the nine sites has also been carried out.

3.1.7. This report summarises the existing local air quality conditions (2014) and the predicted air quality in the anticipated year of opening for Plots 1 Robert Street Car Park (formally Site 1),

Plot 2 Former One Stop Shop (formally Site 2), Plot 3 Varndell Street Corner (formally Site 3), Plot 4 Newlands Plot (formally Site 4), Plot 6 Cape of Good Hope (formally Site 6) and Plot 9 St Bede's Mews (formally Site 11) (2016). For simplicity, the other three plots, Plot 5 Dick Collins Hall (formally Site 5), Plot 7 Camden People's Theatre (formally Site 9) and Plot 9 St Bede's Mews (formally Site 10) (which are anticipated to open in 2017) have been assumed to open in 2016 also, which is a worst-case assumption. The assessment of construction dust impacts focuses on the anticipated duration of the works.

3.1.8. The Air Quality Assessment was prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with the London Borough of Camden.

3.2. Construction Phase Impact Assessment

3.2.1. The construction works at each of the nine plots will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. A summary of the relevant sensitivities (i.e. to residential properties and ecological sites) is provided in **Table 3.1** below and a summary of the risk categories for the four construction activities (demolition, earthworks, construction and trackout) without mitigation are summarised in **Table 3.2**.

Table 3-1: Summary of the area sensitivity

Effects associated with:	Sensitivity of the Surrounding Area	
	On-site works	Trackout
Dust Soiling	High Sensitivity	High Sensitivity
Human Health	Medium Sensitivity	Medium Sensitivity

Table 3-2: Summary of risk of impact without mitigation

Source	Dust Spoiling	Human Health
Demolition*	Medium Risk	Low Risk
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk

*Plots 5, 6 and 8 only. There will be no requirement for demolition of buildings on Plots 1, 2, 3, 4, 7 and 9

3.3. Operational Phase

Energy Plant Impacts

Proposed Energy Plant

3.3.1. Six of the nine plots will be provided with individual boilers serving each residential unit/mixed use area (where applicable). Plot 2 Former One Stop Shop (formally Site 2) and Plot 4 Newlands Plot (formally Site 4) will include new centralised boiler plant with natural gas boilers; Plot 7 Camden People's Theatre (formally Site 9) will make use of the existing boiler plant at the plot which is considered in the next section. The boilers for the proposed new energy plant (3 no. 167kW boilers for Plot 2 and 3 no. 200 kW boilers for Plot 4) will be ultra-low NOx (<40 mg NOx/kWh) and will meet the requirements specified in the GLA's SPG.

3.3.2. TGA, the project's mechanical and electrical engineer, has advised that each boiler flue (there will be one for each boiler) will be designed to terminate a minimum of 31 m above the height of the tallest part of the building on which they will be located, which will allow good dispersion of pollutants from the flue.

3.3.3. On the basis that the boilers at the new plant will adhere to the GLA's strict emissions standards and the flues will be sensibly located to ensure good dispersion of pollutants, it is considered emissions from the new centralised energy plant will not lead to any significant impacts and they are not considered further in this assessment.

Existing Energy Plant (Site 9)

3.3.4. Plot 7 Camden People's Theatre (CPT) (formally Site 9) will be served by the existing boiler plant at the site (2no. boiler with total 760 kW), which currently serves 69 residential units and the theatre located on the ground floor. The building will be refurbished to include five additional residential units. In addition, the proposals include amenity space (a roof terrace) at roof level. The roof terrace represents exposure to the 1-hour mean nitrogen dioxide objective.

3.3.5. **Figure 3.1** provides an indication of the location of the existing boiler flue in relation to the proposed roof terrace, which will be located above the fifth floor level of the CPT building. There is a singular flue associated with the two boilers, which sits approximately 0.5 m above the tallest part of the building. The proposed roof terrace will be located to the north, approximately 1 to 2 stories below the existing boiler flue.

3.3.6. There will be the potential for emissions from the existing boiler plant to impact on the proposed roof terrace at Plot 7 Camden People's Theatre (formally Site 9); however, given the roof terrace is located several meters below the height of the boiler flues, it is considered unlikely the operation of the existing boiler plant at Plot 7 will lead to an exceedance of the 1-hour mean nitrogen dioxide objective at the proposed roof terrace. This potential impact is therefore not considered further by this assessment.

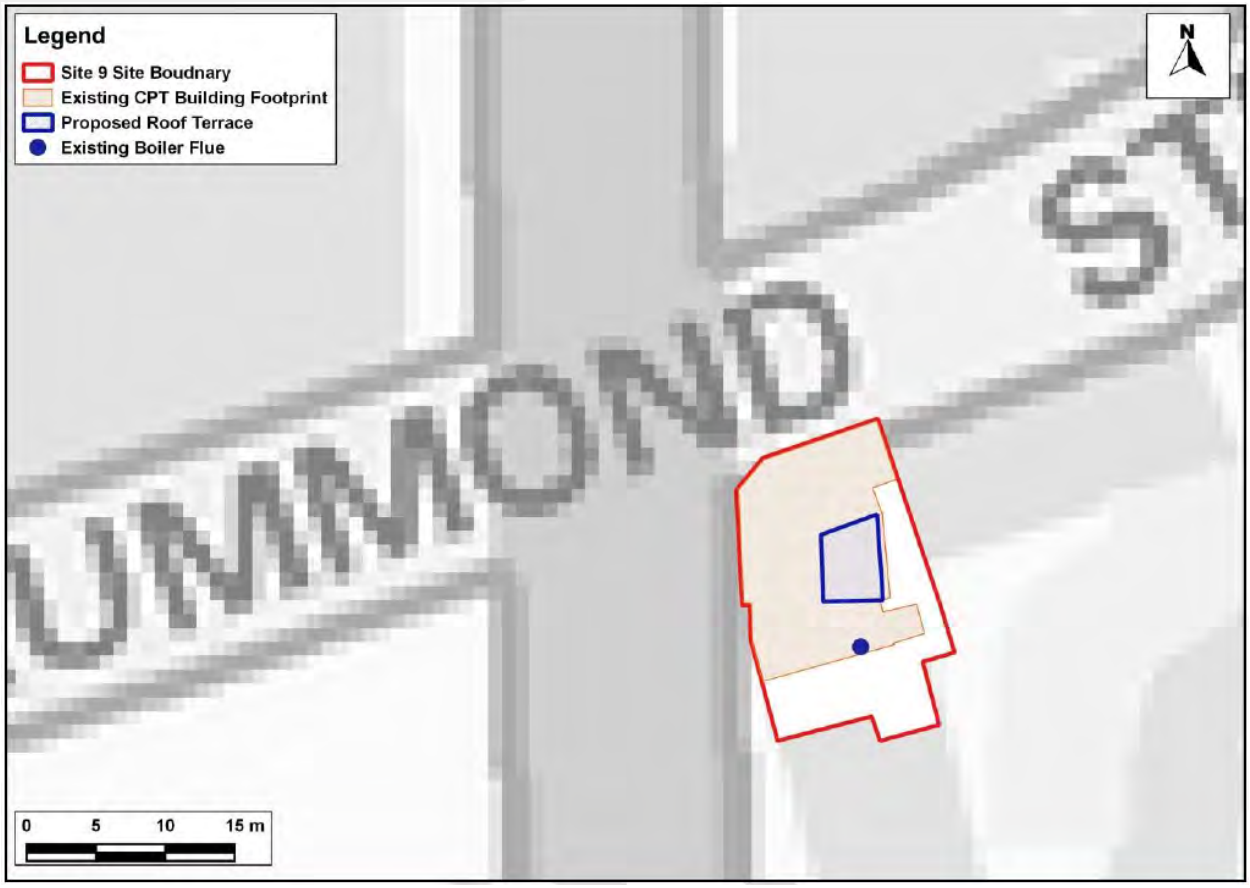

Figure 3.1: Location of Proposed Roof Terrace and Existing Boiler Flue, Site 9

Road Traffic Impacts

Impact of Proposed Development on Surrounding Area

3.3.7. As replacement housing there will be no new traffic generation associated with the development, with exception of a very small number of service vehicles associated with small commercial (A1-A2 usage) areas at three of the nine plots.

3.3.8. Holders of existing parking permits will be issued revised permits for the new development. Further permits will not be issued.

3.3.9. It is therefore considered that the proposals will not significantly increase local traffic movements and the impact of the proposed development of the nine plots on air quality at existing receptors will be insignificant. This is not considered further in this assessment.

Impacts of Existing Pollution Sources on New Residents

Nitrogen Dioxide

Annual Mean

3.3.10. Current measured and mapped background concentrations of nitrogen dioxide in Camden exceed the annual mean objective of 40µg/m^3. The model results suggest that air quality for future residents within the developments will thus be in breach of the national air quality objective for annual mean nitrogen dioxide.

1-hour Mean

3.3.11. Plots 1 Robert Street Car Park (formally Site 1). Plot 2 Former One Stop Shop (formally Site 2), Plot 4 Newlands Plot (formally Site 4), Plot 5 Dick Collins Hall (formally Site 5), Plot 6 Cape of Good Hope (formally Site 6) and Plot 8 The Victory Pub (formally Site 10) include proposed balconies, which represent relevant exposure for the 1-hour mean objective for nitrogen dioxide. Because background nitrogen dioxide concentrations in the study area are high, where balconies are proposed adjacent to main roads there is the potential for exceedance of the 1-hour mean nitrogen dioxide objective.

3.3.12. The detailed modelling undertaken shows that at the proposed balconies predicted 99.79th 1-hour mean concentrations were below 200µg/m^3. The 1-hour mean objective is therefore expected to be achieved.

3.3.13. It is considered therefore that there are no air quality constraints with respect to the proposed balconies at any of the nine plots.

Particulate Matter (PM_{10} and $PM_{2.5}$)

3.3.14. Modelling result for of PM_{10} and $PM_{2.5}$ concentrations show predicted concentrations to be below the air quality objectives, air quality with respect to particulates for future residents within each of the nine plots will be acceptable.

Significance of Impact

3.3.15. Due to the annual mean nitrogen dioxide objective being exceeded at a number of new residential receptors by a large margin, the operational air quality impacts are judged to be Moderate.

Air Quality Neutral Assessment

Building Emissions

3.3.16. For Plots 2 Former One Stop Shop (formally Site 2) and Plot 4 Newlands Plot (formally Site 4), ultra-low NOx boilers (<40 mg NOx/kWh) will be installed within each of the two centralised boiler plant (3 no. 167kW boilers for Plot 2 and 3 no. 200 kW boilers for Plot 4). In terms of the minimum standards, Plot 2 and 4 will comply with the SPG. The total NOx emission from the boilers for each plot will be:

- Site 2 (Former One Stop Shop) – 7.5 kg/annum; and
- Site 4 (Newlands Plot) – 15.3 kg/annum;

3.3.17. Plot 7 Camden People's Theatre (formally Site 9) is to be served by the existing boiler plant at the site (2no. boiler with total 760 kW), which currently serves 69 residential units and the theatre located on the ground floor. The plot will be refurbished to include five additional residential units. The total estimated NOx emission for the existing boiler plant at Plot 7 is 132 kg/annum.

3.3.18. Calculated Building Emissions Benchmarks for Plots 2, 4, 7 are shown in **Table 3.3**.

Table 3.3 Building Emissions Benchmarks (BEB) for Plots , 2, 4, and 7

	Plot 2 Robert Street Car Park	Plot 4 Newlands Plot	Plot 7 Camden Peoples Theatre
Total BEB NOx Emissions (kg/annum)	60.0	94.9	18.7

3.3.19. The remaining plots will contain a small, domestic, gas-fired combination boilers. TGA has advised that Worcester-Bosch Greenstar boilers will be used, which have a maximum NOx emission of 33 mg/kWh. The total NOx emission from all of the proposed boilers for each plot will be:

- Plot 1 Robert Street Car Park (formally Site 1) – 6.5 kg/annum;
- Plot 3 Varndell Street Corner (formally Site 3) – 5.3 kg/annum;
- Plot 5 Dick Collins Hall (formally Site 5) – 6.5 kg/annum.
- Plot 6 Cape of Good Hope (formally Site 6) – 6.7 kg/annum;
- Plot 8 The Victory Pub (formally Site 10) – 4.9 kg/annum; and
- Site 9 St Bede's Mews (formally Site 11) – 1.4 kg/annum.

3.3.20. Calculated BEBs for the remaining plots are shown in **Table 3.4** below.

Table 3-4: Building Emissions Benchmarks for Plots 1, 3, 5, 6, 8, and 9

	Plot 1	Plot 3	Plot 5	Plot 6	Plot 8	Plot 9
Total BEB NOx Emissions (kg/annum)	6.5	5.3	6.5	6.7	4.9	1.4

3.3.21. The BEBs for the proposed 8 plots included in the planning application provide a Total BEB NOx Emission of 61.7 kg/annum and Total Building NOx emissions of 54.1 kg/annum. The proposed development is therefore better than air quality neutral.

3.3.22. At Plot 7 Camden People's Theatre (formally Site 9), Total Building NOx Emissions (132 kg/annum) are greater than Total BEB NOx emissions (18.7 kg/annum). When this particular plot is taken forward further mitigation may be necessary.

Road Transport Emissions

3.3.23. Road transport emissions are assessed by comparing Transport Total Emissions (TTE) of the proposed development with Total Transport Emission Benchmarks (TEB). The methodology for the derivation of these figures is provided in **Appendix 2**. The results are shown in **Table 3.5**.

Table 3-5: Transport Total Emissions and Total Transport Emissions Benchmarks

Site used within assessment (Revised Plot number)	Emission	TTE (kg/annum)	TTEB (kg/annum)
1 (Plot 1)	NOx	5.3	7.3
	PM_{10}	1.0	1.3
2 (Plot 2)	NOx	51.8	49.0
	PM_{10}	9.3	8.8

Site used within assessment (Revised Plot number)	Emission	TTE (kg/annum)	TTEB (kg/annum)
3 (Plot 3)	NOx	3.3	4.5
	PM_{10}	0.6	0.8
4 (Plot 4)	NOx	37.7	38.7
	PM_{10}	6.8	6.9
5 (Plot 5)	NOx	4.5	6.1
	PM_{10}	0.8	1.1
6 (Plot 6)	NOx	6.1	8.4
	PM_{10}	1.1	1.5
9 (Plot 7)	NOx	27.8	53.2
	PM_{10}	5.0	9.5
10 (Plot 8)	NOx	2.1	46.0
	PM_{10}	9.4	8.3
11 (Plot 9)	NOx	1.2	1.7
	PM_{10}	0.2	0.3

3.3.24. TTEs for all of the plots is 162 kg/annum (NOx) and 29.1 kg/annum (PM_{10}); the TTEBs are 161.5 kg/annum (NOx) and 29.0 kg/annum (PM_{10}). The TTE therefore slightly exceed the TTEB, meaning that further mitigation may be required.

3.3.25. Plot 7 Camden People's Theatre (formally Site 9), when considered alone is Air Quality Neutral. This plot will not require further mitigation when brought forward for planning permission.

4.0 MITIGATION

4.1. Construction Impacts

4.1.1. Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby sensitive receptors.

4.1.2. Plot 5 Dick Collins Hall (formally Site 5), Plot 6 Cape of Good Hope (formally Site 6), Plot 7 Camden Peoples Theatre (formally Site 9) and Plot 8 The Victory Pub (formally Site 10) have been identified as being Medium Risk sites during demolition. Every site is Low Risk during earthworks, construction and trackout. Overall the plots are best described as being of Low Risk.

4.1.3. Mitigation measures based on the GLA SPG 'The Control of Dust and Emissions during Construction and Demolition' have been determined and are presented in **Appendix 2**.

4.1.4. Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

4.2. Road Traffic Impacts

4.2.1. Long term mitigation is provided by increasingly stringent emissions standards (EU, and the Camden Air Quality Action Plan).

4.2.2. The exceedances of Mean Annual Nitrogen Dioxide is a borough wide issue, however, potential poor air quality can be mitigated by block design:

- whole house ventilation system (i.e. supply and extract) which have the air inlet located away from the main roads (Roof level inlets at Plots 2 and 4; rear elevation inlets on other sites. This allows for cleaner air (to that at the roadside) to be drawn into the new residential units;
- Where not possible, specify NOx filtration on intakes; and
- Ongoing design iterations to incorporate mitigation best matched to block layout and future air quality conditions.

4.3. Air Quality Neutral

4.3.1. The assessment has shown that in terms of transport the overall development (eight plots) is not air quality neutral. The GLA Sustainable Design and Construction SPD specifies that in such cases on-site mitigation measures, and where necessary other off-setting of excess emissions, be developed in consultation with the planning authority.

5.0 CUMULATIVE IMPACTS: HS2

5.1. Community Forum Area 1 (Euston – Station and Approach) of HS2 is located adjacent to the Regent's Park Estate. There is considered potential for cumulative construction and operational impacts to occur, which are considered below.

5.2. **Construction**

5.2.1. Due to the divergent construction timetables of both HS2 and the Regents Park Estate developments, cumulative construction impacts are unlikely to be significant.

5.2.2. Construction works for the HS2 scheme have the potential to impact on the new residents of the nine plots forming the proposed development; this however is not strictly a cumulative effect. The HS2 Environmental Statement (HS2 ES) concludes that construction dust impacts will be temporary. With mitigation measures in place there are be no significant residual effects from dust emissions.

5.2.3. The additional traffic and changes in traffic flows caused by diversions will have significant effects, which will be both beneficial and adverse. This therefore has the potential to affect future baseline concentrations considered in this assessment. However, the assessment carried out is worst case with respect to road traffic emissions, which are predicted to decline into the future.

5.2.4. Bearing this in mind, along with the temporary nature of construction works and recommended mitigation measures for new residential receptors within the nine plots, it is considered the HS2 development is unlikely to affect the conclusions drawn in this report.

5.3. **Operation**

5.3.1. The HS2 ES considers that the key operational impacts that could potentially arise from the operation of HS2 relate to changes in the volume, composition and distribution of road traffic, as well as boiler emissions in the station.

5.3.2. The HS2 ES concludes that future station boiler emissions will have a negligible impact on local air quality. PM_{10} impacts from road traffic are also predicted to be negligible. With respect to nitrogen dioxide impacts from road traffic will give rise to significant residual effects, both beneficial and adverse. These effects occur on Euston Road and Upper Woburn Place near Euston station. The HS2 ES also concludes that these residual effects "should be seen in the context of future improvements in background air quality which will be brought about by continued reductions in vehicle emissions, which are expect to reduce nitrogen dioxide concentrations beyond 2026".

5.3.3. No significant operational impacts are concluded to occur within the Regent's Park Estate. On the basis of the evidence, it is considered there are unlikely to be significant cumulative operational effects associated with the HS2 scheme and proposed development of the nine plots.

6.0 CONCLUSIONS

6.1. Dust impacts

6.1.1. Dust emissions arising from construction are not significant. However, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will not be significant.

6.2. Road traffic impacts

6.2.1. The impacts of local traffic on the air quality for residents living in the proposed development have been shown to be acceptable with respect to the PM_{10}, $PM_{2.5}$ and 1-hour mean nitrogen dioxide objectives. Due to high background levels in the study area, annual mean nitrogen dioxide concentrations are predicted to exceed the annual mean objective across the nine plots.

6.3. Operational Impacts

6.3.1. The overall operational air quality impacts of the development are judged to be moderate based on the concentrations being well above the objectives at a number of new residential properties. Measures to mitigate against poor air quality should be built into the design for each block to improve air quality for new residents of the eight blocks included in the planning application.

6.3.2. The building emissions associated with the proposed development of eight sites covered by the planning application are below the relevant benchmarks; the transport emissions for the proposed development are however slightly above the benchmark. Appropriate mitigation measures may need to be determined in order to ensure that the development meets the requirements of 'Air Quality Neutral' as defined in the GLA's (SPG) on Sustainable Design and Construction.

6.4. HS2

6.4.1. It is considered unlikely there will be any significant cumulative impacts associated with the proposed development of the nine sites and the HS2 project.

Appendix 1: Baseline Air Quality (Air Quality Consultants, October 2014)

Air Quality CONSULTANTS

Baseline Report:
Regent's Park Estate, London Borough of Camden

October 2014

Experts in air quality management & assessment

Document Control

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Job Number	J2112

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Contents

1 Introduction

1.1 This report describes the baseline air quality at the existing Regent's Park Estate in the London Borough of Camden. It is being prepared to support work on proposals for replacement housing, likely to be required following the identification of residential apartment blocks that will need to be demolished in the event that the High Speed 2 (HS2) project proceeds. The assessment has been carried out by Air Quality Consultants Ltd. on behalf of CampbellReith.

1.2 The Regent's Park Estate lies within an Air Quality Management Area (AQMA) declared by Camden Council for exceedences of the nitrogen dioxide and PM_{10} objectives. The key source of emissions currently affecting existing residential properties of the Regent's Park estate is from road traffic on the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

1.3 This report describes existing local air quality conditions at eleven sites within the existing Regent's Park Estate, which have been identified as potential locations for the replacement housing. This report has been prepared taking into account all relevant local and national guidance and regulations.

2 Policy Context

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) sets out planning policy for England in one document. It 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.

2.3 More specifically the NPPF makes clear 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"*.

2.4 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2014), which includes guiding principles on how planning can take account of the impacts of new development on air quality. 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"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national*

assessment indicates that relevant limits have been exceeded or are near the limit". The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*".

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

2.6 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality"*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".*

The London Plan

2.7 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.

2.8 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.

2.9 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

The Mayor's Air Quality Strategy

2.10 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.

2.11 The MAQS also addresses the issue of 'air quality neutral' and states that "*GLA will work with boroughs to assist in the development of methodologies that will allow an accurate assessment of the impacts of the emissions of new developments*" (Para 5.3.19).

Local Policies

2.12 The Local Development Framework (LDF), which replaced the Unitary Development Plan (UDP) in November 2010, is a collection of planning documents that (in conjunction with national planning policy and the Mayor's London Plan) set out the strategy for managing growth and development in the borough, including where new homes, jobs and infrastructure will be located. Policy DP32 Air Quality and Camden's Clear Zone, in the Camden Development Policies Local Development Framework (London Borough of Camden, 2010) document, sets out how Camden will expect developments to reduce its impact on air quality. It 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.'*

2.13 The London Borough 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. The Council's overarching aim is for new development to be 'air quality neutral' and not lead to further deterioration of existing poor air quality. Mitigation and offsetting measures to deal with any negative air quality impacts associated with the development proposals may be required. The development should be designed to minimise exposure of occupants to existing poor air quality. It states that the Council requires assessments for:

> *'development that could have a significant negative impact in air quality. This impact can arise during both the construction and operational stages of a development as a result of increased NOx and PM_{10} emissions.'*

Air Quality Action Plan

2.14 Camden Council has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough. The Council has since developed an Air Quality Action Plan 2009 - 2012 (London Borough of Camden, 2011c). This identifies actions and mitigating measures necessary to improve air quality in the borough. It sets out objectives to reduce transport emissions and any emissions associated with new development. Key objectives associated with new development include identifying the impact of new development on air quality and controlling emissions from

construction sites. Camden Council has produced a draft Air Quality Action Plan 2013 – 2015, which is currently awaiting final approval from the GLA.

Assessment Criteria

2.15 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).

2.16 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.

2.17 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 $PM_{2.5}$.

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.

3 Site Descriptions

3.1 The Regent's Park Estate is located within the London Borough of Camden. The estate is bounded by the A400 Hampstead Road for the east, William Road and Munster Square to the south, A4021 Albany Street to the west and Cumberland Market and Granary Terrace to the north. Also to the north are the railway lines running north out of Euston national railway station. The A501 Euston Road is located approximately 200 m to the south.

3.2 There are eleven sites on the existing Regent's Park Estate which are being considered to act as replacement housing for the residential apartment blocks due for demolition should the HS2 project proceed. A summary of the eleven sites is provided in Table 2 below, along with a description as to the nearby roads to each site. The locations of each site shown in Figure 1.

Table 2: Individual Site Locations

Site Number	Site Location	Nearby Roads
1	Robert Street Car Park	Robert Street
2	Rydal Water Open Space	Robert Street/ Hampstead Road
3	Varndell Street	Varndell Street/Stanhope Street
4	Newlands Open Space	Varndell Street/Hampstead Road
5	Rothay/Dick Collins Community Hall	Redhill Street/Albany Street
6	Cape of Good Hope Public House	Albany Street
7	Troutbeck Overbuilds	Albany Street
8	Staveley/Newby Overbuilds	Robert Street
9	Camden Peoples Theatre	Drummond Street/ Hampstead Road
10	Victory Public House	Nash Street/Albany Street
11	St Bede's Hall	Clarence Gardens

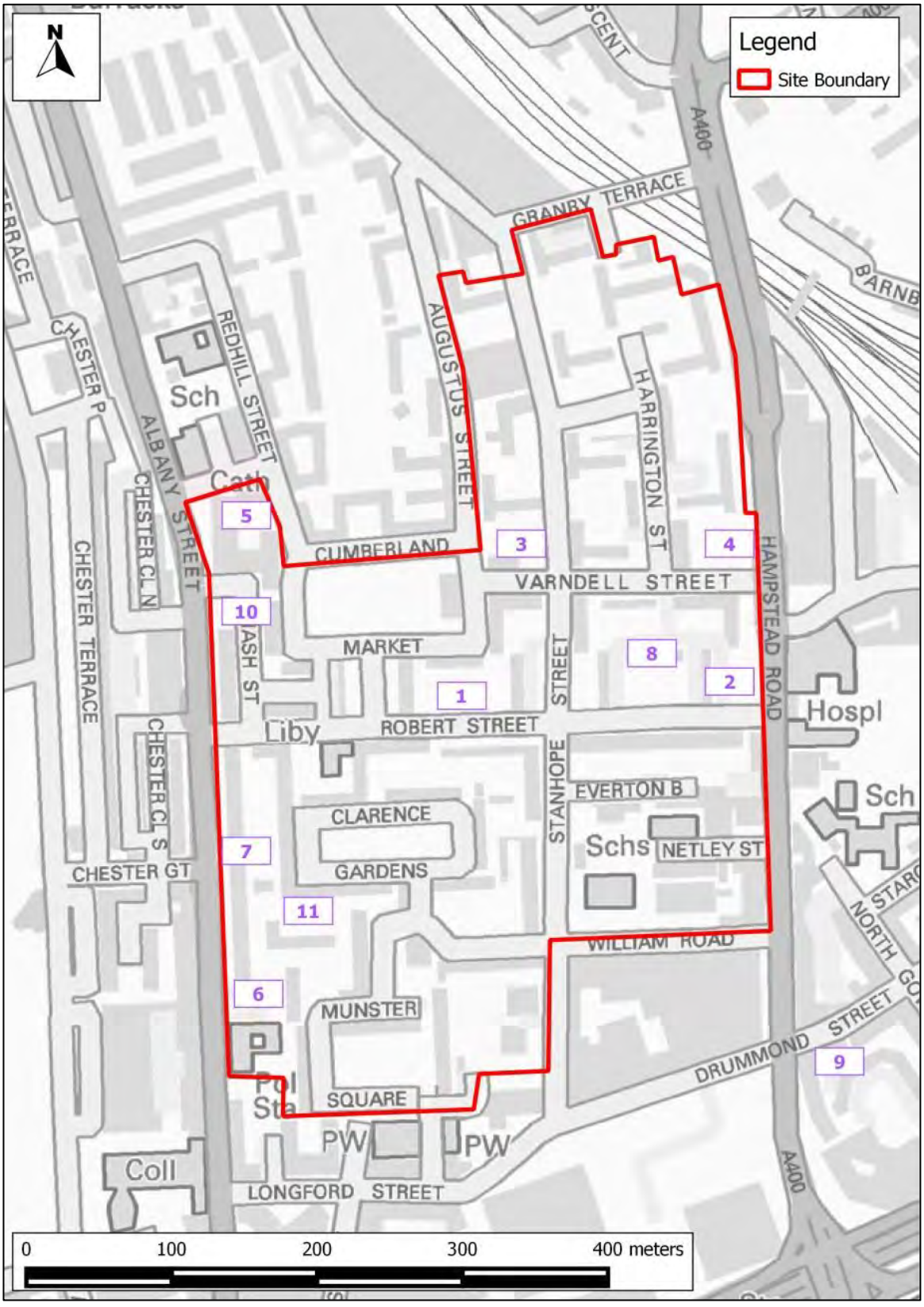

Figure 1: Location of Regent's Park Estate and Eleven Sites Proposed for Replacement Housing Contains Ordnance Survey data © Crown copyright and database right 2014

4 Baseline Conditions

Industrial sources

4.1 A search of the UK Pollutant Release and Transfer Register (Defra, 2013b) 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 existing Regent's Park Estate, in terms of air quality.

Air Quality Review and Assessment

4.2 Camden Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. The Council has declared an AQMA covering the whole borough for exceedences of the nitrogen dioxide and PM_{10} objectives; the Regent's Park Estate is located within the AQMA.

Local Air Quality Monitoring

Nitrogen Dioxide

4.3 In 2013, Camden Council operated four automatic monitoring stations within its area. Two of these, Bloomsbury (an urban background site) and Euston Road (a roadside site) are located less than 1 km from the Regent's Park Estate. A further automatic monitoring station, operated by the City of Westminster and located on Marylebone Road (a kerbside site) is also located within 1 km of the Regent's Park Estate. Camden Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared by Gradko International (using the 50% Triethanolmine (TEA) in acetone method). One of the diffusion tube monitoring sites is located approximately 750 m to the northeast of the Regent's Park Estate, on Brill Place, near to St Pancras station. Results for the years 2009 to 2013 are summarised in Table 3.

4.4 Measured concentrations suggest air quality within the study area is poor. Concentrations at the roadside and kerbside monitoring locations on Euston Road and Marylebone Road are well in excess of the annual mean objective. Measured concentrations at these sites are more than double the annual mean nitrogen dioxide objective of 40 µg/m^3. These analysers are located on more heavily trafficked and congested roads than those surrounding the Regent's Park Estate and therefore unlikely to be representative of air quality at the Regent's Park Estate. Measured concentrations at the Brill Place diffusion tube monitoring site and the urban background analyser at Bloomsbury, which are considered to be broadly representative of air quality conditions at the Regent's Park Estate, also exceed the annual mean objective by around 10 µg/m^3. However, these concentrations are 40-50 µg/m^3 lower than those measured at Euston Road and Marylebone Road.

4.5 The short-term nitrogen dioxide objective is exceeded at the automatic analysers on Euston Road and Marylebone Road. The objective is achieved at the urban background automatic analyser at Bloomsbury, and as measured concentrations at the Brill Place diffusion tube monitoring site are below 60 µg/m^3, it is also expected to be achieved at this location. It is considered likely, therefore, that the short-term objective will also be achieved at the Regent's Park Estate.

Table 3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2009 – 2013) [a]

Site No.[b]	Site Type	Location	2009	2010	2011	2012	2013
Automatic Monitors - Annual Mean (µg/m^3) [c]							
LB	Urban Background	London Bloomsbury	**54**	**55**	**50**	**55**	**51**
CD9	Roadside	Euston Road	**-**	**-**	**122**	**106**	n/a
-	Kerbside	Marylebone Road (Westminster)	**107**	**98**	**97**	**94**	**85**
Objective			**40**				
Automatic Monitors - No. of Hours > 200 µg/m^3 [c]							
LB	Urban Background	London Bloomsbury	2	1	0	1	0
CD9	Roadside	Euston Road	-	-	**712**	**293**	**398**
-	Kerbside	Marylebone Road (Westminster)	**469**	**524**	**217**	**122**	**59**
Objective			**40**				
Diffusion Tubes - Annual Mean (µg/m^3) [d]							
CA16	Roadside	Brill Place	**52**	**54**	**51**	**50**	n/a
Objective			**40**				

[a] Exceedences of the objectives are shown in bold

[b] The Site No. is a site identification code used by Camden Council.

[c] Data downloaded from the London Air website (King's College London, 2014).

[d] Data have been taken from the 2013 Progress Report (London Borough of Camden, 2013). 2013 monitoring data was not available at the time of writing this report.

PM_{10} and $PM_{2.5}$

4.6 The automatic analysers at Bloomsbury and Marylebone Road[1] also record PM_{10}. Results for the period 2009 to 2013 are presented in Table 4. In recent years, measured annual mean

[1] There are two types of PM_{10} analyser at the Marylebone Road monitoring station, a Tapered element oscillating microbalance (TEOM) and Filter Dynamics Measurement Systems (FDMS). Results for both are presented.

concentrations were below the annual mean objective at both Marylebone Road and Bloomsbury. The 24-hour mean objective was exceeded at Marylebone Road but achieved at Bloomsbury. Concentrations at the Regent's Park Estate are likely to be more similar to those at the urban background site, where the objectives are achieved.

Table 4: Summary of PM_{10} Automatic Monitoring (2009 – 2013) [a]

Site No.	Site Type	Location	2009	2010	2011	2012	2013
PM_{10} Annual Mean (µg/m^3)							
LB	Urban Background	London Bloomsbury	23	n/a	23	19	18
-	Kerbside	Marylebone Road (Westminster) TEOM	36	35	**41**	38	33
-		Marylebone Road (Westminster) FDMS	37	32	38	n/a	29
Objective			**40**				
PM_{10} No. Days >50 µg/m^3							
LB	Urban Background	London Bloomsbury	13	n/a	17	10	3
-	Kerbside	Marylebone Road (Westminster) TEOM	**36**	**40**	**73**	**48**	29
-		Marylebone Road (Westminster) FDMS	**43**	23	**57**	n/a	21
Objective			**35**				

[a] Exceedences of the objectives are shown in bold

4.7 There are no analysers in the study area which record $PM_{2.5}$.

Background Concentrations

4.8 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2013 and 2015 (the year in which the replacement housing is likely to first be occupied) (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[2]. The derivation of background concentrations is described in Appendix A2.

2 A disparity between the road transport emission projections and measured annual mean concentrations of nitrogen oxides and nitrogen dioxide has been identified by Defra. The reason for the disparity is thought to relate to the on-road performance of modern diesel vehicles, and further information can be found in (Carslaw et al., 2011).

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2013 and 2015 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2013 [a]	44.5 – 50.3	24.8 – 25.8	17.0 – 17.7
2015 – Without Reductions in Traffic Emissions [b]	43.5 – 49.0	n/a	n/a
2015 – With Reductions in Traffic Emissions [c]	42.4 – 47.7	23.9 – 24.9	16.2 – 16.8
Objectives	**40**	**40**	**25**

n/a = not applicable

[a] This assumes that road vehicle emission factors in 2013 remain the same as in 2011 (See AppendixA2).

[b] This assumes that road vehicle emission factors in 2015 remain the same as in 2011.

[c] This assumes that road vehicle emission factors reduce between 2013 and 2015 at the current 'official' rates.

4.9 The mapped nitrogen dioxide background concentrations exceed the annual mean objective in both 2013 and 2015, with or without emissions reduction. The mapped background concentrations are similar to measured urban background concentrations at the Bloomsbury automatic analyser.

4.10 The mapped PM_{10} and $PM_{2.5}$ background concentrations are well below the objectives.

Baseline Conditions at Individual Sites

4.11 The Regent's Park Estate is located more than 200 m from the heavily trafficked and congested A501 Euston Road, where measured concentrations are well in excess of the nitrogen dioxide objectives. It is possible that the 24-hour mean PM_{10} objective may also be exceeded along this road. Being located some distance from Euston Road, pollutant concentrations are considered likely to be more in-line with background concentrations, as measured at Bloomsbury and mapped by Defra.

4.12 On this basis it is expected that the PM_{10} and $PM_{2.5}$ concentrations will be achieved at the Regent's Park Estate, but that the annual mean nitrogen dioxide objective is likely to be exceeded. The short-term nitrogen dioxide objective is likely to be achieved.

4.13 As described in Section 3, the Regent's Park Estate is bounded by two main roads, A4021 Albany Street to the west and A404 Hampstead Road to the east. These mains roads will experience more traffic and have higher emissions than the other smaller roads running through the Regent's Park Estate. It is expected therefore that pollutant concentrations will be higher at locations near to these roads than locations further from them. Pollutant concentrations are expected to be higher at sites 2, 4 to 7, 9 and 10, than sites 1, 3, 8 and 11.

5 Conclusions and Recommendations

Summary and Conclusions

5.1 This report has identified the baseline air quality at eleven sites on the existing Regent's Park estate in the London Borough of Camden.

5.2 It is concluded that concentrations of PM_{10} and $PM_{2.5}$ are likely to be below the air quality objectives at the eleven sites of the Regent's Park Estate.

5.3 With respect to nitrogen dioxide, concentrations are likely to above the annual mean objective at all eleven sites. Concentrations will be higher at sites located adjacent to the buisier roads. The short-term nitrogen dioxide objective is likely to be achieved across the Regent's Park Estate.

Recommendations

5.4 In order to provide a more robust appraisal of the air quality conditions at each of the eleven individual sites within the Regent's Park Estate, both in relation to the national air quality objectives as well as in comparison to one another, it is recommended that a quantitative air quality assessment utilising detailed dispersion modelling is used. The use of dispersion modelling will allow for pollutant concentrations at each of the sites to be quantified and compared to the air quality objectives. The results of the dispersion modelling would guide recommendations for the level of mitigation for air quality that would be required at each site.

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7 Glossary

AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
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
FDMS	Filter Dynamics Measurement Systems
LEZ	Low Emission Zone
µg/m^3	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
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
TEOM	Tapered element oscillating microbalance
VCM	Volatile Correction Model

8 Appendices

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

London Plan [3]

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;

[3] The GLA has outlined a number of draft alterations to the London Plan, but no changes are proposed to any policies relating to air quality.

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 Background Concentrations

A2.1 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2014a). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The maps include the influence of emissions from a range of different sources; one of which is road traffic. 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 (Carslaw et al., 2011). The maps currently in use were verified against measurements made during 2011 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2011. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

A2.2 In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2013, it is assumed that there was no reduction in the road traffic component of backgrounds between 2011[4] and 2013. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2014a). For each grid square, the road traffic component has been held constant at 2011 levels, while 2013 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2014a) publishes to accompany the maps. The result is a set of 'adjusted 2013 background' concentrations.

A2.3 As an additional step, the 'adjusted 2013 background' mapped values have been calibrated against national background measurements made as part of the AURN during 2013 (see Figure A1.1). Based on the 52 sites with more than 90% data capture for 2013, the maps under-predict the background concentrations by 5.5%, on average. This has been allowed for in production of the calibrated 'adjusted' 2013 background concentrations and 20YY background concentrations.

[4] This approach assumes that there has been no reduction in emissions per vehicle, but 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. This discrepancy is unlikely to influence the overall conclusions of the assessment.

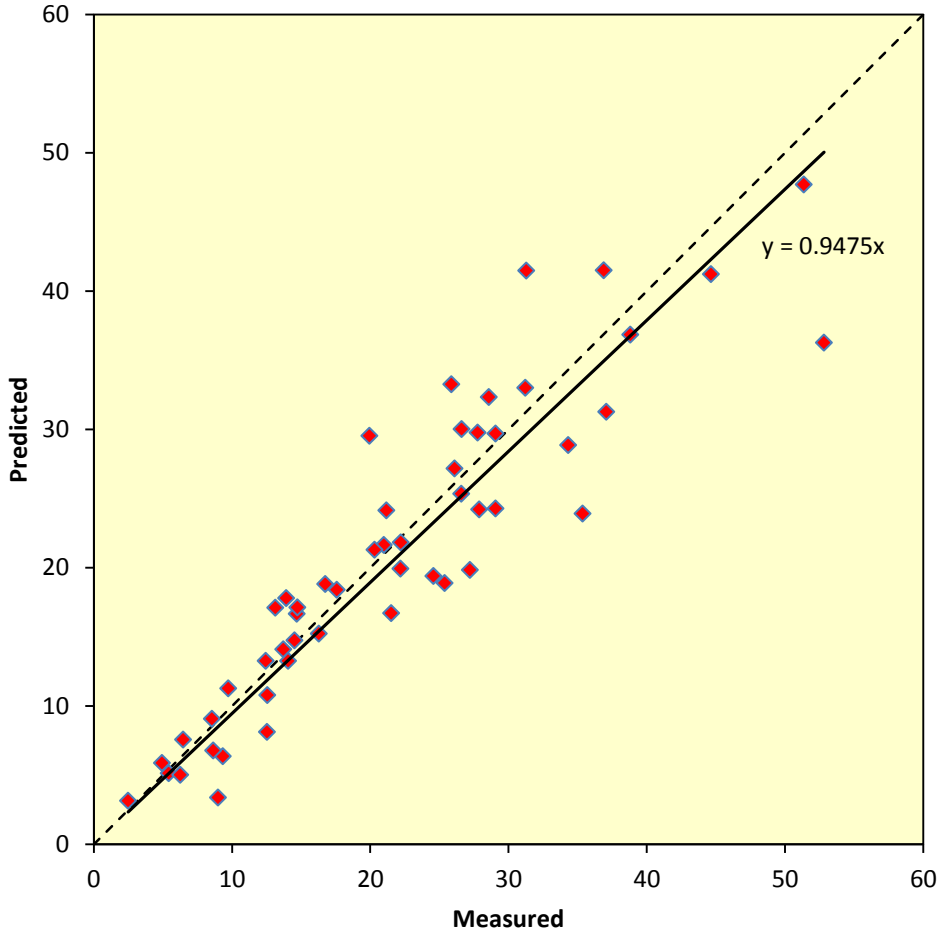

Figure A.1: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2013

A2.4 Two separate sets of 2015 background nitrogen dioxide and nitrogen oxides concentrations have been used for the future-year assessment. The 2015 background 'without emissions reduction' has been calculated using the same approach as described for the 2013 data: the road traffic component of background nitrogen oxides has been held constant at 2011 values, while 2015 data are taken for the other components. Nitrogen dioxide has then been calculated using Defra's background nitrogen dioxide calculator. This has been adjusted by a national factor of 1.0554 for the background calibration, as described in Paragraph A1.3. The 2015 background 'with emissions reduction' assumes that Defra's revised predicted reductions occur from 2013 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2015 to the unadjusted mapped value for 2013. This ratio has then been applied to the adjusted 2013 value (as derived in Paragraph A1.3).

A2.5 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.

Appendix 2: Air Quality Assessment (Air Quality Consultants, May 2015)

Air Quality CONSULTANTS

Air Quality Assessment: Regent's Park Estate, London Borough of Camden

May 2015

Experts in air quality management & assessment

Document Control

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Job Number	J2112

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Document Status and Review Schedule

Report No.	Date	Status	Reviewed by
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Executive Summary

The air quality impacts associated with the construction and operation of the proposed development of nine sites on the Regent's Park Estate have been assessed.

Existing air quality conditions have been described using the results of monitoring carried out by Camden Council, information published by Defra and the Environment Agency, and detailed baseline dispersion modelling. The potential dust impacts arising during the construction phase have been assessed following guidance issued by the GLA, taking into account the sensitivity of the local area and the nature and duration of the works. The operational impacts have been assessed using detailed dispersion modelling. Concentrations of the key air pollutants associated with road traffic, i.e. nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$), have been determined. The predicted concentrations have been compared with air quality objectives set by the Government to protect human health.

During construction it will be necessary to apply a package of mitigation measures to minimise dust emissions. IAQM guidance makes clear that, with the mitigation measures in place, the overall impacts during construction will not be significant.

Existing conditions within the study area show poor air quality, with concentrations of nitrogen dioxide exceeding the annual mean objective in the study area. The site lies within an Air Quality Management Area.

Air quality conditions for residents within the proposed development have been considered. Pollutant concentrations are predicted to be above the air quality objectives across the proposed development. Measures to mitigate against poor air quality should be built into the design for each block to improve air quality for new residents of the eight sites included in the planning application.

The building emissions associated with the eight sites covered by the planning application are below the relevant benchmark, however the transport emissions for the proposed development are slightly above the benchmark. Appropriate mitigation measures may need to be determined in order to ensure that the development meets the requirements of 'Air Quality Neutral' as defined in the GLA's (SPG) on Sustainable Design and Construction.

It is considered unlikely there will be any significant cumulative impacts associated with the proposed development of the nine sites and the High Speed 2 (HS2) project.

Contents

1 Introduction

1.1 This report describes the potential air quality impacts associated with the proposed development of nine sites (the proposals) within the Regent's Park Estate in the London Borough of Camden. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Campbell Reith Hill LLP (CampbellReith).

1.2 The proposed development comprises new build residential accommodation across eight sites with three of the sites also including ground floor commercial space (A1/A2 use), and one site including a replacement community hall (D1). In addition, one further site (subject to a separate planning application) is for the conversion of the upper floors of an existing building to residential use, with an existing theatre in the ground and lower floors to be retained. Whilst being proposed as new housing it is intended that the majority of these new homes (94 of 116 homes) are used as replacement housing for residents that will be displaced by the High Speed Rail (HS2) project, with 22 additional new homes proposed.

1.3 The proposals originally included eleven sites across the Regent's Park Estate, however only nine are considered by this assessment. A summary of the proposals for the nine sites covered in this report is provided below:

- Site 1 Robert Street Car Park: 13 residential units and replacement community hall (336 m^2);
- Site 2 Former One Stop Shop (formerly Rydal Water): 24 residential units and 163 m^2 commercial space;
- Site 3 Vardnell Street Corner: 8 residential units;
- Site 4 Newlands Plot: 32 residential units and 95 m^2 commercial space;
- Site 5 Dick Collins Hall (formerly) Rothay: 11 residential units;
- Site 6 Cape of Good Hope: 15 residential units;
- Site 9 Camden Peoples Theatre: 5 residential units and theatre (230 m^2);
- Site 10 Victory Pub: 10 residential units and 185 m^2 commercial space; and
- Site 11 St Bedes Hall: 3 residential units.

1.4 The sites lie within an Air Quality Management Area (AQMA) declared by the London Borough of Camden for exceedences of the nitrogen dioxide and PM_{10} objectives. The proposals are intended for replacement housing and so they do not represent additional development in the area. The exception to this is new commercial space at some of the sites, although this is proposed on a car-

free basis. The development of the sites will therefore not significantly increase 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 $PM_{2.5}$).

1.5 Sites 2 and 4 will include centralised energy plant (natural gas boilers). Site 9 (not included in the planning application) will be served by an existing centralised boiler plant and dwellings within the remaining six sites will be served by individual gas boilers. Emissions from the two new centralised energy plant could impact upon air quality at existing residential properties, as well as the new residential properties within the developments themselves. The main air pollutant of concern related to boiler plant is nitrogen dioxide.

1.6 The closest site to railway lines at Euston National Railway Station is approximately 100 m away. Defra guidance (Defra, 2009) outlines an approach to assess the potential for exceedences of the annual mean nitrogen dioxide objective as a result of emissions from diesel locomotives. The guidance outlines that there is only the potential for an exceedence where there is long-term exposure within 30 m, and the annual mean background concentration of nitrogen dioxide is above 25 $\mu g/m^3$. All nine sites fall outside these criteria and thus the impact of emissions from railway locomotives on nitrogen dioxide concentrations are not considered further.

1.7 The air quality neutrality of the proposed development has also been assessed following the methodology provided in the Greater London Authority's (GLA's) Supplementary Planning Guidance (SPG) on Sustainable Design and Construction (GLA, 2014a).

1.8 The GLA has also released Supplementary Planning Guidance on the Control of Dust and Emissions from Construction and Demolition (GLA, 2014b). The SPG outlines a risk assessment approach for construction dust assessment and helps determine the mitigation measures that will need to be applied. A construction dust assessment for each of the nine sites has also been carried out.

1.9 This report describes existing local air quality conditions (2014) and the predicted air quality in the anticipated year of opening for Sites 1, 2, 3, 4, 6 and 11 (2016). For simplicity, Sites 5, 9 and 10 (which are anticipated to open in 2017) have been assumed to open in 2016 also, which is a worst-case assumption. The assessment of construction dust impacts focuses on the anticipated duration of the works.

1.10 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with the London Borough of Camden.

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.

Clean Air Act 1993

2.2 Small combustion plant of less than 20 MW net rated thermal input are controlled under the Clean Air Act 1993. This requires the local authority to approve the chimney height. Plant which are smaller than 366kW have no such requirement.

Planning Policy

National Policies

2.3 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It 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 More specifically the NPPF makes clear 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"*.

2.5 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2014), which includes guiding principles on how planning can take account of the impacts of new development on air quality. 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"* and *"It is important that the potential impact of new development on air quality is taken into account … where the national assessment indicates that relevant limits have been exceeded or are near the limit".* The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*". In addition, the PPG makes clear that *"… dust can also be a planning concern, for example, because of the effect on local amenity".*

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

2.7 The PPG sets out the information that may be required in an air quality assessment, making clear that *"Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality".* It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact".*

The London Plan

2.8 The London Plan (GLA, 2015) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to air quality.

2.9 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.

2.10 Policy 7.14B(c), requires that development proposals should be "*at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as designated Air Quality Management Areas (AQMAs))*". Further details of the London Plan in relation to planning decisions are provided in Appendix A1.

The Mayor's Air Quality Strategy

2.11 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.

2.12 The MAQS also addresses the issue of 'air quality neutral' and states that "*GLA will work with boroughs to assist in the development of methodologies that will allow an accurate assessment of the impacts of the emissions of new developments*" (Para 5.3.19).

GLA SPG: Sustainable Design and Construction

2.13 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a) provides details on delivering some of the priorities in the London Plan. Section 4.3 covers Air Pollution. It defines when developers will be required to submit an air quality assessment, explains how location and transport measures can minimise emissions to air, and provides emission standards for gas-fired boilers, Combined Heat and Power (CHP) and biomass plant. It also sets out, for the first time, guidance on how Policy 7.14B(c) of the London Plan relating to 'air quality neutral' (see Paragraph 2.10, above) should be implemented.

GLA SPG: The Control of Dust and Emissions During Construction and Demolition

2.14 The GLA's SPG on The Control of Dust and Emissions During Construction and Demolition (GLA, 2014b) outlines a risk assessment based approach to considering the potential for dust generation from a construction site, and sets out what mitigation measures should be implemented to minimise the risk of construction dust impacts, dependent on the outcomes of the risk assessment. This guidance is largely based on the Institute of Air Quality Management's (IAQM) 2014 guidance on the Assessment of dust from demolition and construction (Institute of Air Quality Management, 2014), and it states that "*the latest version of the IAQM Guidance should be used*".

Local Policies

2.15 The Local Development Framework (LDF), which replaced the Unitary Development Plan (UDP) in November 2010, is a collection of planning documents that (in conjunction with national planning policy and the Mayor's London Plan) set out the strategy for managing growth and development in the borough, including where new homes, jobs and infrastructure will be located. Policy DP32 Air Quality and Camden's Clear Zone, in the Camden Development Policies Local Development Framework (London Borough of Camden, 2010) document, sets out how Camden will expect developments to reduce its impact on air quality. It 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.'

2.16 The London Borough 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. The Council's overarching aim is for new development to be 'air quality neutral' and not lead to further deterioration of existing poor air quality. Mitigation and offsetting measures to deal with any negative air quality impacts associated with the development proposals may be required. The development should be designed to minimise exposure of occupants to existing poor air quality. It states that the Council requires assessments for:

'development that could have a significant negative impact in air quality. This impact can arise during both the construction and operational stages of a development as a result of increased NOx and PM_{10} emissions.'

Air Quality Action Plan

2.17 Camden Council has declared an AQMA for nitrogen dioxide and PM_{10} that covers the whole Borough. The Council has since developed an Air Quality Action Plan 2013 – 2015 (London Borough of Camden, 2014). This identifies actions and mitigating measures necessary to improve air quality in the borough. It sets out objectives to reduce transport emissions and any emissions associated with new development. Key objectives associated with new development include identifying the impact of new development on air quality and controlling emissions from construction sites.

Assessment Criteria

Health Criteria

2.18 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).

2.19 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.

2.20 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.; they do not apply at hotels. 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 and at hotels. 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.

2.21 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but 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). In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.

2.22 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.

Construction Dust Criteria

2.23 There are no formal assessment criteria for dust. In the absence of formal criteria, the approach developed by the Institute of Air Quality Management[1] (IAQM) (2014), on which the assessment methodology outlined in the GLA's SPG (GLA, 2014b) is based, has been used. Full details of this approach are provided in Appendix A2.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

2.24 Guidance from the IAQM (Institute of Air Quality Management, 2014) is that, with appropriate mitigation in place, the impacts of construction dust will not be significant. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that impacts will normally not be significant.

Operational Significance

2.25 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's) 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 A3, with the professional experience of the consultants preparing the report set out in Appendix A4.

[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 London Borough of Camden via a telephone discussion and subsequent email correspondence between Amy Farthing (Air Quality Officer at the London Borough of Camden) and Suzanne Hodgson (Air Quality Consultants) held on 27th April 2015.

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, 2015d) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2015). Local sources have also been identified through discussion with the London Borough of Camden's Environmental Health 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 both the study area and nearby sites, the latter being 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 (2015a). These cover the whole country on a 1x1 km grid. Measurements made during 2014 have been used to estimate concentrations in 2016 following the methodology described in Appendix A6. Current exceedences of the annual mean EU limit value for nitrogen dioxide have been identified using the maps of roadside concentrations published by Defra (2015e). These are the maps, currently based on 2012 data, used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedences of the limit value to the EU.

Construction Impacts

3.4 The construction dust assessment considers the potential for impacts within 350 m of the nine site boundaries; or within 50 m of roads used by construction vehicles. The assessment methodology follows the GLA's SPG on the Control of Dust and Emissions During Construction and Demolition (GLA, 2014b), which is based on that provided by the IAQM (Institute of Air Quality Management, 2014). This follows a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-site works and by vehicles leaving the site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from

Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Appendix A2 explains the approach in more detail.

Road Traffic Impacts

Sensitive Locations

3.5 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations within each site. Receptors have been identified to represent worst-case exposure within each site. When selecting these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links. The receptors have been located on the façades of the properties closest to the sources.

3.6 Receptor locations have been identified within each site, which represents exposure to existing sources. These locations are described in Table 2 and shown in Figure 1. In addition, concentrations have been modelled at the automatic monitoring site located at Euston Road, in order to verify the modelled results (see Appendix A5 for verification method).

Table 2: Description of Receptor Locations

Site Number	Site Description	Modelled Receptors (in Figure 1)	Modelled Floor Levels [a]
1	Robert Street Car Park*	RS1 and RS2	First to Fourth
2	Former One Stop Shop*	RW1 to RW4	First to Sixth
3	Varndell Street Corner	VS1 and VS2	Ground to Fourth
4	Newlands Plots*	N1 to N4	First to Tenth
5	Dick Collins Hall	R1 to R5	Ground to Fourth
6	Cape of Good Hope	CGH1 to CGH4	Ground to Fifth
9	Camden Peoples Theatre*	CPT1 and CPT 2	Ground to Fourth
10	Victory Pub*	V1 to V4	Ground to Fourth
11	St Bedes Hall	SBM1	Ground to Second

[a] Generally, there is 3.1 m between floors. The exception is sites with commercial uses at the ground floor level (marked with an asterix*), where the distance between ground and first floors is assumed to be 4 m. Receptors have been modelled at heights of 1.5 m (considered to be breathing height) above the relevant floor level.

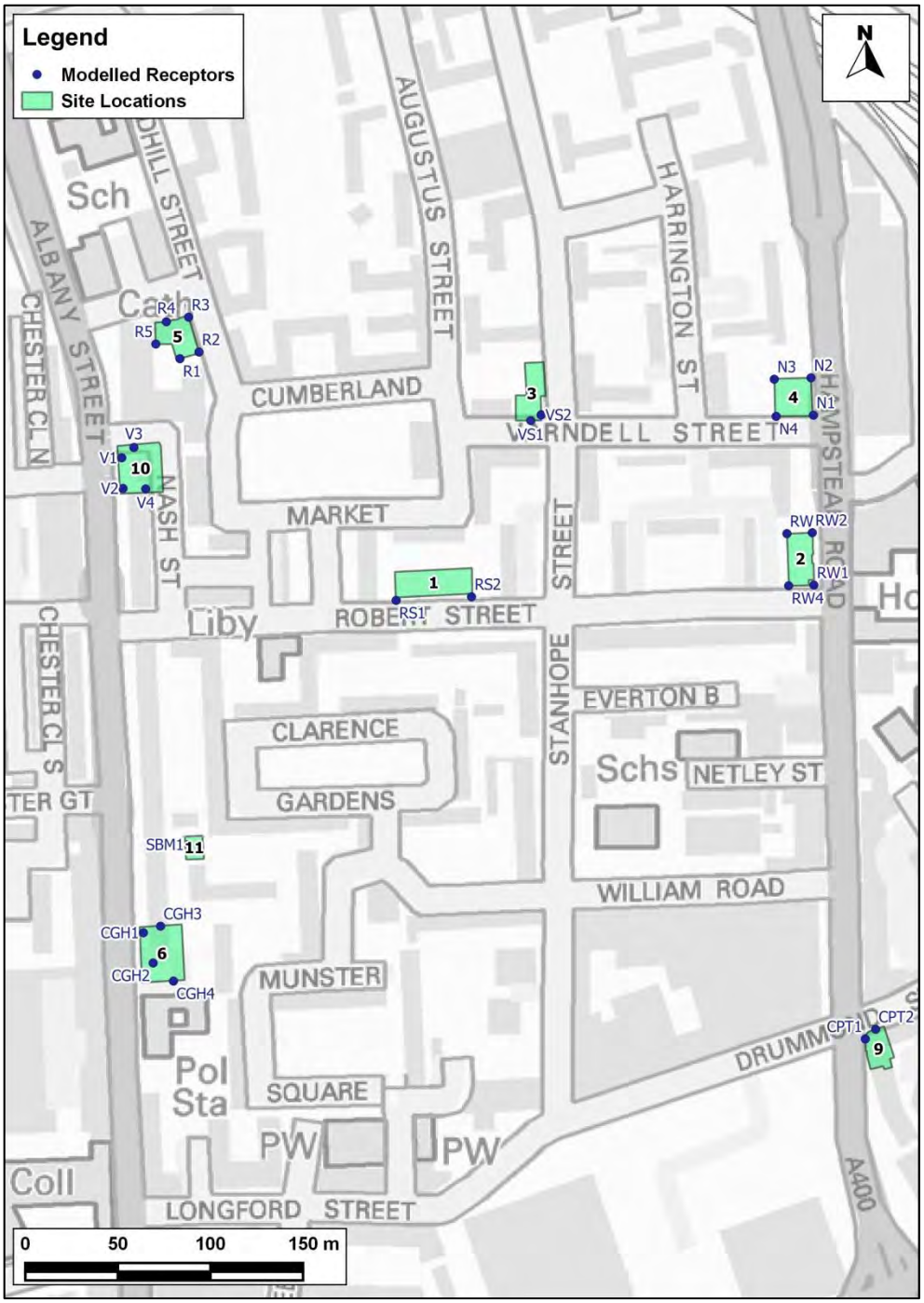

Figure 1: Modelled Receptor Locations

Contains Ordnance Survey data © Crown copyright and database right 2015

Assessment Scenarios

3.7 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2014), and the proposed year of opening for each site (2016). A 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,

Beevers, Westmoreland, & Williams, 2011) that road traffic emissions have not been declining as expected (see Uncertainty section in Appendix A5). Nitrogen dioxide concentrations in 2016 are thus presented for two scenarios: 'With Emissions Reduction' and 'Without Emissions Reduction'.

Modelling Methodology

3.8 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs and the model verification are provided in Appendix A5, together with the method used to derive current and future year background nitrogen dioxide concentrations.

Impact of Proposed Development on Surrounding Area

3.9 The impacts of traffic generated by the proposals upon the surrounding area have been considered qualitatively. The assessment is based on the likely overall change in traffic movements in the Regent's Park Estate as a result of the proposed development of the nine sites.

Energy Plant Impacts

3.10 The potential impacts of the proposed energy plant have been assessed qualitatively. The assessment is based on the size of the plant, dispersion conditions and compliance with the GLA's SPG (GLA, 2014a).

'Air Quality Neutral'

3.11 The guidance relating to air quality neutral follows a tiered approach, such that all developments are expected to comply with minimum standards for gas boilers, combined heat and power (CHP) and biomass (GLA, 2014a). Compliance with 'air quality neutral' is then founded on emissions benchmarks that have been derived for both building (energy) use and road transport in different areas of London. Developments that exceed the benchmarks are required to implement on-site or off-site mitigation to offset the excess emissions (GLA, 2014a).

3.12 Appendix A7 of this report sets out the emissions benchmarks. The approach has been to calculate the emissions for the proposed development and to compare them with these benchmarks.

4 Site Description and Baseline Conditions

Site Description

4.1 The Regent's Park Estate is located within the London Borough of Camden. There are nine sites on the existing Regent's Park Estate which are intended to act as replacement housing for residents displaced by the HS2 project. The estate is bounded by the A400 Hampstead Road to the east, William Road and Munster Square to the south, A4021 Albany Street to the west and Cumberland Market and Granary Terrace to the north. Also to the north are the railway lines running north out of Euston national railway station. The A501 Euston Road is located approximately 200 m to the south.

Industrial Sources

4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2013b) 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 existing Regent's Park Estate, in terms of air quality.

Air Quality Review and Assessment

4.3 Camden Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. The Council has declared an AQMA covering the whole borough for exceedences of the nitrogen dioxide and PM_{10} objectives; the Regent's Park Estate is located within the AQMA.

Local Air Quality Monitoring

Nitrogen Dioxide

4.4 In 2013, Camden Council operated four automatic monitoring stations within its area. Two of these, Bloomsbury (an urban background site) and Euston Road (a roadside site) are located less than 1 km from the Regent's Park Estate. A further automatic monitoring station, operated by the City of Westminster and located on Marylebone Road (a kerbside site) is also located within 1 km of the Regent's Park Estate. Camden Council also operates a number of nitrogen dioxide monitoring sites using diffusion tubes prepared by Gradko International (using the 50% Triethanolmine (TEA) in acetone method). One of the diffusion tube monitoring sites is located approximately 750 m to the northeast of the Regent's Park Estate, on Brill Place, near to St Pancras station. Results for the years 2009 to 2014 are summarised in Table 3.

Table 3: Summary of Nitrogen Dioxide (NO_2) Monitoring (2009 – 2014) [a]

Site No.[b]	Site Type	Location	2009	2010	2011	2012	2013	2014
Automatic Monitors - Annual Mean (µg/m^3) [c]								
LB	Urban Background	London Bloomsbury	**54**	**55**	**50**	**55**	**51**	**45**
CD9	Roadside	Euston Road	**-**	**-**	**122**	**106**	n/a	**98**
-	Kerbside	Marylebone Road (Westminster)	**107**	**98**	**97**	**94**	**85**	**80**
Objective			**40**					
Automatic Monitors - No. of Hours > 200 µg/m^3 [c]								
LB	Urban Background	London Bloomsbury	2	1	0	1	0	0
CD9	Roadside	Euston Road	-	-	**712**	**293**	**398**	**170**
-	Kerbside	Marylebone Road (Westminster)	**469**	**524**	**217**	**122**	**59**	17
Objective			**40**					
Diffusion Tubes - Annual Mean (µg/m^3) [d]								
CA16	Roadside	Brill Place	**52**	**54**	**51**	**50**	n/a	**55**
Objective			**40**					

[a] Exceedences of the objectives are shown in bold

[b] The Site No. is a site identification code used by Camden Council.

[c] Data downloaded from the London Air website (King's College London, 2015).

[d] Data have been taken from the 2013 Progress Report (London Borough of Camden, 2013). 2014 diffusion tube data has been provided by Camden Council. 2013 monitoring data for the Brill Place diffusion tube was not available at the time of writing this report.

4.5 Measured concentrations suggest air quality within the study area is poor. Concentrations at the roadside and kerbside monitoring locations on Euston Road and Marylebone Road are well in excess of the annual mean objective. Measured concentrations at these sites are more than double the annual mean nitrogen dioxide objective of 40 µg/m^3. These analysers are located on more heavily trafficked and congested roads than those surrounding the Regent's Park Estate and are therefore unlikely to be representative of air quality at the Regent's Park Estate. Measured concentrations at the Brill Place diffusion tube monitoring site and the urban background analyser at Bloomsbury may be considered to be more closely representative of air quality conditions at the Regent's Park Estate; concentrations of nitrogen dioxide at these locations also exceed the annual mean objective by around 10 µg/m^3. However, these concentrations are 40-50 µg/m^3 lower than those measured at Euston Road and Marylebone Road.

4.6 The short-term nitrogen dioxide objective is exceeded at the automatic analysers on Euston Road and Marylebone Road. The objective is achieved at the urban background automatic analyser at Bloomsbury, and as measured concentrations at the Brill Place diffusion tube monitoring site are below 60 µg/m^3, it is also expected to be achieved at this location. It is considered likely, therefore, that the short-term objective will also be achieved at the Regent's Park Estate.

PM_{10} and $PM_{2.5}$

4.7 The automatic analysers at Bloomsbury and Marylebone Road[2] also record PM_{10} concentrations. Results for the period 2009 to 2014 are presented in Table 4. In recent years, measured annual mean concentrations were below the annual mean objective at both Marylebone Road and Bloomsbury. The 24-hour mean objective was exceeded at Marylebone Road but achieved at Bloomsbury. Concentrations at the Regent's Park Estate are likely to be closer to those at the urban background site, where the objectives are achieved.

Table 4: Summary of PM_{10} Automatic Monitoring (2009 – 2014) [a]

Site No.	Site Type	Location	2009	2010	2011	2012	2013	2014
PM_{10} Annual Mean (µg/m^3)								
LB	Urban Background	London Bloomsbury	23	n/a	23	19	18	19
-	Kerbside	Marylebone Road (Westminster) TEOM	36	35	**41**	38	33	35
-		Marylebone Road (Westminster) FDMS	37	32	38	n/a	29	31
Objective			**40**					
PM_{10} No. Days >50 µg/m^3								
LB	Urban Background	London Bloomsbury	13	n/a	17	10	3	10
-	Kerbside	Marylebone Road (Westminster) TEOM	**36**	**40**	**73**	**48**	29	21
-		Marylebone Road (Westminster) FDMS	**43**	23	**57**	n/a	21	17
Objective			**35**					

[a] Exceedences of the objectives are shown in bold

[b] The Site No. is a site identification code used by Camden Council.

[c] Data downloaded from the London Air website (King's College London, 2015).

[d] Data have been taken from the 2013 Progress Report (London Borough of Camden, 2013). 2014 diffusion tube data has been provided by Camden Council. 2013 monitoring data for the Brill Place diffusion tube was not available at the time of writing this report.

[2] There are two types of PM_{10} analyser at the Marylebone Road monitoring station, a tapered element oscillating microbalance (TEOM) and Filter Dynamics Measurement Systems (FDMS). Results for both are presented.

4.8 There are no analysers in the study area which record $PM_{2.5}$.

Exceedences of EU Limit Value

4.9 There are several Automatic Urban and Rural Network (AURN) monitoring sites within the Greater London Urban Area that have measured exceedences of the annual mean nitrogen dioxide limit value. Furthermore, the national map of roadside annual mean nitrogen dioxide concentrations (Defra, 2015e), used to report exceedences of the limit value to the EU, identifies exceedences of this limit value in 2012 along many roads in London, including Hampstead Road and Albany Road which border some of the sites and Euston Road near to the Regent's Park Estate. The Greater London Urban Area has thus been reported to the EU as exceeding the limit value for annual mean nitrogen dioxide concentrations. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations show no exceedences of the limit values anywhere in London. These maps are for 2012 concentrations; detailed maps of predicted future year exceedences are not available (Defra, 2015e).

Background Concentrations

4.10 In addition to these locally measured concentrations, estimated background concentrations in the study area have been determined for 2014 and 2016 (the year in which the new sites are likely to first be occupied) (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[3]. The derivation of background concentrations is described in Appendix A2.

Table 5: Estimated Annual Mean Background Pollutant Concentrations in 2014 and 2016 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2014 [a]	**41.7 – 47.1**	24.4 – 25.3	15.8 – 16.0
2016 – Without Reductions in Traffic Emissions [b]	**40.8 – 46.0**	n/a	n/a
2016 – With Reductions in Traffic Emissions [c]	39.1 – **44.0**	23.6 – 23.7	16.0 – 16.6
Objectives	**40**	**40**	**25**

n/a = not applicable

[a] This assumes that road vehicle emission factors in 2014 remain the same as in 2011 (See AppendixA2).

[b] This assumes that road vehicle emission factors in 2016 remain the same as in 2011.

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[3] A disparity between the road transport emission projections and measured annual mean concentrations of nitrogen oxides and nitrogen dioxide has been identified by Defra. The reason for the disparity is thought to relate to the on-road performance of modern diesel vehicles, and further information can be found in (Carslaw, Beevers, Westmoreland, & Williams, 2011).

4.11 The data in Table 5 demonstrate that nitrogen dioxide background concentrations have the potential to exceed the annual mean objective in both 2014 and 2016, with or without emissions reduction. The mapped background concentrations are similar to measured urban background concentrations at the Bloomsbury automatic analyser.

4.12 The mapped PM_{10} and $PM_{2.5}$ background concentrations are well below the objectives.

5 Construction Phase Impact Assessment

5.1 The construction works at each of the nine sites will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway.

Potential Dust Emission Magnitude

Demolition

5.2 There will be no requirement for demolition of buildings on Sites 1, 2, 3, 4 and 11. Site 9 is an internal refurbishment, so some walls and fitting will be removed internally, but there will be no external or substantial demolition works.

5.3 At Site 5 the existing masonry-built single-storey building of approximately 1,500 m^3 volume will be demolished. The existing masonry-built 3-storey pub buildings at Site 6 (with a total building volume of approximately 1,000 m^3) and Site 10 (approximately 900 m^3) will also be demolished.

5.4 Based on the example definitions set out in Table A2.1, the dust emission class for demolition is considered to be *small* for Sites 5, 6 and 10. Given that no demolition will take place at Sites 1, 2, 3, 4, 9 and 11, this phase of works will not be considered further at the sites.

Earthworks

5.5 The characteristics of the soil at the nine sites have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2015), as set out in Table 6. Overall, it is considered that, when dry, the soil in the area has the potential to be very dusty.

Table 6: Summary of Soil Characteristics

Category	Record
Sites 6 & 11	
Soil layer thickness	Deep
Soil Parent Material Grain Size	Argillaceous (grain size < 0.06 mm)
European Soil Bureau Description	Residual Clay and Loamy Loess [a]
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Clay to Clayey Loam [b]
All Other Sites	
Soil layer thickness	Deep
Soil Parent Material Grain Size	Argillaceous (grain size < 0.06 mm)
European Soil Bureau Description	Pre-quaternary Marine/Estuarine Sand and Silt
Soil Group	Medium to Light (Silty) to Heavy
Soil Texture	Clay to Silt

[a] a loess is a wind-blown sediment.

[b] a loam is composed mostly of sand and silt.

5.6 There will be no earthworks at Site 9, where the existing building is being refurbished, thus this phase of works will not be considered further at this site.

5.7 Earthworks will last for approximately one month at Site 11, three months at Sites 1, 2, 3, 4, 5 and 10 and four months at Site 6. Activities that are expected to take place at each of these sites include excavation, haulage, tipping, stockpiling, landscaping and piling, but no bunds will be formed at any site. Each of the site areas are below 700 m^2 and it is anticipated that the earthworks will primarily take place during the winter months.

5.8 Based on the example definitions set out in Table A2.1, the dust emission class for earthworks is considered to be *small* at every site.

Construction

5.9 Construction details for each of the sites are summarised in Table 7. All of the new buildings will be constructed with a concrete frame and masonry façade. Dust will arise from vehicles travelling over unpaved ground and the handling and storage of dusty materials. Based on the example definitions set out in Table A2.1, the dust emission class for construction is considered to be *small* for all sites.

Table 7: Summary of Construction Parameters

Site	Site Location	Approximate Building Height (m)	Approximate Building Volume (m^3)	Approximate Construction Timeframe (months)
1	Robert Street Car Park	19	9,000	12
2	Former One Stop Shop	25	9,750	12
3	Varndell Street Corner	13.5	5,600	12
4	Newlands Plots	37	14,800	18
5	Dick Collins Hall	17.5	6,000	12
6	Cape of Good Hope	21	6,550	12
9	Camden Peoples Theatre	Internal Refurbishment Only		12
10	Victory Pub	17.5	5,100	15
11	St Bedes Hall	11	1,300	12

Trackout

5.10 The number of vehicles accessing the sites, which may track out dust and dirt is currently unknown, but given the small size of the sites it is likely that there will be fewer than 10 outward heavy vehicle movements per day. While vehicles are likely to travel over unpaved ground at each of the sites, the individual sites are so small that they are unlikely to drive over much more than 10-20 m of it. Based on the example definitions set out in Table A2.1, the dust emission class for trackout is considered to be *small*.

5.11 Table 8 summarises the dust emission magnitude for the proposed development.

Table 8: Summary of Dust Emission Magnitude for all Sites

Source	Dust Emission Magnitude
Demolition	Small
Earthworks	Small
Construction	Small
Trackout	Small

Sensitivity of the Area

5.12 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

5.13 The IAQM guidance, upon which the GLA's guidance is based, explains that residential properties are 'high' sensitivity receptors to dust soiling (Table A2.2). Most of the sites lie in residential areas, with apartment blocks within 20m. The only exception is Site 9, which is in a commercial area, although the shops adjacent to this building do have residential apartments above them. Figure 2 shows the 20 m distance bands around each site. Using the matrix set out in Table A2.3, and assuming every apartment to be an individual receptor, the area surrounding the onsite works is of 'high' sensitivity to dust soiling at every site.

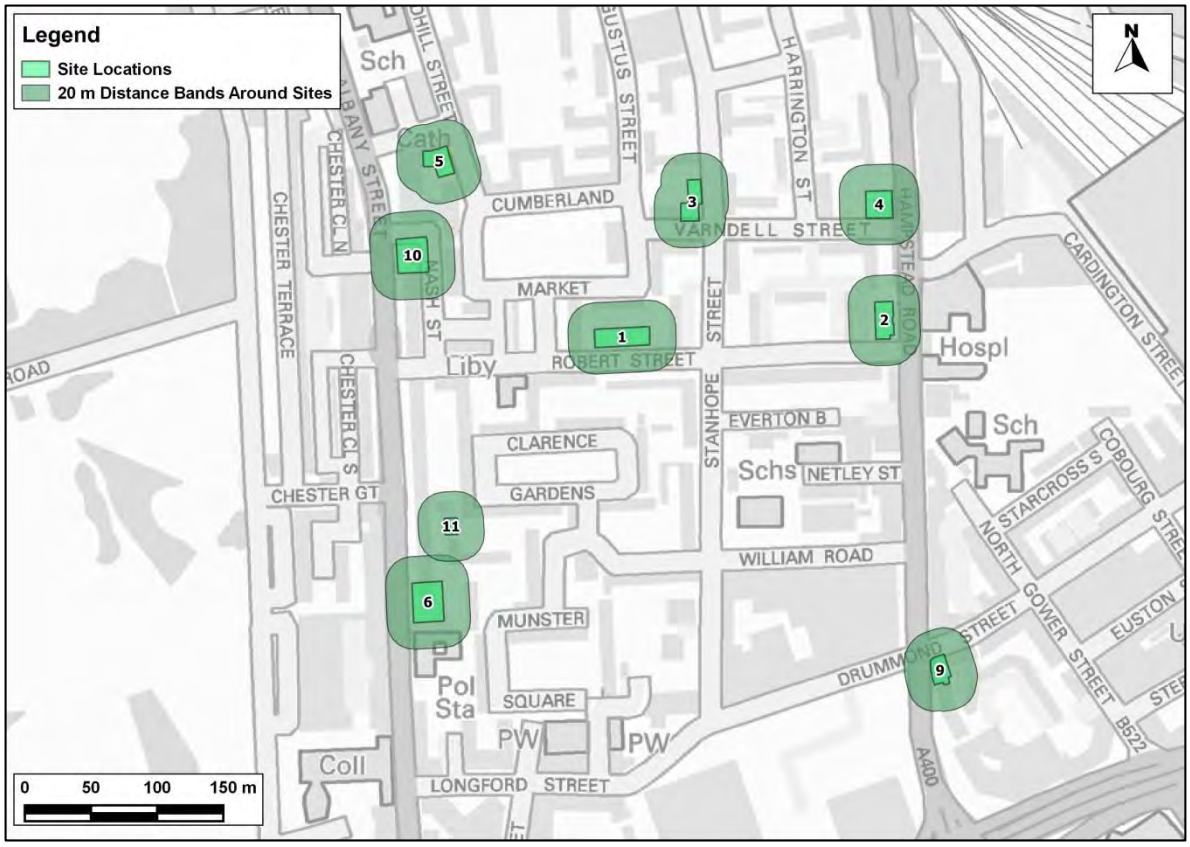

Figure 2: 20 m Distance Bands around Each Site Boundary

5.14 Table 8 shows that dust emission magnitude for trackout is 'small' and Table A2.3 thus explains that there is a risk of material being tracked 50 m from each site exit. There are at least 10 residential properties within 20 m of the roads along which material could be tracked at every site (see Figure 2), and Table A2.3 thus indicates that the area is of 'high' sensitivity to dust soiling due to trackout.

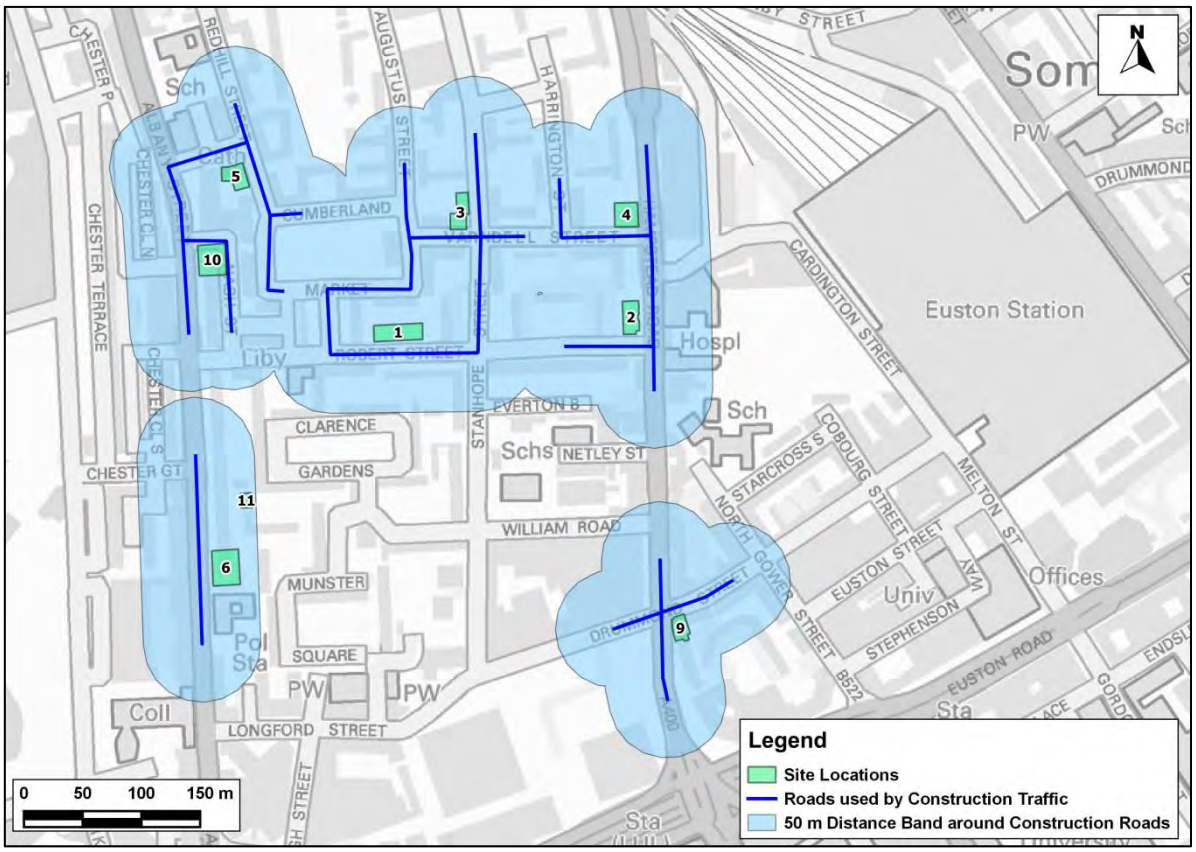

Figure 3: 50 m Distance Bands around Roads Used by Construction Traffic Within 50 m of the Each Site Exit

Contains Ordnance Survey data © Crown copyright and database right 2015

Sensitivity of the Area to any Human Health Effects

5.15 Residential properties are also classified as being of 'high' sensitivity to human health effects. The matrix in Table A2.4 requires information on the baseline annual mean PM_{10} concentration in the area. Predicted baseline PM_{10} concentrations in Appendix A8 are below 20 µg/m^3, so this value has been used. Using the matrix in Table A2.4, the area surrounding the onsite works and the area surrounding roads along which material may be tracked from each site is of 'medium' sensitivity to human health effects.

Sensitivity of the Area to any Ecological Effects

5.16 The guidance only considers designated ecological sites within 50 m to have the potential to be impacted by the construction works. There are no designated ecological sites within 50 m of each site or those roads along which material may be tracked, thus ecological impacts will not be considered further.

5.17 A summary of the relevant area sensitivities is provided in Table 9.

Table 9: Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	High Sensitivity	High Sensitivity
Human Health	Medium Sensitivity	Medium Sensitivity

Risk and Significance

5.18 The dust emission magnitudes in Table 8 have been combined with the sensitivities of the area in Table 9 using the matrix in Table A2.6 in Appendix A2, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 10. These risk categories have been used to determine the appropriate level of mitigation as set out in Section 6.28.

Table 10: Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health
Demolition [a]	Medium Risk	Low Risk
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk

[a] Sites 5, 6 and 10 only. There will be no requirement for demolition of buildings on Sites 1, 2, 3, 4, 9 and 11 and thus there is no risk of impacts at these sites.

5.19 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally not be significant (Institute of Air Quality Management, 2014).

6 Operational Phase

Energy Plant Impacts

Proposed Energy Plant

6.1 Six of the nine sites will be provided with individual boilers serving each residential unit/mixed use area (where applicable). Sites 2 and 4 will include new centralised boiler plant with natural gas boilers; Site 9 will make use of the existing boiler plant at the site which is considered in the next section. The boilers for the proposed new energy plant (3 no. 167kW boilers for Site 2 and 3 no. 200 kW boilers for Site 4) will be ultra-low NOx (<40 mg NOx/kWh) and will meet the requirements specified in the GLA's SPG ((GLA, 2014a) (see Appendix A10).

6.2 TGA, the project's mechanical and electrical engineer, has advised that each boiler flue (there will be one for each boiler) will be designed to terminate a minimum of 1 m above the height of the tallest part of the building on which they will be located, which will allow good dispersion of pollutants from the flue.

6.3 On the basis that the boilers at the new plant will adhere to the GLA's strict emissions standards and the flues will be sensibly located to ensure good dispersion of pollutants, it is considered emissions from the new centralised energy plant will not lead to any significant impacts and they are not considered further in this assessment.

Existing Energy Plant (Site 9)

6.4 Site 9 (CPT) will be served by the existing boiler plant at the site (2no. boiler with total 760 kW), which currently serves 69 residential units and the theatre located on the ground floor. The site will be refurbished to include five additional residential units. In addition, the proposals include amenity space (a roof terrace) at roof level. The roof terrace represents exposure to the 1-hour mean nitrogen dioxide objective.

6.5 Figure 4 provides an indication of the location of the existing boiler flue in relation to the proposed roof terrace, which will be located above the fifth floor level of the CPT building. There is a singular flue associated with the two boilers, which sits approximately 0.5 m above the tallest part of the building. The proposed roof terrace will be located to the north, approximately 1 to 2 stories below the existing boiler flue.

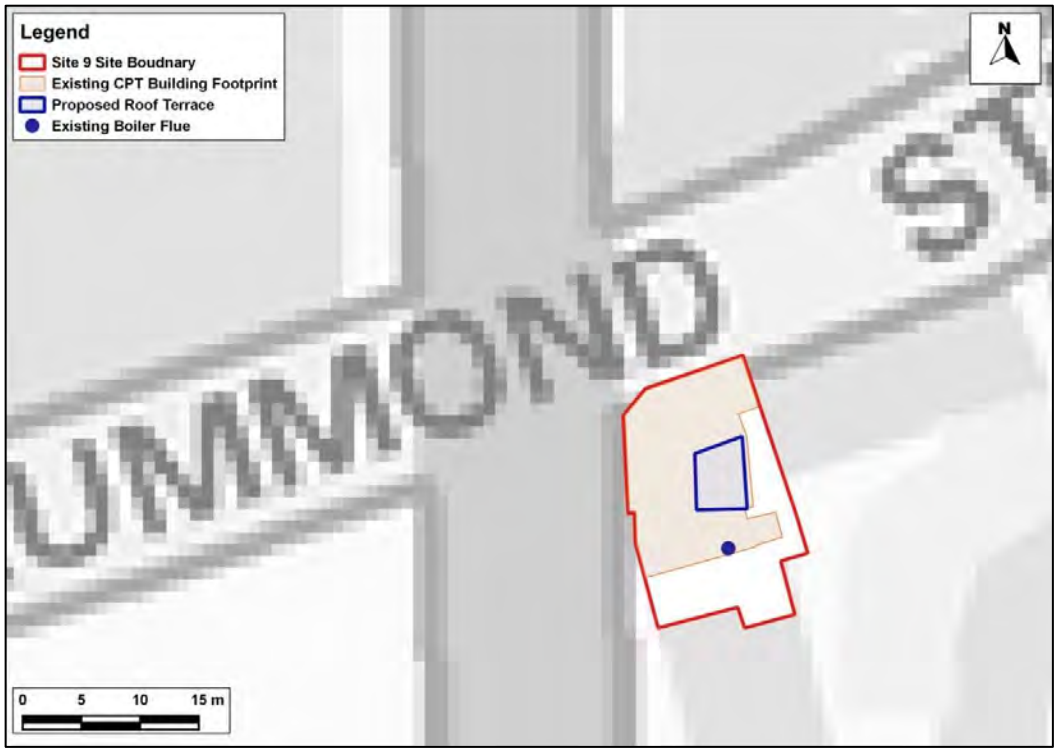

Figure 4: Location of Proposed Roof Terrace and Existing Boiler Flue, Site 9

Based on drawing 1328-S9-106 (MAE LLP)

6.6 There will be the potential for emissions from the existing boiler plant to impact on the proposed roof terrace at Site 9; however, given the roof terrace is located several meters below the height of the boiler flues, it is considered unlikely the operation of the existing boiler plant at Site 9 will lead to an exceedance of the 1-hour mean nitrogen dioxide objective at the proposed roof terrace. This potential impact is therefore not considered further by this assessment.

Road Traffic Impacts

Impact of Proposed Development on Surrounding Area

6.7 The proposed development of the nine sites are intended to provide replacement housing for existing residents on the Regent's Park Estate displaced by the HS2 project, with 22 additional new homes proposed. On the whole, there will be no new traffic generation associated with the development, with exception of a very small number of service vehicles associated with small commercial (A1 A2 usage) areas at three of the nine sites.

6.8 Furthermore, the existing residential blocks include areas of residential parking, which are located in an area with a residential parking scheme. Existing residents who currently own parking permits will be entitled to keep their permits when moving into the proposed replacement housing. Existing residents who do not own permits will not be permitted to apply for a permit when living in the new accommodation.

6.9 It is therefore considered that the proposals will not significantly increase local traffic movements and the impact of the proposed development of the nine sites on air quality at existing receptors will be insignificant. This is not considered further in this assessment.

Impacts of Existing Pollution Sources on New Residents

Nitrogen Dioxide

Annual Mean

6.10 Current measured and mapped background concentrations of nitrogen dioxide in Camden exceed the annual mean objective of 40 µg/m^3. Future predictions of background nitrogen dioxide concentrations suggest that the annual mean objective is likely to continue to exceed the annual mean objective in the study area in 2016. The annual mean objective is therefore predicted to be exceeded at all modelled receptors across the study area. The results from modelling for each site are presented in Appendix A8. The model results suggest that air quality for future residents within the developments will thus be in breach of the national air quality objective for annual mean nitrogen dioxide.

1-hour Mean

6.11 Sites 1, 2, 4, 5, 6 and 10 include proposed balconies, which represent relevant exposure for the 1-hour mean objective for nitrogen dioxide. Because background nitrogen dioxide concentrations in the study area are high, where balconies are proposed adjacent to main roads there is the potential for exceedance of the 1-hour mean nitrogen dioxide objective.

6.12 The predicted annual mean concentrations have been used to screen for potential exceedance of the 1-hour mean objective (see paragraph 2.19). For Sites 1, 5, 6 and 10, predicted annual mean concentrations are below 60 µg/m^3 and therefore it is considered unlikely that the 1-hour mean objective will be exceeded at proposed balconies at these sites.

6.13 For Sites 2 and 4, predicted annual mean concentrations are above 60 µg/m^3 where the proposed balcony is located on the main road façade (Hampstead Road). As concentrations are predicted to be above 60 µg/m^3, there is a risk the 1-hour mean objective may be exceeded at these proposed balconies.

6.14 More detailed modelling has been carried out (as outlined in Appendix A5) to assess the potential for exceedance of the 1-hour mean objective at these proposed balconies, with results presented in Appendix A8. The results show that at the proposed balconies predicted 99.79th 1-hour mean concentrations were below 200 µg/m^3. The 1-hour mean objective is therefore expected to be achieved.

6.15 It is considered therefore that there are no air quality constraints with respect to the proposed balconies at any of the nine sites.

Particulate Matter (PM_{10} and $PM_{2.5}$)

6.16 The results from modelling of PM_{10} and $PM_{2.5}$ concentrations for each site are presented in Appendix A8. The results show predicted concentrations to be below the air quality objectives, therefore with respect to PM_{10} and $PM_{2.5}$, air quality for future residents within each of the nine sites will be acceptable.

Significance of Impact

6.17 The operational air quality impacts are judged to be *Moderate*. This professional judgement is made in accordance with the methodology set out in Paragraph A1.1 (in Appendix A3), taking into account the factors set out in Table A1.1. More specifically, the judgement that the air quality impacts will be *Moderate* takes account of the assessment that concentrations are judged to exceed the annual mean nitrogen dioxide objective at a number of new residential receptors by a large margin.

Table 11: 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, where new exposure is being introduced.	At new residential properties which have a façade with either Hampstead Road (Site 2 (Rydal Water), 4 (Newlands) and 9 (CPT)) or Albany Road (Site 6 (CoGH) and Site 10 (Victory)), annual mean nitrogen dioxide concentrations are predicted to be exceeded by a large margin (> 50 µg/m^3). At the other sites, predicted concentrations exceed the annual mean objective by a smaller amount (40 – 50 µg/m^3).
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 actual concentrations in 2016 are likely to be closer to the with emissions reduction scenario. The assumption that Hampstead Road, Albany Road, Robert Street and Redhill Street are street canyons is likely to have led to an over-prediction of concentrations at receptors in these locations. There is some uncertainty relating to background concentrations within the Regent's Park Estate, however, based on high measured background concentrations nearby in Bloomsbury, it is considered likely that the annual mean nitrogen dioxide concentration will exceed the objective at new residential units near to main roads within the Regent's Park Estate.
The extent to which an objective is exceeded.	The annual mean nitrogen dioxide objective is predicted to be exceeded across all nine development sites.

'Air Quality Neutral'

Building Emissions

6.18 For Sites 2 and 4, ultra-low NOx boilers (<40 mg NOx/kWh) will be installed within each of the two centralised boiler plant (3 no. 167kW boilers for Site 2 and 3 no. 200 kW boilers for Site 4). In terms of the minimum standards, Sites 2 and 4 will comply with the SPG. The total NOx emission from the boilers for each site will be:

- Site 2 (Former One Stop Shop) – 7.5 kg/annum;
- Site 4 (Newlands Plot) – 15.3 kg/annum; and

6.19 Site 9 (CPT) is to be served by the existing boiler plant at the site (2no. boiler with total 760 kW), which currently serves 69 residential units and the theatre located on the ground floor. The site will be refurbished to include five additional residential units. The total estimated NOx emission for the existing boiler plant at Site 9 is 132 kg/annum.

6.20 Appendix A7 shows the Building Emissions Benchmarks (BEBs) for each land use category. The commercial uses Sites 2 and 4 will either be A1 or A2 uses[4]. The GLA has only published BEBs for a limited number of land-use categories due to the non-availability of robust data for their calculation. Where BEBs have not been derived for specific land-use classes (i.e. such as the theatre (Sui Generis) at Site 9), the benchmark for A2 use has been used, as for Sites 2 and 4. This is considered to be the most stringent criteria in this case. Table 12 shows the calculation of the BEBs for Sites 2, 4 and 9.

Table 12: Calculation of Building Emissions Benchmark for the Development, Centralised Boiler Plant (Site 2, 4, and 9)

Description		Value			Reference
		Site 2	Site 4	Site 9	
A	Gross Internal Floor Area of Residential Units (m^2)	2,098	3,511	444	Campbell Reith
B	NOx BEB for Residential Units (g/m^2/annum)	26.2			Table A7.1
C	Gross Internal Floor Area of A2 Commercial (m^2)	162.5	95	230	Campbell Reith
D	NOx BEB for A2 Commercial (g/m^2/annum)	30.8			Table A7.1
E	Total BEB NOx Emissions (kg/annum)	**60.0**	**94.9**	**18.7**	(A x B + C x D) / 1000

6.21 For the other six sites, each residential (C3) dwelling, commercial (A2[4]) unit and the community hall at Site 1 will contain a small, domestic, gas-fired combination boiler. TGA has advised that Worcester-Bosch Greenstar boilers will be used, which have a maximum NOx emission of 33 mg/kWh. The total NOx emission from all of the proposed boilers for each site will be:

- Site 1 (Robert Street Car Park) – 6.5 kg/annum;
- Site 3 (Varndell Street Corner) – 5.3 kg/annum;
- Site 5 (Dick Collins Hall) – 6.5 kg/annum.
- Site 6 (Cape of Good Hope) – 6.7 kg/annum;
- Site 10 (Victory Pub) – 4.9 kg/annum; and
- Site 11 (St Bedes Mews) – 1.4 kg/annum;

6.22 Appendix A7 shows the Building Emissions Benchmarks (BEBs) for each land use category. The commercial use at Site 10 will either be A1 or A2 use[4] and the community hall at Site 1 is classed

[4] The commercial spaces could be A1 or A2 use. Building emissions for A2 use are higher than for A1; the latter has been applied as a worst-case assessment.

as D1(b) use. Table 13 shows the calculation of the BEBs for the six sites fitted with individual boilers.

Table 13: Calculation of Building Emissions Benchmark for Sites 1, 3, 5, 6, 10, and 11

Description		Value						Reference
		Site 1	Site 3	Site 5	Site 6	Site 10	Site 11	
A	Gross Internal Floor Area of Residential Units (m^2)	1,523	1,078	1,321	1,538	1,016	243	Campbell Reith
B	NOx BEB for Residential Units (g/m^2/annum)	26.2						Table A7.1
C	Gross Internal Floor Area of A2/D1(b) Use (m^2)	336	n/a	n/a	n/a	184.5	n/a	Campbell Reith
D	NOx BEB for A2/D1(b) Use (g/m^2/annum)	75	n/a	n/a	n/a	30.8	n/a	Table A7.1
E	Total BEB NOx Emissions (kg/annum)	65.1	28.2	34.6	40.3	32.3	6.4	(A x B + C x D) / 1000
Total Building NO_x Emission (kg/annum)		6.5	5.3	6.5	6.7	4.9	1.4	-

6.23 For the eight sites included in the planning application, the Total BEB NOx emission is 361.7 kg/annum and the Total Building NOx emissions is 54.1 kg/annum. The Total Building NOx Emission (kg/annum) for these eight sites is less than the Total BEB NOx Emission of (kg/annum) and the proposed development is therefore better than air quality neutral in terms of building emissions.

6.24 For Site 9 (not included in the planning application), the Total BEB NOx emission is 18.7 kg/annum and the Total Building NOx emissions is 132 kg/annum. The Total Building NOx Emission (kg/annum) for this site is more than the Total BEB NOx Emission of (kg/annum). At a time when this site moves forwards to planning submission, it may be necessary to introduce mitigation measures, which will need to be discussed with the Council.

Road Transport Emissions

6.25 The Transport Emission Benchmarks (TEBs) are based on the number of trips generated by different land-use classes, together with the associated trip lengths and vehicle emission rates.

The commercial uses at Sites 2, 4 and 10 will either be A1 or A2 uses[5]. The GLA has however only published TEBs for a limited number of land-use categories due to the non-availability of robust data for their calculation. CampbellReith has advised that no traffic will be generated by the community hall at Site 1, therefore there are no associated transport emissions. In the case of the theatre at Site 9, which is a Sui Generis use, there are no benchmark trip rates against which to compare the development-related trip rates, so the assessment has been made against the A1 use TEB.

6.26 CampbellReith has advised that each site is expected to generate the following car trips per year:

- Site 1 (Robert Street Car Park) – 3,877 (Residential) and 0 (Community Hall);
- Site 2 (Former One Stop Shop) – 7,157 (Residential) and 19,244 (Commercial);
- Site 3 (Varndell Street Corner) – 2,386 (Residential);
- Site 4 (Newlands Plot) – 9,543 (Residential) and 11,285 (Commercial);
- Site 5 (Dick Collins Hall) – 3,280 (Residential),
- Site 6 (Cape of Good Hope) – 4,473 (Residential);
- Site 9 (Camden Peoples Theatre) – 1,491 (Residential) and 11,795 (Theatre[6])
- Site 10 (Victory Pub) – 2,982 (Residential) and 21,976 (Commercial); and
- Site 11 (St Bedes Mews) – 895 (Residential).

6.27 Appendix A7 provides default values for the average trip length for residential properties and A1 retail use in Inner London, as well as the average NOx and PM_{10} emissions per vehicle-kilometre. This information has been used to calculate the transport emissions generated by the development (see Table 14). These have then been compared with the TEBs for the development set out in Table 15.

[5] For the assessment of Transport Emissions, the category A1 Retail has been used as Benchmark Emissions are not available for class A2 use. This was considered more appropriate for use than comparing simply against trip rate.

[6] Daily vehicle trip rates for the theatre at Site 9 have been determined based on a travel survey carried out the theatre in 2000, where the estimated daily trip rate for the theatre was 2.81 vehicles trips per day. As this data is out of date, this trip rate has been multiplied by a factor of 5, to allow a worst case assessment to be carried. There is nothing to indicated that daily trip rates for the theatre will have increased by this much.

Table 14: Calculation of Transport Emissions for Each Site

Description		Value																		Ref.
		Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 9		Site 10		Site 11		
		Residential (C3)																		
A	Total Vehicle Trips per Year [a]	3,877		7,157		2,386		9,543		3,280		4,473		1,491		2,982		895		Campbell Reith
B	Average Distance per Trip (km)	3.7																		Table A7.3
		NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	-
C	Emissions per Vehicle-km (g)	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	0.37	0.07	Table A7.4
D	Residential Transport Emissions (kg/annum)	5.3	1.0	3.3	0.6	3.3	0.6	13.1	2.3	4.5	0.8	6.1	1.1	2.0	0.4	4.1	0.7	1.2	0.2	A x B x C / 1,000
		Retail (A1)																		
E	Total Vehicle Trips per Year [a]	n/a	n/a	19,244		n/a	n/a	11,285		n/a	n/a	n/a	n/a	11,795		21,976		n/a	n/a	Campbell Reith
F	Average Distance per Trip (km)	n/a	n/a	5.9		n/a	n/a	5.9		n/a	n/a	n/a	n/a	5.9		5.9		n/a	n/a	Table A7.3
		NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}			NOx	PM_{10}	
G	Emissions per Vehicle-km (g)	n/a	n/a	0.37	0.07	n/a	n/a	0.37	0.07	n/a	n/a	n/a	n/a	0.37	0.07	0.37	0.07	n/a	n/a	Table A7.4
H	Retail Transport Emissions (kg/annum)	n/a	n/a	42.0	7.6	n/a	n/a	24.6	4.4	n/a	n/a	n/a	n/a	25.7	4.6	48.0	8.6	n/a	n/a	E x F x G / 1,000
		Entire Development																		
Total Transport Emission (kg/annum)		**5.3**	**1.0**	**51.8**	**9.3**	**3.3**	**0.6**	**37.7**	**6.8**	**4.5**	**0.8**	**6.1**	**1.1**	**27.8**	**5.0**	**52.1**	**9.4**	**1.2**	**0.2**	D + H

[a] Each trip is 1-way (i.e. a return journey would be two trips).

Table 15: Calculation of Transport Emissions Benchmarks for Each Site

Description		Value																		Reference
		Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 9		Site 10		Site 11		
		Residential (C3)																		
A	Number of Dwellings	13		24		8		32		11		15		5		10		3		Campbell Reith
		NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	-
B	Benchmark Emissions (g/dwelling/ annum)	558	100	558	100	558	100	558	100	558	100	558	100	558	100	558	100	558	100	Table A7.4
C	Residential TEBs	7.3	1.3	13.4	2.4	4.5	0.8	17.9	3.2	6.1	1.1	8.4	1.5	2.8	0.5	5.6	1.0	1.7	0.3	A x B x C / 1,000
		Retail (A1)																		
D	Gross Internal Floor Area (m^2) of A1 Use	n/a	n/a	163		n/a	n/a	95		n/a	n/a	n/a	n/a	230		185		n/a	n/a	Campbell Reith
		NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	NOx	PM_{10}	
E	Benchmark Emissions (g/m^2/annum)	n/a	n/a	219	39.3	n/a	n/a	219	39.3	n/a	n/a	n/a	n/a	219	39.3	219	39.3	n/a	n/a	Table A7.2
F	Retail TEBs	n/a	n/a	35.6	6.4	n/a	n/a	20.8	3.7	n/a	n/a	n/a	n/a	50.4	9.0	40.4	7.3	n/a	n/a	D x E / 1000
		Entire Development																		
Total TEBs (kg/annum)		**7.3**	**1.3**	**49.0**	**8.8**	**4.5**	**0.8**	**38.7**	**6.9**	**6.1**	**1.1**	**8.4**	**1.5**	**53.2**	**9.5**	**46.0**	**8.3**	**1.7**	**0.3**	C + F

[a] Each trip is 1-way (i.e. a return journey would be two trips).

6.28 For the eight sites included in the planning application, the Total Transport Emissions is 162.0 kg/annum (for NOx) and 29.1 kg/annum(for PM_{10}). This slightly exceeds the Total Transport Emissions Benchmark for these eight sites (NOx – 161.5 kg/annum and PM_{10} – 29.0 kg/annum). The potential to introduce additional mitigation measures for the proposed development will need to be discussed with the Council.

6.29 For Site 9 (not included in the planning application), the Total (estimated) Transport Emission is 27.8 kg/annum (for NOx) and 5.0 kg/annum (for PM_{10}). This is below the Total Transport Emissions Benchmark for the site (NOx – 53.2 kg/annum and PM_{10} – 9.5 kg/annum) and therefore this site is considered to be air quality neutral with respect to transport emissions.

7 Mitigation

Construction Impacts

7.1 Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby sensitive receptors.

7.2 Sites 5, 6, 9 and 10 have been identified as being *Medium* Risk sites during demolition, while the other sites will undergo no demolition works. Every site is *Low* Risk during earthworks, construction and trackout, as set out in Table 10. Overall the sites are best described as being of *Low* Risk.

7.3 The GLA's SPG on *The Control of Dust and Emissions During Construction and Demolition* (GLA, 2014b) describes measures that should be employed, as appropriate, to reduce the impacts, along with guidance on what monitoring that should be undertaken during the construction phase. This reflects best practice experience and has been used, together with the professional experience of the consultant and the findings of the dust impact assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix A9. The mitigation measures should be written into a dust management plan (DMP).

7.4 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

Road Traffic Impacts

7.5 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. The Council's Air Quality Action Plan will also be helping to deliver improved air quality.

7.6 Modelling has predicted there will be exceedences of the annual mean nitrogen dioxide objective at new residential receptors across the nine sites. The high nitrogen dioxide concentrations are dominated by high background levels within the study area, which currently exceed the annual mean objective; these high concentrations are a borough-wide issue. Higher pollutant concentrations are predicted at new residential units located at lower floor levels adjacent to the sections of main roads (Hampstead Road and Albany Road), which form a street canyon with existing buildings, inhibiting the dispersion of pollutants into the surrounding atmosphere. Away from the main roads and outside of street canyons, pollutant concentrations will be closer to background levels. Work carried out by AQC also suggests that concentrations decrease with height within street canyon, which is not something that is replicated within the model results.

7.7 Measures to mitigate against poor air quality should be built into the design for each block. Examples measures could include:

- a whole house ventilation system (i.e. supply and extract) which have the air inlet located away from the main roads (the main source of pollution); and/or
- inclusion of a NO_x filtration system which actively removed nitrogen dioxide from ambient air.

7.8 The current designs are such that each block will be fitted with a whole house ventilation system. For blocks with a centralised core (Sites 2 and 4) there is opportunity for air inlets to be located at roof level[7]. For the other blocks, air inlets could be located at elevations located at the rear of the building. In both cases this allows for cleaner air (to that at the roadside) to be drawn into the new residential units.

7.9 The above are examples as to how the design for each of the eight sites covered by the planning application could include measures to mitigate against poor air quality. This should be built into the design at a later stage, dependent on what is considered most appropriate in terms of both design and predictions for air quality conditions in the future.

Air Quality Neutral

7.1 The assessment has shown that in terms of transport the overall development (eight sites) is not air quality neutral; therefore mitigation measures either on site, or off site in the vicinity the study area, may need to be identified, in consultation with the Council. This is consistent with the advice in the GLA's Sustainable Design and Construction SPD (Defra, 2014d), which states the following:

"Developers of schemes which do not meet the 'air quality neutral' benchmark for buildings or transport (considered separately) after appropriate onsite mitigation measures have been incorporated will be required to off-set any excess in emissions. The developer should investigate options for providing NOx and PM abatement measures offsite in the vicinity of the development.

This will involve working with the relevant planning authority or nearby property owners to identify suitable mitigation measures."

[7] Consideration of the location for the inlet to the ventilation system in relation to the boiler flues will be given, within the realms of feasible design.

8 Cumulative Impacts Associated with HS2

8.1 Community Forum Area 1 (Euston – Station and Approach) of HS2 is located adjacent to the Regent's Park Estate. There is considered potential for cumulative construction and operational impacts to occur, which are considered below.

Construction

8.2 The air quality chapter of the CFA Environmental Statement for CFA1 (Department for Transport, 2013) considers the construction effects associated with construction of HS2, which includes consideration of dust-generating activities and emissions from construction traffic, in the year 2017. The anticipated years of opening for the nine sites are 2016 or 2017. It is unlikely therefore that much of the construction works associated with the proposed development of the nine sites will occur at the same time as construction of the HS2 scheme, and there will be no significant cumulative construction impacts.

8.3 Construction works for the HS2 scheme have the potential to impact on the new residents of the nine sites forming the proposed development; this however is not strictly a cumulative effect. The air quality chapter concludes that construction dust impacts will be temporary. Measures to mitigate against dust effects will be outlined in a Code of Construction Practice (CoCP); with these measures in place there are concluded to be no significant residual effects from dust emissions. The additional traffic and changes in traffic flows caused by diversions will have significant effects, which will be both beneficial and adverse. This therefore has the potential to affect future baseline concentrations considered in this assessment. The assessment carried out is worst case with respect to road traffic emissions, which are predicted to decline into the future. Bearing this in mind, along with the temporary nature of construction works and recommended mitigation measures for new residential receptors within the nine sites, it is considered the HS2 development is unlikely to affect the conclusions drawn in this report.

Operation

8.4 The air quality chapter considers that the key operational impacts that could potentially arise from the operation of HS2 relate to changes in the volume, composition and distribution of road traffic, as well as boiler emissions in the station. There are not considered to be direct emissions from the operation of trains that will cause an impact on air quality. The assessment is carried out for the future assessment year 2026.

8.5 The air quality chapter concludes that future station boiler emissions will have a negligible impact on local air quality. PM_{10} impacts from road traffic are also predicted to be negligible. With respect to nitrogen dioxide impacts from road traffic will give rise to significant residual effects, both beneficial and adverse. These effects occur on Euston Road and Upper Woburn Place near

Euston station. The chapter also concludes that these residual effects "*should be seen in the context of future improvements in background air quality which will be brought about by continued reductions in vehicle emissions, which are expect to reduce nitrogen dioxide concentrations beyond 2026*".

8.6 No significant operational impacts are concluded to occur within the Regent's Park Estate. On the basis of the conclusions drawn by the CFA air quality chapter and those drawn in this report with respect to operation of the proposed development, it is considered there are unlikely to be significant cumulative operational effects associated with the HS2 scheme and proposed development of the nine sites.

9 Conclusions

9.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be 'not significant'. However, the guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will not be significant.

9.2 The impacts of traffic from local roads on the air quality for future residents have been assessed at worst-case locations within each of the nine development sites. 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 uncertainty over emission factors for nitrogen oxides identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011).

9.3 The impacts of local traffic on the air quality for residents living in the proposed development have been shown to be acceptable with respect to the $PM_{10,}$ $PM_{2.5}$ and 1-hour mean nitrogen dioxide objectives. Due to high background levels in the study area, annual mean nitrogen dioxide concentrations are predicted to exceed the annual mean objective across the nine sites.

9.4 The overall operational air quality impacts of the development 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 well above the objectives at a number of new residential properties. Measures to mitigate against poor air quality should be built into the design for each block to improve air quality for new residents of the eight blocks included in the planning application.

9.5 The building emissions associated with the proposed development of eight sites covered by the planning application are below the relevant benchmarks; the transport emissions for the proposed development are however slightly above the benchmark. Appropriate mitigation measures may need to be determined in order to ensure that the development meets the requirements of 'Air Quality Neutral' as defined in the GLA's (SPG) on Sustainable Design and Construction (GLA, 2014). Providing this mitigation is applied the development can be considered to meet the requirement of the SPG.

9.6 It is considered unlikely there will be any significant cumulative impacts associated with the proposed development of the nine sites and the HS2 project.

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11 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
BEB	Building Emissions Benchmark
CHP	Combined Heat and Power
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EFT	Emission 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
µg/m^3	Microgrammes per cubic metre
MAQS	Mayor's Air Quality Strategy
NAEI	National Atmospheric Emissions Inventory

NRMM	Non-road Mobile Machinery
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
PPG	Planning Practice Guidance
SPG	Supplementary Planning Guidance
SPD	Supplementary Planning Document
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
TEB	Transport Emissions Benchmark
TEOM	Tapered Element Oscillating Microbalance
VCM	Volatile Correction Model

12 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) is included in the LEZ for HGVs, buses and coaches, from 2015.

A2 Construction Dust Assessment Procedure

A2.1 The criteria developed by IAQM, upon which the GLA's guidance is based, divide the activities on construction sites into four types to reflect their different potential impacts. These are:

- demolition;
- earthworks;
- construction; and
- trackout.

A2.2 The assessment procedure includes the four steps summarised below:

STEP 1: Screen the Need for a Detailed Assessment

A2.3 An assessment is required where there is a human receptor within 350 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s), or where there is an ecological receptor within 50 m of the boundary of the site and/or within 50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).

A2.4 Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is *negligible* and that any effects will not be significant. No mitigation measures beyond those required by legislation will be required.

STEP 2: Assess the Risk of Dust Impacts

A2.5 A site is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude (Step 2A); and
- the sensitivity of the area to dust effects (Step 2B).

A2.6 These two factors are combined in Step 2C, which is to determine the risk of dust impacts with no mitigation applied. The risk categories assigned to the site may be different for each of the four potential sources of dust (demolition, earthworks, construction and trackout).

Step 2A – Define the Potential Dust Emission Magnitude

A2.7 Dust emission magnitude is defined as either 'Small', 'Medium', or 'Large'. The IAQM explains that this classification should be based on professional judgement, but provides the examples in Table Table A2.1.

Table A2.1: Examples of How the Dust Emission Magnitude Class May be Defined

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

[a] These numbers are for vehicles that leave the site after moving over unpaved ground.

Step 2B – Define the Sensitivity of the Area

A2.8 The sensitivity of the area is defined taking account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters to reduce the risk of wind-blown dust.

A2.9 The first requirement is to determine the specific sensitivities of local receptors. The IAQM recommends that this should be based on professional judgment, taking account of the principles in Table A2.2. These receptor sensitivities are then used in the matrices set out in Table A2.3, Table A2.4 and Table A2.5 to determine the sensitivity of the area. Finally, the sensitivity of the area is considered in relation to any other site-specific factors, such as the presence of natural shelters etc., and any required adjustments to the defined sensitivities are made.

Step 2C – Define the Risk of Impacts

A2.10 The dust emission magnitude determined at Step 2A is combined with the sensitivity of the area determined at Step 2B to determine the *risk* of impacts with no mitigation applied. The IAQM provides the matrix in Table A2.6 as a method of assigning the level of risk for each activity.

STEP 3: Determine Site-specific Mitigation Requirements

A2.11 The IAQM provides a suite of recommended and desirable mitigation measures which are organised according to whether the outcome of Step 2 indicates a low, medium, or high risk. The list provided by the IAQM has been used as the basis for the requirements set out in Appendix A9.

STEP 4: Determine Significant Effects

A2.12 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally not be significant (Institute of Air Quality Management, 2014).

A2.13 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will not be significant.

Table A2.2: Principles to be Used When Defining Receptor Sensitivities

Class	Principles	Examples
Sensitivities of People to Dust Soiling Effects		
High	users can reasonably expect enjoyment of a high level of amenity; or the appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably be expected a to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land	dwellings, museum and other culturally important collections, medium and long term car parks and car showrooms
Medium	users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or the appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land	parks and places of work
Low	the enjoyment of amenity would not reasonably be expected; or there is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or there is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land	playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads
Sensitivities of People to the Health Effects of PM_{10}		
High	locations where members of the public may be exposed for eight hours or more in a day	residential properties, hospitals, schools and residential care homes
Medium	locations where the people exposed are workers, and where individuals may be exposed for eight hours or more in a day.	may include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}
Low	locations where human exposure is transient	public footpaths, playing fields, parks and shopping streets
Sensitivities of Receptors to Ecological Effects		
High	locations with an international or national designation and the designated features may be affected by dust soiling; or locations where there is a community of a particularly dust sensitive species	Special Areas of Conservation with dust sensitive features
Medium	locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; or locations with a national designation where the features may be affected by dust deposition	Sites of Special Scientific Interest with dust sensitive features
Low	locations with a local designation where the features may be affected by dust deposition	Local Nature Reserves with dust sensitive features

Table A2.3: Sensitivity of the Area to Effects on People and Property from Dust Soiling [8]

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

Table A2.4: Sensitivity of the Area to Human Health Effects [8]

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

[8] For demolition, earthworks and construction, distances are taken either from the dust source or from the boundary of the site. For trackout, distances are measured from the sides of roads used by construction traffic. Without mitigation, trackout may occur from roads up to 500 m from large sites, 200 m from medium sites and 50 m from small sites, as measured from the site exit. The impact declines with distance from the site, and it is only necessary to consider trackout impacts up to 50 m from the edge of the road.

Table A2.5: Sensitivity of the Area to Ecological Effects [8]

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

Table A2.6: Defining the Risk of Dust Impacts

Sensitivity of the Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

A3 Assessment of Significance

A3.1 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[9] (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 A3.1 should be taken into account. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A4.

Table A3.1: Factors Taken into Account in Determining Air Quality Significance

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

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

A4 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.

Laurence Caird, MEarthSci CSci MIEnvSc MIAQM

Mr Caird is a Principal Consultant with AQC, with nine years' experience in the field of air quality including the detailed assessment of emissions from road traffic, airports, heating and energy plant, and a wide range of industrial sources including the thermal treatment of waste. He has experience in ambient air quality monitoring for numerous pollutants using a wide range of techniques and is also competent in the monitoring and assessment of nuisance odours and dust. Mr Caird has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. He is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Suzanne Hodgson, BSc (Hons) MSc CSci MIEnvSc MIAQM

Miss Hodgson is a Principal Consultant with AQC, with over eight years' experience in the field of air quality management and assessment. She has been responsible for a wide range of air quality projects covering impact assessments for new residential, commercial and industrial developments, local air quality management, ambient air quality monitoring of various pollutants and the assessment of nuisance odours and construction dust. She has extensive modelling experience, including the modelling of road traffic, energy centre (including energy from waste) and odour sources, and is familiar with preparing stand-alone air quality reports as well as chapters for inclusion within an Environment Statement. Suzanne 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 and a Chartered Scientist.

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

A5 Modelling Methodology

Model Inputs

Road Traffic

A5.1 Predictions have been carried out using the ADMS-Roads dispersion model (v3.4). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the Emission Factor Toolkit (Version 6.0.2) published by Defra (2015a). For nitrogen dioxide, future-year concentrations have been predicted once using year-specific emission factors from the EFT, and once using emission factors for 2014[10], which is the year for which the model has been verified.

A5.2 The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2014). The meteorological data has been taken from the monitoring station located at Heathrow Airport, which is considered suitable for this area.

A5.3 For the purposes of modelling, it has been assumed that the front façade of Sites 1 to 6 are within a street canyon formed by the buildings on the relevant road on which a site is located (i.e. Hampstead Road, Albany Road, Robert Street and Redhill Street). Each of these roads have a number of canyon-like features, which reduce dispersion of traffic emissions, and can therefore lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. None of these roads are full canyons however, as there are gaps between buildings allowing a reasonable level of near-road dispersion. As a precautionary measure, the front facades of Sites 1 to 6 have been assumed to be a canyon and in each case ADMS-roads may have over predicted concentrations at the façades of the respective proposed property.

A5.4 The section of Hampstead Road near to Site 4 will be raised by 3 m as part of the HS2 development. This section of elevated road has been included within the model at an appropriate height.

A5.5 Traffic data for the main roads in the study area have been taken from the London Atmospheric Emissions Inventory (LAEI) (GLA, 2013). Traffic speeds have been based on those presented in the LAEI, with some having been adjusted based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. A linear growth to 2016 has been assumed between 2015 and 2020. For the local roads, AADT flows for 2014 have been provided by CampbellReith. The 2014 AADT flows have been factored forwards to the assessment year of

[10] i.e. combining current-year emission factors with future-year traffic data.

2016 using growth factors derived from the National Transport Model and associated guidance (DfT, 2009), adjusted to local conditions using the TEMPRO System v6.2 (DfT, 2011). Traffic speeds on local roads have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table A5.1.

Table A5.1: Summary of Traffic Data used in the Assessment [a]

Road Link	AADT	%HDV	Source
Hampstead Road	24,682	10.7	LAEI
Cardington Street	13,389	7.6	LAEI
Albany Street	14,498	6.9	LAEI
Outer Circle	7,094	3.5	LAEI
Euston Road (Eastbound)	15,430	7.7	LAEI
Euston Road (Westbound)	14,927	7.2	LAEI
Tottenham Court Road	7,666	12.1	LAEI
Augstus Street	601	7.6	CampbellReith
Redhill Street	679	7.6	CampbellReith
Varndell Street	762	7.6	CampbellReith
Stanhope Street	1,917	7.6	CampbellReith
Stanhope Road	2,828	7.6	CampbellReith
William Road	1,592	7.6	CampbellReith
Robert Street (East)	5,014	7.6	CampbellReith
Robert Street (West)	4,463	7.6	CampbellReith
Longford Street	5,639	7.6	CampbellReith
Drummond Street [b]	5,639	7.6	CampbellReith

[a] This is just a summary of the data entered into the model, which have been input as percentage of motorcycles, cars, buses, Light Goods Vehicles and Heavy Goods Vehicles.

[b] No data was available for Drummond Street, therefore traffic flows were assumed to be the same as Longford Street.

A5.6 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (DfT, 2011).

A5.7 Figure A5.1 shows the road network included within the model.

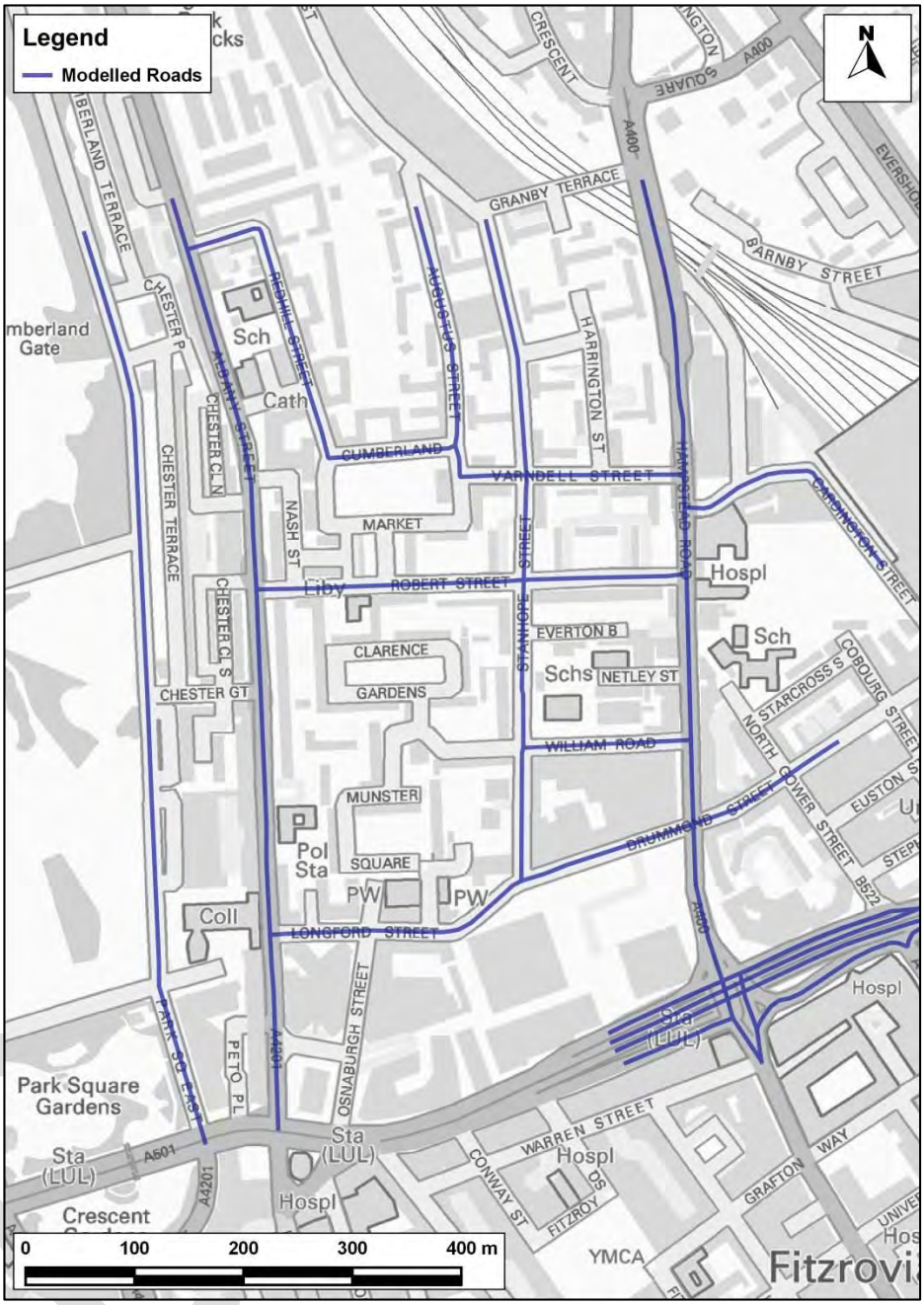

Figure A5.1: Modelled Road Network

Model Verification

A5.8 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.

Nitrogen Dioxide

A5.9 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 2014 at the Euston Road automatic monitoring site. Concentrations have been modelled at 2.5 m, the height of the monitor.

A5.10 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 has been calculated from the measured NO_2 concentration and the measured background NO_2 concentration using the NOx from NO_2 calculator (Version 4.1) available on the Defra LAQM Support website (Defra, 2015a).

A5.11 An adjustment factor has been determined as the ratio of the 'measured' road contribution and the model derived road 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 nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator (Defra, 2015a).

A5.12 The data used to calculate the adjustment factor are provided below:

- Measured NO_2 : 98 µg/m^3
- Background NO_2 : 45 µg/m^3 [11]
- 'Measured' road-NOx (from NOx to NO_2 calculator): 175.1 µg/m^3
- Modelled road-NOx = 138.4 µg/m^3
- Road-NOx adjustment factor: 175.1/138.4 = 1.266

A5.13 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 $PM_{2.5}$

A5.14 There are no nearby PM_{10} or $PM_{2.5}$ monitors within the study area. 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 NOx.

[11] Background concentration measured at the Bloomsbury automatic analyser (2014). See section on 'Model Post-processing' for further information of the use of background concentrations in modelling.

Model Post-processing

Background Concentrations

A5.15 For the assessment of the 1-hour mean objective, it was necessary to use measured 1-hour mean concentrations from a nearby background monitoring site (the Bloomsbury automatic analyser). For consistency, measured concentrations were also used for the prediction of total concentrations for assessment against the annual mean objectives for nitrogen dioxide and PM_{10}. This was considered to be an appropriate approach, bearing in mind the similarities between measured and mapped background concentrations.

A5.16 The measured 2014 annual mean concentrations (nitrogen dioxide and PM_{10}) from Bloomsbury were adjusted to 2016 using the average ratio of change from 2014 to 2016 data for Defra's mapped concentrations for the grid squares in which the Regent's Park Estate is located (see Appendix A6 for further details). The annual mean background concentrations used in the modelling are presented in Table A5.2.

Table A5.2: Background Concentrations Used in Modelling (2016)

Pollutant (µg/m^3)	With Emissions Reduction	Without Emissions Reduction
Nitrogen Dioxide	42.2	44.0
PM_{10}	18.1	n/a

A5.17 The Bloomsbury monitoring site does not measure $PM_{2.5}$, therefore the Defra mapped concentrations were used.

Road Traffic

Annual Mean

Nitrogen Oxides and Nitrogen Dioxide

A5.18 The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the adjustment factor, which, along with the background NO_2, is processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2015a) to calculate the total NO_2 concentration. The traffic mix within the calculator has been set to "All London traffic", which is considered suitable for the study area.

PM_{10} and $PM_{2.5}$

A5.19 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.

1-Hour Mean

A5.20 For the assessment of the potential exceedance of the 1-hour mean objective at the proposed balconies located on Sites 2 and 4, the 99.79th percentile of total 1-hour mean nitrogen dioxide concentrations were calculated. Total nitrogen dioxide concentrations were calculated within the ADMS-Roads model by using the chemistry module[12] and measured 2014 background data from the Bloomsbury automatic analyser. To account for uncertainty within the model, road emissions were adjusted using the verification factor determined above.

Uncertainty in Road Traffic Modelling Predictions

A5.21 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 A5). The level of confidence in the verification process is necessarily enhanced when data from an automatic analyser have been used, as has been the case for this assessment (see Model Verification section above). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2014) concentrations.

A5.22 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, Beevers, Westmoreland, & Williams, 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 6 to 8 years prior to 2009, at many monitoring sites levels remained relatively

[12] The proportion of primary nitrogen dioxide (f-NO_2) was assumed to be the same as that for Camden within Defra's NOx to NO_2 calculator (Defra, 2013c), which was 23.7%.

stable, or even showed a slight increase. This pattern is mirrored in the monitoring data assembled for this study, as set out in Section 4.

A5.23 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, Beevers, Westmoreland, & Williams, 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[13] 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[14] and includes a separate slow-speed cycle for heavy duty vehicles.

A5.24 The 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 2014 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; according to Defra's Emission Factors Toolkit (Defra, 2015a), by 2016 it is forecast that there will be a roughly 35% penetration of Euro VI HDVs and a roughly 20% penetration of Euro 6 LDVs. These new vehicles are expected to deliver real on-road reductions in nitrogen oxides emissions.

A5.25 The dispersion modelling has assumed that some of the local roads formed street canyons, which is precautionary as the model assumes that only limited dispersion occurs within the canyon. In reality, dispersion does occur within street canyons, particularly those which are wide and shallow, with uneven or broken facades on one or both sides. The consequence of this is that modelled nitrogen dioxide concentrations at the proposed development façades are likely to be higher than will occur in practice.

[13] 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.

[14] The test cycle for real-world emissions for Euro 6 vehicles will not be implemented until about 2017. However, there is still expected to be a substantial improvement in NOx emissions from Euro 6 vehicles (as compared with Euro 5) from 2015 onwards.

A6 Defra Mapped Background Concentrations

A6.1 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2015a). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The maps include the influence of emissions from a range of different sources; one of which is road traffic. There is evidence that the current 'official' emissions factors published by Defra may over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future (Carslaw, Beevers, Westmoreland, & Williams, 2011). The maps currently in use were verified against measurements made during 2011 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2011. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

A6.2 Background concentrations in 2014 have been calculated for the study area and have been used 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 2011[15] and 2014. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2015a). For each grid square, the road traffic component has been held constant at 2011 levels, while 2014 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2015a) publishes to accompany the maps. The result is a set of 'adjusted 2014 background' concentrations.

A6.3 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 2014 data: the road traffic component of background nitrogen oxides has been held constant at 2011 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 2014 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2016 to the unadjusted mapped value for 2014.

A6.4 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.

[15] 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.

A7 'Air Quality Neutral'

A7.1 The GLA's SPG on Sustainable Design and Construction (GLA, 2014a), and its accompanying Air Quality Neutral methodology report (AQC, 2014), provide an approach to assessing whether a development is air quality neutral. The approach is to compare the expected emissions from the building energy use and the car use associated with the proposed development against defined emissions benchmarks for buildings and transport in London.

A7.2 The benchmarks for heating and energy plant (termed 'Building Emissions Benchmarks' or 'BEBs') are set out in Table A7.1, while the 'Transport Emissions Benchmarks' ('TEBs') are set out in Table A7.2. In order to assess against the TEBs, it is necessary to combine the expected trip generation from the development with estimates of average trip length and average emission per vehicle. So as to ensure a consistent methodology, the report which accompanies the SPG (AQC, 2014) recommends that the information in Table A7.3 and Table A7.4 (upon which the TEBs are based) is used. Similarly, the information in Table A7.5 may be used if site-specific information are not available (AQC, 2014).

Table A7.1: Building Emissions Benchmarks (g/m^2 of Gross Internal Floor Area)

Land Use Class	NOx	PM_{10}
Class A1	22.6	1.29
Class A3 - A5	75.2	4.32
Class A2 and Class B1	30.8	1.77
Class B2 - B7	36.6	2.95
Class B8	23.6	1.90
Class C1	70.9	4.07
Class C2	68.5	5.97
Class C3	26.2	2.28
D1 (a)	43.0	2.47
D1 (b)	75.0	4.30
Class D1 (c -h)	31.0	1.78
Class D2 (a-d)	90.3	5.18
Class D2 (e)	284	16.3

Table A7.2: Transport Emissions Benchmarks

Land use	CAZ [a]	Inner [b]	Outer [b]
NOx (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NOx (g/dwelling/annum)			
Residential (C3)	234	558	1553
PM_{10} (g/m^2/annum)			
Retail (A1)	29.3	39.3	42.9
Office (B1)	0.22	2.05	11.8
PM_{10} (g/dwelling/annum)			
Residential (C3,C4)	40.7	100	267

[a] Central Activity Zone

[b] Inner London and Outer London (as defined in the LAEI) (GLA, 2013)

Table A7.3: Average Distance Travelled by Car per Trip

Land use	Distance (km)		
	CAZ	Inner	Outer
Retail (A1)	9.3	5.9	5.4
Office (B1)	3.0	7.7	10.8
Residential (C3)	4.3	3.7	11.4

Table A7.4: Average Road Traffic Emission Factors in London in 2010 (AQC, 2014)

Pollutant	g/vehicle-km		
	CAZ	Inner	Outer
NOx	0.4224	0.370	0.353
PM_{10}	0.0733	0.0665	0.0606

Table A7.5: Average Emissions from Heating and Cooling Buildings in London in 2010 (AQC, 2014)

	Gas (kg/kWh)		Oil (kg/kWh)	
	NOx	PM_{10}	NOx	PM_{10}
Domestic	0.0000785	0.00000181	0.000369	0.000080
Industrial/Commercial	0.000194	0.00000314	0.000369	0.000080

A7.3 The transport benchmarks for other use classes than residential, A1 retail and B1 office are set out in Table A6.6.

Table A7.6: Transport Emissions Benchmarks

Land use	Number of Trips (trips/m^2/annum)		
	CAZ [a]	Inner [b]	Outer [b]
A3	153	137	170
A4	2.0	8.0	-
A5	-	32.4	590
B2	-	15.6	18.3
B8	-	5.5	6.5
C1	1.9	5.0	6.9
C2	-	3.8	19.5
D1	0.07	65.1	46.1
D2	5.0	22.5	49.0

[a] Central Activity Zone

[b] Inner London and Outer London (as defined in the LAEI) (GLA, 2013)

A8 Model Results

A8.1 The modelled impacts of the existing traffic sources on air quality conditions for residents of each site are set out in the tables below, receptor locations are described in Table 2 and shown Figure 1.

Site 1 (Robert Street Car Park)

Table A8.1: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 1[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
First	RS1	**46.3**	**48.8**	18.7	2	16.3
	RS2	**44.3**	**46.5**	18.4	2	16.1
Second	RS1	**46.1**	**48.5**	18.7	2	16.3
	RS2	**43.7**	**45.8**	18.3	2	16.1
Third	RS1	**45.9**	**48.3**	18.6	2	16.3
	RS2	**43.5**	**45.5**	18.3	2	16.1
Fourth	RS1	**45.8**	**48.2**	18.6	2	16.3
	RS2	**43.3**	**45.3**	18.2	2	16.1
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

[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 2014 and 2016 at the current 'official' rates.

[c] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 2 (Former One Stop Shop)

Table A8.2: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 2[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
First	RW1	**60.6**	**64.9**	20.7	4	17.6
	RW2	**60.3**	**64.6**	20.7	4	17.6
	RW3	**50.7**	**53.7**	19.2	3	16.7
	RW4	**47.6**	**50.3**	19.3	3	16.7
Second	RW1	**59.6**	**63.7**	20.6	4	17.5
	RW2	**59.5**	**63.7**	20.6	4	17.5
	RW3	**48.6**	**51.4**	18.9	2	16.5
	RW4	**46.0**	**48.4**	18.9	2	16.5
Third	RW1	**58.9**	**63.0**	20.5	4	17.5
	RW2	**59.0**	**63.1**	20.5	4	17.5
	RW3	**46.9**	**49.4**	18.7	2	16.4
	RW4	**44.9**	**47.2**	18.7	2	16.3
Fourth	RW1	**58.5**	**62.6**	20.4	4	17.4
	RW2	**58.5**	**62.6**	20.4	4	17.4
	RW3	**45.7**	**48.1**	18.5	2	16.3
	RW4	**44.2**	**46.4**	18.5	2	16.3
Fifth	RW1	**45.0**	**47.2**	18.4	2	16.2
	RW2	**44.9**	**47.1**	18.4	2	16.2
	RW3	**44.9**	**47.1**	18.4	2	16.2
	RW4	**44.9**	**47.2**	18.4	2	16.2
Sixth	RW1	**44.4**	**46.6**	18.4	2	16.1
	RW2	**44.3**	**46.5**	18.4	2	16.1
	RW3	**44.3**	**46.5**	18.4	2	16.1
	RW4	**44.4**	**46.6**	18.4	2	16.1
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold. Concentrations above 60 µg/m^3 (indicative of the 1-hour objective being exceeded) shown in red.

[b] 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).

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Table A8.3: Predicted 99.79th Percentile of 1-hour Mean Nitrogen Dioxide (NO_2) Concentrations in 2016 for Balconies in Site 2 [a]

Floor	Receptor	99.79th Percentile of 1-hour Mean NO_2 (µg/m^3)	
		With 'Official' Emissions Reduction [b]	Without Emissions Reduction [c]
First	RW1	154.3	154.6
	RW2	157.0	157.1
Second	RW1	151.8	151.8
	RW2	153.1	153.1
Third	RW1	149.7	149.7
	RW2	150.1	150.3
Fourth	RW1	148.2	148.2
	RW2	148.6	148.6
Objective		200	

[a] Exceedences of the objective shown in bold.

[b] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[c] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 3 (Vardnell Street Corner)

Table A8.4: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 3[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Ground	VS1	**45.7**	**48.1**	18.6	2	16.3
	VS2	**45.8**	**48.2**	18.6	2	16.3
First	VS1	**45.3**	**47.6**	18.5	2	16.2
	VS2	**45.4**	**47.7**	18.5	2	16.2
Second	VS1	**44.8**	**47.1**	18.4	2	16.2
	VS2	**44.9**	**47.1**	18.5	2	16.2
Third	VS1	**44.5**	**46.7**	18.4	2	16.2
	VS2	**44.5**	**46.7**	18.4	2	16.2
Fourth	VS1	**44.2**	**46.4**	18.4	2	16.1
	VS2	**44.3**	**46.4**	18.4	2	16.1
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

[b] 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).

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 4 (Newlands Plot)

Table A8.5: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 4[a]

Floor	Receptor	Annual Mean NO_2 ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$) [b]		$PM_{2.5}$ ($\mu g/m^3$)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 $\mu g/m^3$	Annual Mean
First	N1	65.5	70.3	21.6	6	18.1
	N2	65.1	69.9	21.5	6	18.1
	N3	48.9	51.8	19.0	2	16.5
	N4	49.3	52.2	19.0	2	16.6
Second	N1	64.1	68.8	21.3	5	18.0
	N2	63.8	68.4	21.3	5	18.0
	N3	47.5	50.2	18.8	2	16.4
	N4	47.7	50.4	18.8	2	16.4
Third	N1	63.3	67.9	21.2	5	17.9
	N2	63.0	67.6	21.1	5	17.9
	N3	46.3	48.7	18.6	2	16.3
	N4	46.4	48.9	18.6	2	16.3
Fourth	N1	62.8	67.4	21.1	5	17.9
	N2	62.5	67.1	21.1	5	17.8
	N3	45.3	47.6	18.5	2	16.2
	N4	45.4	47.7	18.5	2	16.2
Fifth	N1	62.5	67.0	21.1	5	17.8
	N2	62.2	66.7	21.0	5	17.8
	N3	44.6	46.8	18.4	2	16.2
	N4	44.7	46.9	18.4	2	16.2
Sixth	N1	62.3	66.8	21.0	5	17.8
	N2	62.0	66.5	21.0	5	17.8
	N3	44.1	46.2	18.3	2	16.1
	N4	44.2	46.3	18.3	2	16.1
Seventh	N1	43.8	45.8	18.3	2	16.1
	N2	43.7	45.8	18.3	2	16.1
	N3	43.8	45.8	18.3	2	16.1
	N4	43.8	45.9	18.3	2	16.1
Eighth	N1	43.5	45.5	18.2	2	16.1
	N2	43.5	45.5	18.2	2	16.1
	N3	43.5	45.5	18.2	2	16.1
	N4	43.5	45.6	18.3	2	16.1
Ninth	N1	43.3	45.3	18.2	2	16.1
	N2	43.3	45.3	18.2	2	16.1

Floor	Receptor	Annual Mean NO_2 ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$) [b]		$PM_{2.5}$ ($\mu g/m^3$)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 $\mu g/m^3$	Annual Mean
	N3	**43.3**	**45.3**	18.2	2	16.1
	N4	**43.3**	**45.3**	18.2	2	16.1
Tenth	N1	**43.1**	**45.1**	18.2	2	16.0
	N2	**43.1**	**45.1**	18.2	2	16.0
	N3	**43.1**	**45.1**	18.2	2	16.0
	N4	**43.1**	**45.1**	18.2	2	16.0
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold. Concentrations above 60 $\mu g/m^3$ (indicative of the 1-hour objective being exceeded) shown in red.

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

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Table A8.6: Predicted 99.79th Percentile of 1-hour Mean Nitrogen Dioxide (NO_2) Concentrations in 2016 for Balconies in Site 4[a]

Floor	Receptor	99.79th Percentile of 1-hour Mean NO_2 ($\mu g/m^3$)	
		With 'Official' Emissions Reduction [b]	Without Emissions Reduction [c]
First	N1	172.0	172.0
	N2	176.0	176.2
Second	N1	167.0	167.1
	N2	168.3	168.3
Third	N1	164.2	164.2
	N2	164.7	164.7
Fourth	N1	161.9	162.0
	N2	162.8	162.8
Fifth	N1	161.0	161.0
	N2	161.8	161.8
Sixth	N1	159.7	159.8
	N2	160.9	160.9
Objective		**200**	

[a] Exceedences of the objective shown in bold.

[b] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[c] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 5 (Dick Collins Hall)

Table A8.7: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 5[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Ground	R1	**45.4**	**47.6**	18.6	2	16.9
	R2	**44.4**	**46.5**	18.4	2	16.8
	R3	**44.3**	**46.5**	18.4	2	16.8
	R4	**45.4**	**47.7**	18.6	2	16.9
First	R1	**45.1**	**47.4**	18.5	2	16.9
	R2	**44.3**	**46.4**	18.4	2	16.8
	R3	**44.3**	**46.4**	18.4	2	16.8
	R4	**45.2**	**47.4**	18.6	2	16.9
	R5	**45.5**	**47.8**	18.6	2	16.9
Second	R1	**44.8**	**47.0**	18.5	2	16.8
	R2	**44.1**	**46.2**	18.4	2	16.8
	R3	**44.1**	**46.2**	18.4	2	16.8
	R4	**44.8**	**47.0**	18.5	2	16.8
	R5	**45.0**	**47.2**	18.5	2	16.8
Third	R1	**44.4**	**46.6**	18.4	2	16.8
	R2	**44.0**	**46.1**	18.4	2	16.7
	R3	**43.9**	**46.0**	18.3	2	16.7
	R4	**44.4**	**46.5**	18.4	2	16.8
	R5	**44.5**	**46.7**	18.4	2	16.8
Fourth	R1	**44.0**	**46.1**	18.4	2	16.7
	R2	**43.8**	**45.9**	18.3	2	16.7
	R3	**43.8**	**45.8**	18.3	2	16.7
	R4	**44.0**	**46.1**	18.4	2	16.7
	R5	**44.1**	**46.1**	18.4	2	16.7
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

[b] 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).

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 6 (Cape of Good Hope)

Table A8.8: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 6[a]

Floor	Receptor	Annual Mean NO_2 ($\mu g/m^3$)		PM_{10} ($\mu g/m^3$) [b]		$PM_{2.5}$ ($\mu g/m^3$)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 $\mu g/m^3$	Annual Mean
Ground	CGH2	**49.5**	**52.3**	19.3	3	17.3
	CGH3	**48.2**	**50.8**	19.1	2	17.2
	CGH4	**47.2**	**49.8**	18.9	2	17.1
First	CGH1	**49.4**	**52.2**	19.3	3	17.3
	CGH2	**47.9**	**50.4**	19.0	2	17.1
	CGH3	**47.2**	**49.7**	18.9	2	17.1
	CGH4	**46.6**	**49.0**	18.8	2	17.0
Second	CGH1	**49.1**	**51.9**	19.2	3	17.3
	CGH2	**46.0**	**48.4**	18.7	2	16.9
	CGH3	**45.9**	**48.2**	18.7	2	16.9
	CGH4	**45.7**	**48.0**	18.6	2	16.9
Third	CGH1	**49.0**	**51.7**	19.2	2	17.3
	CGH2	**44.9**	**47.1**	18.5	2	16.8
	CGH3	**44.9**	**47.1**	18.5	2	16.8
	CGH4	**44.9**	**47.1**	18.5	2	16.8
Fourth	CGH1	**48.8**	**51.5**	19.2	2	17.2
	CGH2	**44.2**	**46.4**	18.4	2	16.8
	CGH3	**44.3**	**46.4**	18.4	2	16.8
	CGH4	**44.3**	**46.4**	18.4	2	16.8
Fifth	CGH1	**43.8**	**45.9**	18.3	2	16.7
	CGH2	**43.8**	**45.9**	18.3	2	16.7
	CGH3	**43.9**	**45.9**	18.3	2	16.7
	CGH4	**43.9**	**46.0**	18.3	2	16.7
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

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

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 9 (Camden Peoples Theatre)

Table A8.9: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 9[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Ground	CPT1	**60.5**	**64.7**	20.3	4	17.4
	CPT2	**58.7**	**62.8**	20.1	4	17.2
First	CPT1	**52.4**	**55.7**	19.3	3	16.7
	CPT2	**52.5**	**55.7**	19.3	3	16.7
Second	CPT1	**48.7**	**51.5**	18.8	2	16.5
	CPT2	**48.9**	**51.7**	18.9	2	16.5
Third	CPT1	**46.9**	**49.4**	18.6	2	16.3
	CPT2	**47.0**	**49.5**	18.6	2	16.3
Fourth	CPT1	**45.8**	**48.1**	18.5	2	16.2
	CPT2	**45.8**	**48.2**	18.5	2	16.2
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold. Concentrations above 60 µg/m^3 (indicative of the 1-hour objective being exceeded) shown in red.

[b] 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).

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Table A8.10: Predicted 99.79th Percentile of 1-hour Mean Nitrogen Dioxide (NO_2) Concentrations in 2016 for New Receptors in Site 9[a]

Floor	Receptor	99.79th Percentile of 1-hour Mean NO_2 (µg/m^3)	
		With 'Official' Emissions Reduction [b]	Without Emissions Reduction [c]
Ground	CPT1	137.1	138.2
	CPT2	133.8	134.7
Objective		**200**	

[a] Exceedences of the objective shown in bold.

[a] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[b] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 10 (Victory Pub)

Table A8.11: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 10[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Ground	V1	**50.6**	**53.5**	19.5	3	17.4
	V2	**50.4**	**53.3**	19.5	3	17.4
	V3	**48.6**	**51.2**	19.1	2	17.2
	V4	**47.8**	**50.4**	19.0	2	17.1
First	V1	**50.0**	**52.8**	19.4	3	17.4
	V2	**49.9**	**52.8**	19.4	3	17.4
	V3	**47.3**	**49.9**	18.9	2	17.1
	V4	**47.0**	**49.5**	18.8	2	17.0
Second	V1	**49.4**	**52.2**	19.3	3	17.3
	V2	**49.4**	**52.2**	19.3	3	17.3
	V3	**45.9**	**48.2**	18.7	2	16.9
	V4	**45.9**	**48.2**	18.6	2	16.9
Third	V1	**49.0**	**51.7**	19.2	3	17.3
	V2	**49.1**	**51.8**	19.2	3	17.3
	V3	**44.8**	**47.0**	18.5	2	16.8
	V4	**44.9**	**47.1**	18.5	2	16.8
Fourth	V1	**48.8**	**51.5**	19.2	2	17.3
	V2	**48.8**	**51.5**	19.2	2	17.3
	V3	**44.2**	**46.3**	18.4	2	16.8
	V4	**44.3**	**46.4**	18.4	2	16.8
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

[b] 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).

[c] This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

[d] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

Site 11 (St. Bedes Mews)

Table A8.12: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2016 for New Receptors in Site 11[a]

Floor	Receptor	Annual Mean NO_2 (µg/m^3)		PM_{10} (µg/m^3) [b]		$PM_{2.5}$ (µg/m^3)
		With 'Official' Emissions Reduction [c]	Without Emissions Reduction [d]	Annual Mean	No. Days >50 µg/m^3	Annual Mean
Ground	**SBM1**	**46.2**	**48.6**	18.7	2	17.0
First	**SBM2**	**45.9**	**48.2**	18.7	2	16.9
Second	**SBM3**	**45.4**	**47.7**	18.6	2	16.9
Objectives		**40**		**40**	**35**	**25**

[a] Exceedences of the objective shown in bold.

[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 2014 and 2016 at the current 'official' rates.

[c] This assumes that road vehicle emission factors in 2016 will remain the same as in 2014.

A9 Construction Mitigation

A9.1 The following is a set of measures that should be incorporated into the specification for the works:

Site Management

- develop a Dust Management Plan (DMP);
- display the name and contact details of person(s) accountable for air quality pollutant emissions and dust issues on the site boundary;
- display the head or regional office contact information;
- record and respond to all dust and air quality pollutant emissions complaints;
- make a complaints log available to the local authority when asked;
- carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions are being carried out and during prolonged dry or windy conditions; and
- record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and ensure that the action taken to resolve the situation is recorded in the log book.

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed, or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone;
- ensure all Non-road Mobile Machinery (NRMM) comply with the standards set within the GLA's Control of Dust and Emissions During Construction and Demolition SPG. This outlines that, from 1st September 2015, all NRMM of net power 37 kW to 560 kW used on the site of a major development in Greater London must meet Stage IIIA of EU Directive 97/68/EC (Directive 97/68/EC of the European Parliament and of the Council, 1997) and its subsequent amendments as a minimum. NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IIIB of the Directive as a minimum. From 1st September 2020 NRMM used on any site within Greater London will be required to meet Stage IIIB of the Directive as a minimum, while NRMM used on any site within the Central Activity Zone or Canary Wharf will be required to meet Stage IV of the Directive as a minimum;
- ensure all vehicles switch off engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using recycled water where possible and appropriate;
- use enclosed chutes, conveyors and covered skips; and
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

Waste Management

- Reuse and recycle waste to reduce dust from waste materials; and
- avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust);
- ensure water suppression is used during demolition operations;
- avoid explosive blasting, using appropriate manual or mechanical alternatives; and
- bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible.

Measures Specific to Trackout

- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.

A10 Energy Plant Specifications

A10.1 Sites 2 and 4, forming part of the planning application, will be provided with heat and hot water using condensing natural gas-fired boilers. Specifications for these plant are shown in Table A10.1.

Table A10.1: Boiler Specifications

Parameter	Value		Restriction
	Site 2	Site 4	
kW fuel input	258.17	344.84	Max
Exhaust Temperature (°C)	80	80	Min
Flue Diameter (m)	0.15 (per flue)	0.15 (per flue)	Max
Mass Flow (kg/hr)	286	344.9	Min
Condensing	Yes	Yes	-

A10.2 In order to ensure that the final plant design does not lead to adverse air quality impacts, it must adhere to the following minimum specifications:

- a boiler system to be comprised of units totalling a maximum of 600 kW fuel input which will have three flue outlets terminating at least 1 m above the roof level;
- all stacks should discharge vertically upwards and be unimpeded by any fixture on top of the stack (e.g., rain cowls or 'Chinaman's Hats');
- the system must be designed to conform to the requirements of the GLA's guidance on sustainable design and construction (GLA, 2014a). The gas boilers will therefore conform to a maximum NOx emission of <40 mg/kWh. The SPG makes clear that the emission standards are 'end-of-pipe' concentrations expressed at specific reference conditions for temperature, pressure, oxygen and moisture content. Compliance with these standards will be confirmed prior to occupation, based on:
  - monitoring undertaken on the actual installed plant; or
  - manufacturer guaranteed performance levels supported by type approval monitoring undertaken by the equipment supplier.
- in order to attain these values, relevant catalyst or alternative abatement will be required.

A10.3 If the design of the energy centre deviates significantly from the modelled specification, additional future modelling may be required.

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