British Land Property Management Limited

Templar House

Air Quality Assessment Addendum

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Contents

1 Introduction

1.1 Context

Ove Arup and Partners Ltd (Arup) has been commissioned by DP9 Ltd to prepare an addendum to the air quality assessment which accompanied a planning application for the Proposed Development at Templar House, High Holborn, hereafter referred to as the Site, in the London Borough of Camden (LBC). Figure 1 shows the Site location.

LBC requested dispersion modelling be carried out to assess the impact of the proposed combustion plant on nearby receptors and to assess the air quality to which new residential users of the proposed development will be exposed, for instance due to nearby combustion sources.

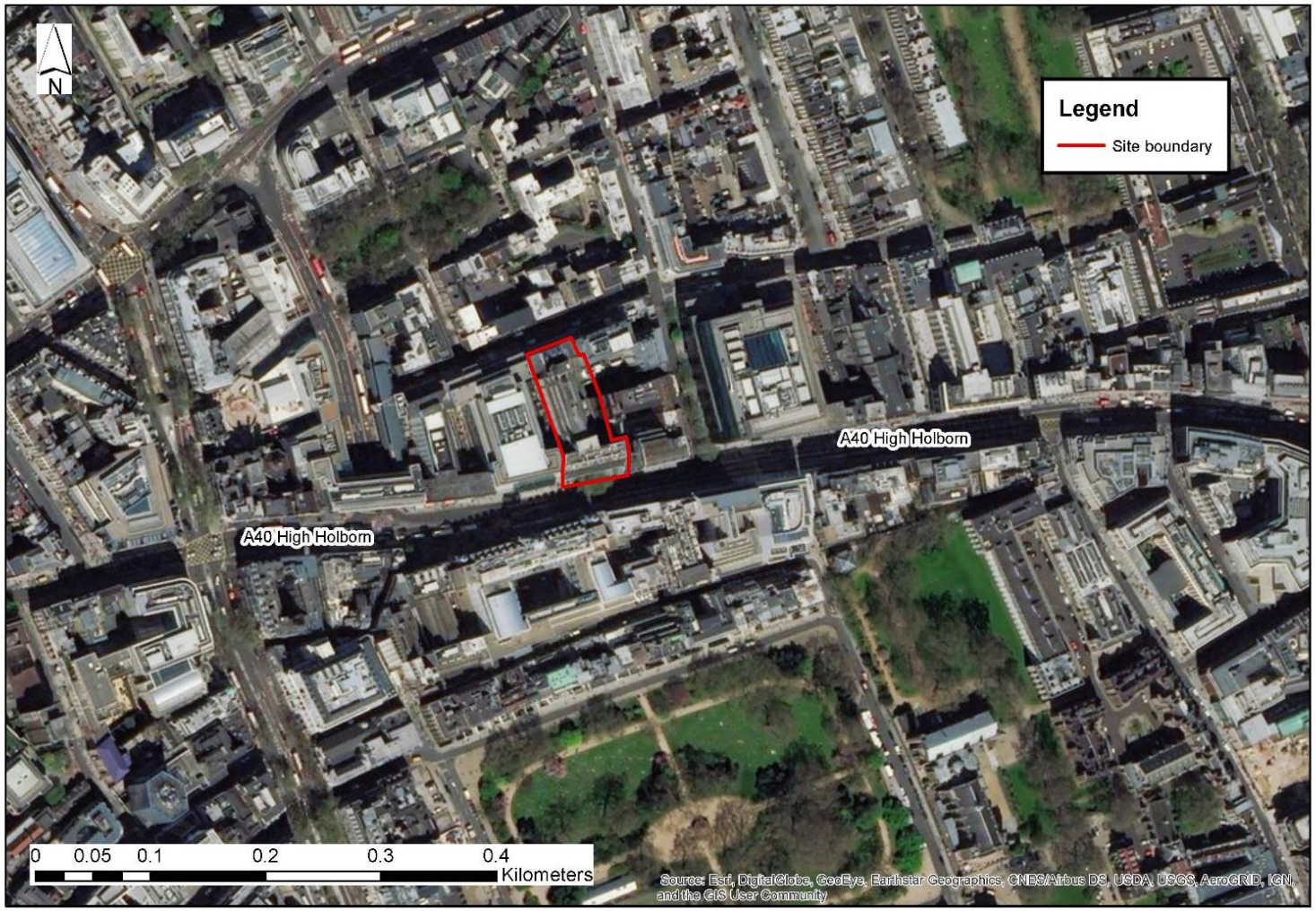
1.2 Combustion Plant

The combustion plant will comprise four natural gas-fired boilers, two 250kW thermal output boilers for the commercial development and two 300kW thermal output boilers for the residential development. The two boilers for the residential use will exhaust via one flue and the two boilers for the commercial use will exhaust via two flues.

The residential boilers will provide domestic hot water for all apartments and operation is likely to span 2-3 hours in the morning and 2-3 hours in the evening while tenants are using hot water. The residential boilers do not provide space heating.

The commercial building boilers will be operated on a schedule and temperature sensing demand. In summer, they will operate for a short period, around 1-2 hours in the morning, and then will provide a baseline energy for heating domestic hot water (which is likely to be less than 10% of the boiler's capacity). In winter it is anticipated that the boilers are likely to be operated throughout the day to provide space heating, for around 11 hours per day.

Figure 1: Site location



2 Methodology of Operational Assessment

2.1 Traffic Assessment

2.1.1 Traffic Data

Traffic data for the roads surrounding the proposed development and for the roads with air quality monitoring sites that were used for dispersion model verification was selected from the London Atmospheric Emissions Inventory (LAEI)[1]. Figure 2 shows the modelled road network and Table 1 provides the details of the modelled roads. The traffic data used in this assessment is shown in

Table 2Table 2.

Table 1: Details of modelled road network

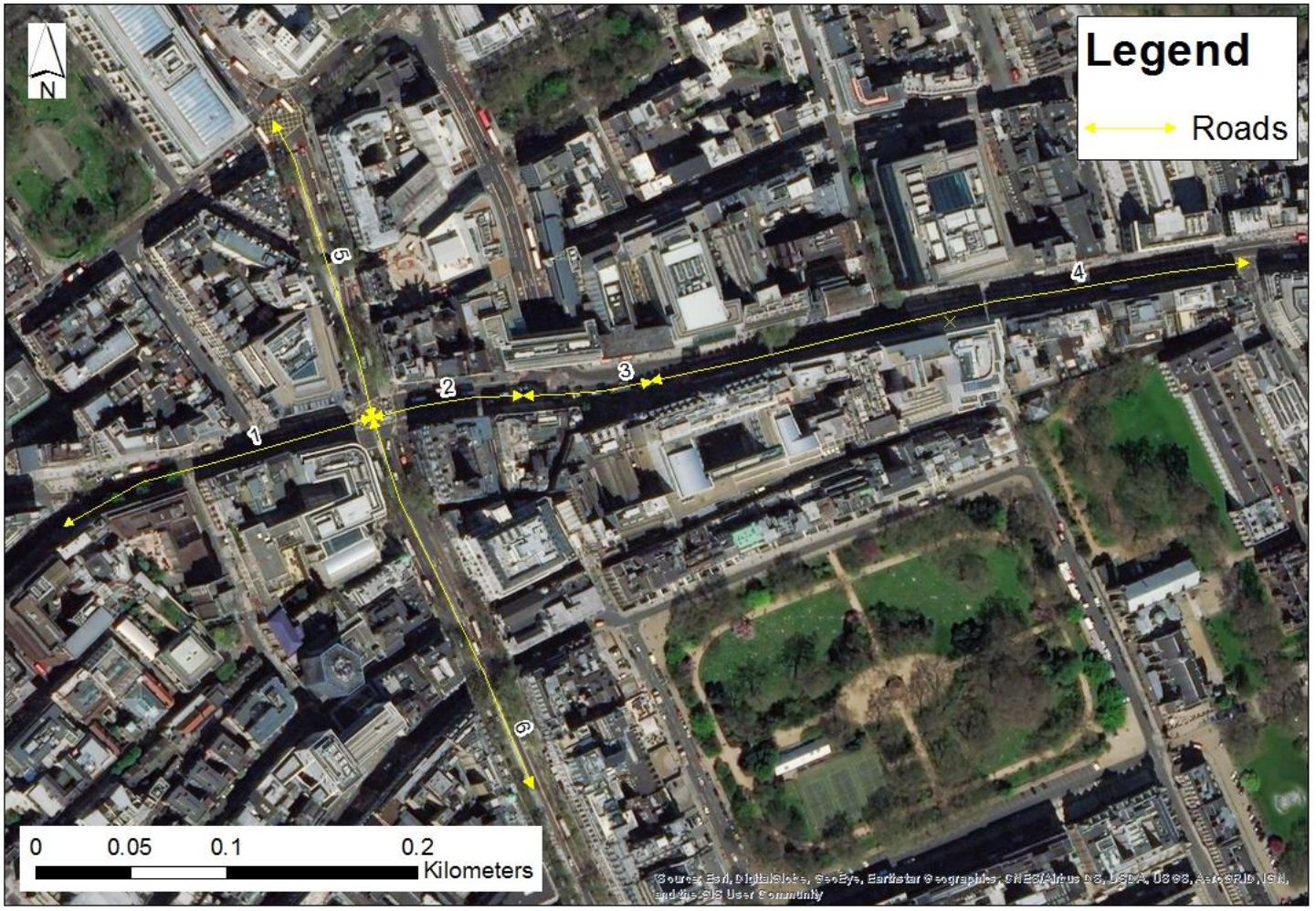
Road ID	Road description	Road width (m)	Canyon height (m)
1	High Holborn (A40)	18	21
2	High Holborn (A40)	20	21
3	High Holborn (A40)	18	21
4	High Holborn (A40)	24	21
5	Southampton Row (A4200)	20	18
6	Kingsway (A4200)	20	21

Table 2: Traffic data for modelled road network

Road ID	Speed (kph)	AADT	% HGV
1	25	18,023	2.0
2	7	15,869	4.0
3	7	15,869	4.0
4	7	15,869	4.0
5	14	22,999	4.8
6	13	26,962	3.2

[1] London Atmospheric Emissions Inventory (LAEI) - https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory-2013 [Accessed December 2017]

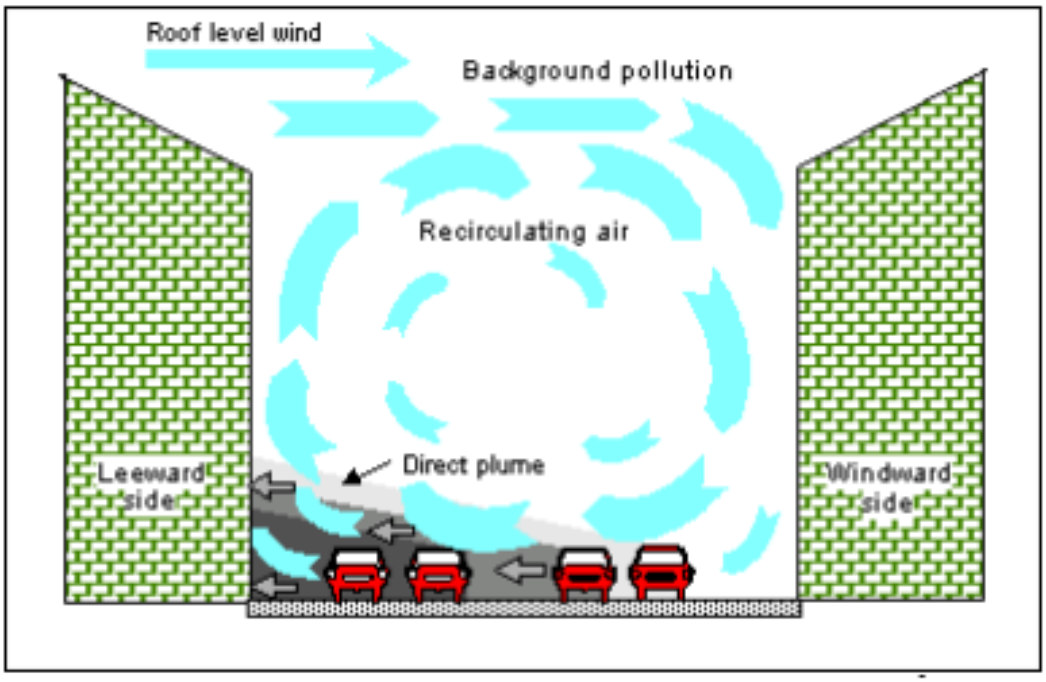
Figure 2: Modelled road network



2.1.2 Street Canyons

The existing urban streetscape along all road create a street canyon. The street canyon effect can impact dispersion within the canyon, such as increasing concentrations on the leeside of the road (Figure 3). The ADMS-Roads model is able to model the impacts of street canyons and these have been included in the model set-up.

Figure 3: Conventional street canyon air flow



2.2 Combustion Plant Assessment

Typical boiler parameters have been assumed for GB312 condensing boilers.[2] The boiler parameters are shown in Table 3. Both meet the GLA's target for low NOx boiler emissions of less than 40mg/kWh.

The residential boilers have been assumed to operate 6 hours per day and the commercial boilers 11 hours per day, both of which are conservative estimates. The predicted annual mean concentrations have be multiplied by a factor to account for the hours of operations (6/24 for residential and 11/24 for office). For short-term concentrations it has been assumed as a conservative assumption that the boilers operate continuously and therefore may coincide with all the worst case met conditions.

[2] From www.burderus.co.uk

Table 3: Boiler parameters

Parameter	Units	Residential boiler (combined flue)	Commercial boiler (per boiler)
Thermal output	kW	500	300
Efficiency	-	0.95	0.95
Stack height	m	55	55
Stack diameter	m	0.15	0.125
Exhaust temperature	°C	75	78
Exhaust velocity	m/s	12.0	10.5
Emission rate of NOx	g/s	0.0050	0.0034
Emission concentration	Mg/kWh	34	39

2.2.1 Buildings

Buildings can have a significant effect on the dispersion of pollutants. If tall buildings are close to a stack, the plume can be entrained in the cavity zone downwind of the building. This can lead to higher ground concentrations near the stack than would be expected in the absence of buildings.

The assessment considered the existing situation plus the proposed development. Figure 4 shows the buildings which have been included in the dispersion model. Buildings can only be added to the ADMS model as rectangular or circular shapes, therefore, some simplification of the building geometries has been made. Details of building geometries included in the model are provided in Table 4. The modelling was approached in two ways to provide a sensitivity analysis. The first approach was to model all the buildings and the second approach was to model just the proposed Templar House buildings. This sensitivity analysis was undertaken as the ADMS 5 model creates an effective building that can be extensive and therefore the local dispersion detail can be lost. The second approach produced slightly higher results at all receptors and those are the results reported in section 4.2.1.

Figure 4: Buildings modelled

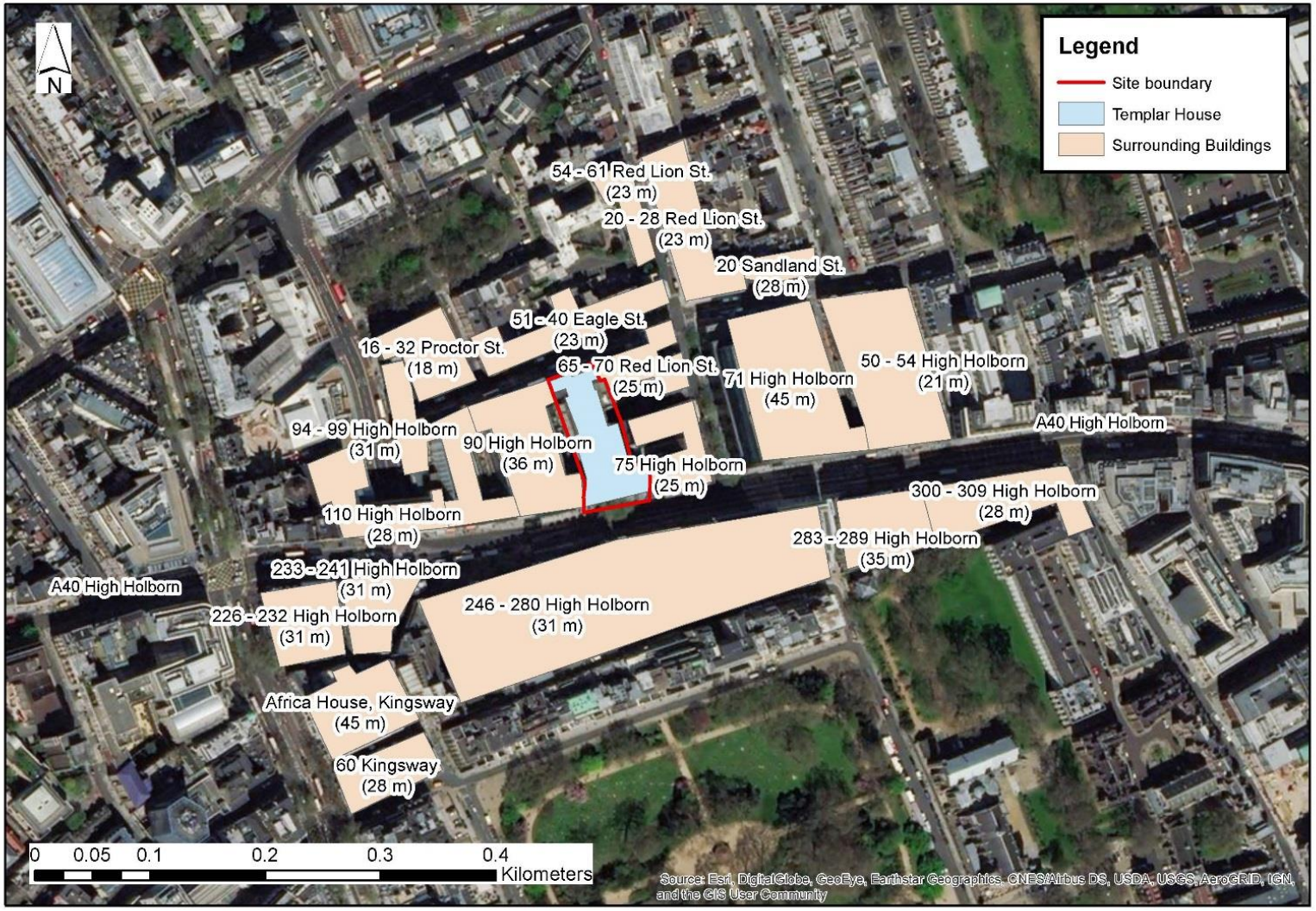


Table 4: Building parameters

Name	X (m)	Y (m)	Height (m)	Length (m) / Diameter (m)	Width (m)	Angle (Degrees)
65 – 70 Red Lion St.	530617	181706	25	47.6	17.6	249.5
75 High Holborn	530638	181657	25	32.3	41.0	257.6
226 – 232 High Holborn	530439	181559	31	35.8	40.7	256.0
233 – 241 High Holborn	530483	181564	31	36.9	37.5	82.8
Africa House	530471	181513	45	50.4	35.6	243.2
60 Kingsway	530485	181479	28	53.1	25.9	240.8
50 – 54 High Holborn	530750	181708	21	86.4	43.4	339.9
110 High Holborn	530486	181616	28	60.5	18.4	262.9
110 High Holborn	530459	181637	28	22.3	25.5	255.4
94 – 99 High Holborn	530530	181622	31	38.1	16.6	80.1
94 – 99 High Holborn	530522	181644	31	14.7	31.0	261.3
90 High Holborn	530558	181654	36	70.0	35.1	164.5
Templar House	530587	181682	48.75	16.1	32.2	251.8
Templar House	530603	181650	48.75	39.5	29.8	165.9
16 – 32 Proctor St.	530505	181707	18	33.5	44.0	245.0
283 – 309 High Holborn	530790	181632	31	21.5	128.2	168.3
71 High Holborn	530697	181692	45	81.6	48.5	161.1
54 – 61 Eagle St.	530579	181721	23	13.4	111.4	155.2
20 – 28 Red Lion St.	530639	181780	23	85.2	24.6	164.2
246 – 280 High Holborn	530664	181596	31	108.7	46.3	255.1
246 – 280 High Holborn	530561	181563	31	106.7	57.8	250.7

2.3 Model Set up

2.3.1 Sensitive Receptors

A desk-top study was undertaken in order to identify sensitive receptors on the adjacent buildings in the vicinity of the proposed development that required specific consideration during the assessment. Receptors were chosen at roof height where air intakes may be located, at street level (1.5m) and at half the building height. The sensitive receptors are shown in Figure 5 and their details are summarised in Table 5.

Figure 5: Sensitive receptors

Table 5: Sensitive receptors

Receptor name	Receptor ID	OS Grid Ref.		Height (m)	Existing or future
		X	Y		
Templar House 1	A1	530583	181660	48.75	Existing
Templar House 2	A2	530583	181660	24.375	Existing
Templar House 3	A3	530583	181660	1.5	Existing
Templar House 4	B1	530584	181656	48.75	Existing
Templar House 5	B2	530584	181656	24.375	Existing
Templar House 6	B3	530584	181656	1.5	Existing
Templar House 7	C1	530582	181696	48.75	Existing
Templar House 8	C2	530582	181696	24.375	Existing
Templar House 9	C3	530582	181696	1.5	Existing
90 High Holborn 1	D1	530570	181685	36	Existing
90 High Holborn 2	D2	530570	181685	18	Existing
90 High Holborn 3	D3	530570	181685	1.5	Existing
65 – 70 Red Lion St. 1	E1	530594	181694	25	Existing
65 – 70 Red Lion St. 2	E2	530594	181694	12.5	Existing
65 – 70 Red Lion St. 3	E3	530594	181694	1.5	Existing
90 High Holborn 1	F1	530572	181658	36	Existing
90 High Holborn 2	F2	530572	181658	18	Existing
90 High Holborn 3	F3	530572	181658	1.5	Existing
75 High Holborn 1	G1	530613	181665	25	Existing
75 High Holborn 2	G2	530613	181665	12.5	Existing
75 High Holborn 3	G3	530613	181665	1.5	Existing
51 – 40 Eagle St. 1	H1	530585	181716	23	Existing
51 – 40 Eagle St. 2	H2	530585	181716	11.5	Existing
51 – 40 Eagle St. 3	H3	530585	181716	1.5	Existing
20 – 28 Red Lion St. 1	I1	530640	181737	23	Existing
20 – 28 Red Lion St. 2	I2	530640	181737	11.5	Existing
20 – 28 Red Lion St. 3	I3	530640	181737	1.5	Existing
54 – 61 Red Lion St. 1	J1	530614	181755	23	Existing
54 – 61 Red Lion St. 2	J2	530614	181755	11.5	Existing
54 – 61 Red Lion St. 3	J3	530614	181755	1.5	Existing
20 Sandland St. 1	K1	530674	181750	28	Existing
20 Sandland St. 3	K2	530674	181750	14	Existing
20 Sandland St. 2	K3	530674	181750	1.5	Existing
71 High Holborn 1	L1	530671	181700	45	Existing
71 High Holborn 2	L2	530671	181700	22.5	Existing
71 High Holborn 3	L3	530671	181700	1.5	Existing
246 – 280 High Holborn 1	M1	530613	181609	31	Existing

246 – 280 High Holborn 2	M2	530613	181609	15.5	Existing
246 – 280 High Holborn 3	M3	530613	181609	1.5	Existing
283 – 289 High Holborn 1	N1	530724	181631	35	Existing
283 – 289 High Holborn 2	N2	530724	181631	17.5	Existing
283 – 289 High Holborn 3	N3	530724	181631	1.5	Existing
300 – 309 High Holborn 1	O1	530770	181639	28	Existing
300 – 309 High Holborn 2	O2	530770	181639	14	Existing
300 – 309 High Holborn 3	O3	530770	181639	1.5	Existing
50 – 54 High Holborn 1	P1	530713	181740	21	Existing
50 – 54 High Holborn 2	P2	530713	181740	10.5	Existing
50 – 54 High Holborn 3	P3	530713	181740	1.5	Existing
94 – 99 High Holborn 1	Q1	530550	181630	31	Existing
94 – 99 High Holborn 2	Q2	530550	181630	15.5	Existing
94 – 99 High Holborn 3	Q3	530550	181630	1.5	Existing
94 – 99 High Holborn 4	R1	530526	181672	31	Existing
94 – 99 High Holborn 5	R2	530526	181672	15.5	Existing
94 – 99 High Holborn 6	R3	530526	181672	1.5	Existing
16 – 32 Proctor St. 1	S1	530528	181692	18	Existing
16 – 32 Proctor St. 2	S2	530528	181692	9	Existing
16 – 32 Proctor St. 3	S3	530528	181692	1.5	Existing

2.3.2 NOx to NO_2 Conversion

The model predicts NOx concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NOx is emitted from combustion processes, primarily as NO with a small percentage of NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form NO_2. NO_2 is associated with effects on human health and therefore the air quality standards for the protection of human health are based on NO_2 rather than total NOx or NO. A suitable NOx:NO_2 conversion has been applied to the modelled NOx concentrations in order to determine the impact of the NOx emissions on ambient concentrations of NO_2.

For the concentrations due to boilers the Environment Agency advice[3] has been followed. Long term concentrations have been multiplied by a factor of 0.7 and short-term concentrations by a factor of 0.35.

LAQM.TG(16) details an approach for calculating the roadside conversion of NO_x to NO_2, which takes into account the difference between ambient NO_x concentrations with and without the proposed development, the concentration of ozone and the different proportions of primary NO_2 emissions in different years. This approach is available as a spreadsheet calculator, with the most up to date version having been released in October 2017 (v6.1)[4].

[3] https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit#environmental-standards-for-air-emissions
[4] Defra, 2017. NO_x to NO_2 calculator. http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc [Accessed December 2017]

2.3.3 Model Verification

Model verification refers to the comparison of modelled and measured pollutant concentrations at the same points to determine the performance of the model. Should the model results for NO_2 be mostly within ±25% of the measured values and there is no systematic over or under-prediction of concentrations, then the LAQM.TG(16) guidance advises that no adjustment is necessary. If this is not the case, modelled concentrations are adjusted based on the observed relationship between modelled and measured NO_2 concentrations to provide a better agreement.

The outcome of the model verification exercise is reported in Section 4.2.1.

2.3.4 Assessing Significance

2.3.4.1 EPUK/IAQM

The 2017 EPUK/IAQM guidance note 'Land-Use Planning & Development Control' provides an approach to determining the air quality impacts resulting from a proposed development and the overall significance of local air quality effects arising from a proposed development.

First, impact descriptors are determined based on the magnitude of incremental change as a proportion of the relevant assessment level, in this instance the annual mean NO_2 objective. The change is then examined in relation to the predicted total pollutant concentrations in the assessment year and its relationship with the annual mean NO_2 objective.

The assessment framework for determining impact descriptors at each of the assessed receptors is shown in Table 6.

Table 6: Impact descriptors

Annual average concentrations at receptor in the assessment year	**% Change in concentrations relative to annual mean NO_2 and hourly mean objectives**			
	1	**2-5**	**6-10**	**>10**
75% or less of objective	Negligible	Negligible	Slight	Moderate
76-94% of objective	Negligible	Slight	Moderate	Moderate
95-102% of objective	Slight	Moderate	Moderate	Substantial
103-109% of objective	Moderate	Moderate	Substantial	Substantial
110% or more of objective	Moderate	Substantial	Substantial	Substantial

Note: Changes in pollutant concentrations of 0% i.e. <0.5% would be described as negligible

The impact descriptors at each of the assessed receptors are then used as a starting point for making a judgement on the overall significance of effect of a proposed development, however, other influences would also need to be taken into account, such as:

- The existing and future air quality in the absence of the site;
- The extent of current and future population exposure to the impacts; and

- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

The guidance also provides advice for determining the magnitude of change for hourly mean NO_2 concentrations, which is shown in Table 7 objective.

Table 7. The impact descriptor is determined by considering the process contribution only. However, in assessing the significance, consideration is also given to total pollutant concentrations, including background concentrations, and comparison of these with the hourly mean NO_2 objective.

Table 7: Magnitude of change for hourly mean NO_2 concentrations

Change in hourly mean concentrations at receptor in the assessment year	**Magnitude of Change**	**Impact Descriptor**
<10% of hourly mean NO_2 threshold	Imperceptible	Negligible
10-20% of hourly mean NO_2 threshold	Small	Slight
20-50% of hourly mean NO_2 threshold	Medium	Moderate
>50% of hourly mean NO_2 threshold	Large	Substantial

Professional judgement should be used to determine the overall significance of effect of the site, however in circumstances where the site can be judged in isolation, it is likely that a 'moderate' or 'substantial' impact will give rise to a significant effect and a 'negligible' or 'slight' impact will not result in a significant effect.

2.3.4.2 London Council's Air Quality and Planning Guidance

The guidance[5] says that in areas where the predicted total concentration is over 5% more than the air quality objective for NO_2, i.e. higher than 42µg/m^3, that:

> "Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further.
>
> Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures."

At roadside locations in the vicinity of the Site 42µg/m^3 is exceeded. The applicant has designed in mitigation following the GLA's Supplementary Planning Guidance on Sustainable Design and Construction, following the energy hierarchy and proposing low NOx boilers.

2.4 Dispersion Model Set-up

This section details the inputs and set up for the dispersion modelling.

[5] London Councils, Air Quality and Planning Guidance, Revised version- January 2007

2.4.1.1 Meteorological Data

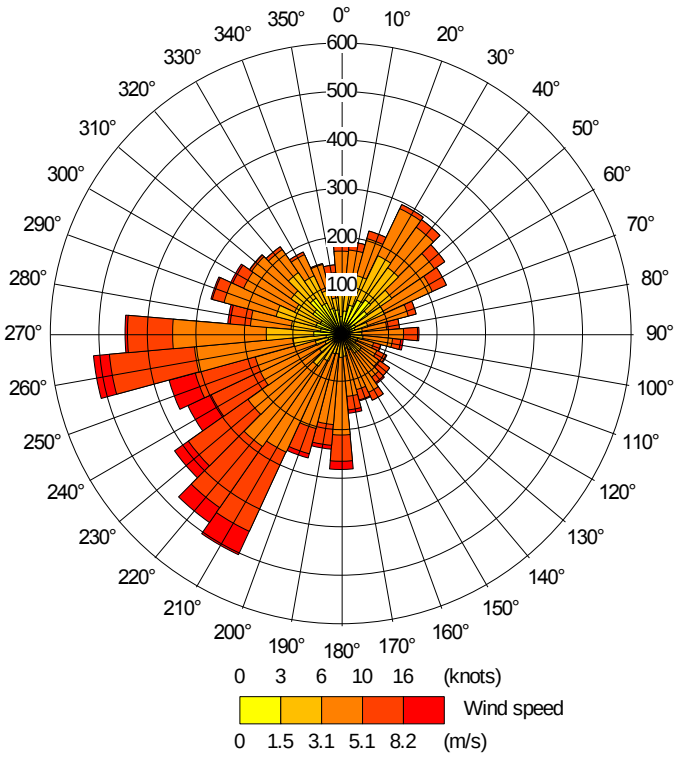
Meteorological data used in this assessment has been taken from measurements at Heathrow Airport meteorological station for the year 2016. Heathrow Airport is located approximately 19km west of the proposed development. This meteorological site is considered the most suitable for this assessment.

Most dispersion models of roads do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75m/s. LAQM.TG(16) guidance states that the meteorological data file is tested in a dispersion model and the relevant output log file checked to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. The guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably greater than 90%.

The meteorological data selected from Heathrow airport includes greater than 95% of usable data. This is above the 90% threshold and this data therefore meets the requirement of the Defra guidance.

The wind rose for the Heathrow Airport 2016 meteorological data is presented in Figure 6. It can be seen that the predominant wind direction is from the south-west and therefore receptors located to the north-east of the emission sources will be the most affected.

Figure 6: Heathrow 2016 windrose



2.4.1.2 Other Model Parameters

The extent of mechanical turbulence (and hence, mixing) in the atmosphere is affected by the roughness of the surface/ground over which the air is passing. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts).

In this assessment, the general land use in the area around the site can be described as ‘large urban areas’ with a corresponding surface roughness of 1.5m. In addition, the minimum Monin-Obukhov length was set to ‘large conurbations greater than 1 million” with a corresponding value of 100m.

3 Baseline

3.1 Sources of Air Pollution

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A or Part B processes, regulated through the Pollution Prevention and Control (PPC) system[6,7]. The larger more polluting processes are regulated by the Environment Agency (EA) and the smaller less polluting ones by the local authorities. Local authorities tend also to regulate only for emissions to air whereas the EA regulates emissions to air, water and land.

There is one regulated process for emissions to air within 1.5km of the proposed development, the Citigen plant located at 47-53 Charterhouse Street, which is around 900m to the east of the site. The operation of these processes and subsequent emissions are included in baseline monitoring data available from LBC and therefore their effect on ambient air quality at the proposed development site has been considered.

3.1.1 Committed Developments

Development consented from 2014 within 500m of the Site have been reviewed for installation of a boiler or CHP. The relevant applications are shown in Table 8. The only potentially significant scheme is the one at Beckley House, 71 High Holborn. In this application communal heating and domestic hot water production was replaced by individual low NOx boilers. Therefore, there are no committed developments to be modelled explicitly.

Table 8: Committed development within 5km of the Site

Application Ref	Address	Description
2014/0482/P	Beckley House, Eagle Street, London, WC1R 4AP	Installation of boiler flues on the rear elevation of residential block of flats.
2014/0975/P	20A John Street, London, WC1N 2DR	Details required by condition 3 (details of airbrick, vertical and boiler flues) to planning permission 2013/1479/P granted on 09/10/2013 for the change of use of office (Class B1) to residential (Class C3) to create 5 flats and 1 mews house and alteration.
2015/1999/P	National Hospital for Neurology and Neurosurgery, Queen Square, London, WC1N 3BG	Installation of boiler flue to east elevation roof area (Powis Place).

[6] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[7] The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390

2015/4366/P	National Hospital for Neurology and Neurosurgery, Queen Square, London, WC1N 3BG	Non-material amendments to planning permission ref. 2015/1999/P granted on 27th May 2015 for the installation of boiler flue to east elevation roof area (Powis Place).
2016/0224/P	Tybalds Estate, New North Street, London, WC1N	Details required by condition 15 (CHP plant noise) attached to planning permission 2013/1014/P dated 13/05/2014 for mixed use development to provide 93 mixed tenure residential units and associated works.
2016/0484/P	35 Lamb's Conduit Street, London, WC1N 3NG	Conversion of 5x1bed self-contained flats to a 1x Single Family Dwelling House; insertion of an access door to the front basement area and the tanking of basement vaults to form kitchen laundry and boiler room.
2016/0810/L	35 Lamb's Conduit Street, London, WC1N 3NG	Conversion of 5x1bed self-contained flats to a 1x Single Family Dwelling House; insertion of an access door to the front basement area and the tanking of basement vaults to form kitchen laundry and boiler room.
2016/3681/L	Flat 3, 37 Lamb's Conduit Street, London, WC1N 3NG	Installation of boiler flue and extract vent to the rear elevation and other internal alterations including replacement doors, floor finishes, bathroom fittings, replacement services and upgrading of sound insulation.

3.1.2 Nearby Combustion Plant

The London Council's Air Quality Planning Guidance at paragraph 2.4 describes domestic and commercial sources as area sources. Modelling nearby commercial and domestic sources as an area source would double count the impact of the sources, and therefore a contribution would have to be subtracted from the background concentration beforehand. As the background concentration already includes the impact of nearby combustion sources they have not been modelled explicitly, but have used the unchanged background.

3.2 Local Air Quality

The Environment Act 1995[8] requires local authorities to review and assess air quality with respect to the objectives for seven pollutants specified in the National Air Quality Strategy. Local authorities were required to carry out an Updating and Screening Assessment (USA) of their area every three years and now Annual Status Report (ASR) every year. If the USA identifies potential hotspot areas likely to exceed air quality objectives, then a detailed assessment of those areas is required.

[8] Environment Act (1995) Chapter 25, Part IV Air Quality

Where objectives are not predicted to be met, local authorities must declare the area as an AQMA. In addition, local authorities are required to produce an Air Quality Action Plan (AQAP) which includes measures to improve air quality within the AQMA.

A review of the Defra website[9] showed that LBC has declared a borough wide AQMA. The AQMA has been declared due to exceedances of the annual mean NO_2 air quality objective, and the 24-hour mean PM_{10} objective. As such, the proposed development is located within an AQMA.

3.2.1 Automatic Monitoring

Air quality monitoring is undertaken in the boroughs within 1.5km of the proposed development using both continuous and passive monitoring methods. There are six automatic monitoring sites within 1.5km of the proposed development. Monitoring data for NO_2 and PM_{10} for the five sites are shown in Table 9, for 2015 to 2017. Data for the London Borough of Camden and City of Westminster were obtained through the LondonAir webiste[10] and City of London from the latest ASR[11].

Table 9 shows that the annual mean NO_2 objective has been exceeded at all sites apart from Covent Garden in 2015 to 2017, however there are no exceedances of the PM_{10} objective. Where concentrations of NO_2 are greater than 60µg/m^3 it is likely that there were also exceedances of the NO_2 hourly mean air quality objective[12].

Figure 7 presents the locations of the automatic (continuous) monitoring sites within approximately 1.5km of the proposed development.

Table 9: Automatic monitoring results (2015-2017) in 1.5km of the proposed development

Site	**Site Type**	**Site OS Grid Ref**		**Annual mean NO_2 concentration (µg/m^3)**			**Annual mean PM_{10} concentration (µg/m^3)**		
		X	**Y**	**2015**	**2016**	**2017**	**2015**	**2016**	**2017**
London Borough of Camden									
London Bloomsbury	Urban background	530123	182014	**48**	**42**	**40**	19	20	19
Holborn	Kerbside	530528	181505	**83**	**84**	**74**	-	-	-
Euston Road	Roadside	529884	182639	**91**	**88**	**82**	28	24	21
City of Westminster									
Strand	Roadside	530785	180911	**108**	**106**	**92**	-	-	-
Covent Garden	Urban background	530444	180903	-	-	37*	-	-	-
City of London									
Beech Street	Roadside	532141	181861	**89**	**85**	-	28	25	-
Moved location to here in 2016		532176	181862						
Air Quality Objective				**40**			**40**		

[9] Defra (2016) Air quality management areas; http://uk-air.defra.gov.uk/aqma/list, Accessed January 2018
[10] LondonAir, https://www.londonair.org.uk/LondonAir/Default.aspx, Accessed January 2018
[11] (2017) City of London Corporation, Air Quality Annual Status Report for 2016
[12] Defra (2016) Local Air Quality Management: Technical Guidance LAQM.TG(16)

Note - exceedances of the annual mean objective are highlighted as **bold**
'*' – data capture is below 75%

Table 10 shows the monitoring results for NO_2 measured using diffusion tubes in Camden, for the years 2015 and 2017[13]. This shows that the annual mean NO_2 objective has been exceeded at the majority of sites in 2015 and 2017.

Table 10: Monitored annual mean NO_2 concentrations at diffusion tube monitoring sites in Camden (2015-2017) within 1.5km of the proposed development

Site	**Site Type**	**Site OS Grid Ref**		**Annual mean NO_2 concentration ($\mu g/m^3$)**		
		X	**Y**	**2015**	**2016**	**2017**
Euston Road	Roadside	530110	182795	**74.2**	**70.6**	**81.8**
Tavistock Gardens	background	529880	182334	38.1	33.4	**44.1**
Tottenham Court Road	Urban	529568	181728	**87.8**	**84.6**	**73.9**
Bloomsbury Street	background	529962	181620	**74.9**	**71.8**	**68.8**
Air Quality Objective				**40**		

Note - exceedances of the annual mean objective are highlighted as **bold**

Table 11 shows the monitoring results for NO_2 measured using diffusion tubes in Islington, for the years 2015 and 2017[14]. This shows that the annual mean NO_2 objective has been exceeded at both of the sites in 2015 and 2017.

Table 11: Monitored annual mean NO_2 concentrations at diffusion tube monitoring sites in Islington (2015-2017) within 1.5km of the proposed development

Site	**Site Type**	**Site OS Grid Ref**		**Annual mean NO_2 concentration ($\mu g/m^3$)**		
		X	**Y**	**2015**	**2016**	**2017**
Roseberry Avenue	Roadside	530123	182014	**62**	**62**	-
Percy Circus	Urban	530528	181505	**45**	**46**	
Air Quality Objective				**40**		

Note - exceedances of the annual mean objective are highlighted as **bold**

13 London Borough of Camden, https://opendata.camden.gov.uk/Environment/Air-Quality-Monitoring-Diffusion-Tube/gy6e-i4w6
14 (2017) Islington Air Quality Annual Status Report, 2016 Report

Table 12 shows the monitoring results for NO_2 measured using diffusion tubes in Camden, for the years 2015 and 2017[6]. This shows that the annual mean NO_2 objective has been exceeded at the majority of sites in 2015 and 2017. Where concentrations of NO_2 are greater than 60µg/m^3 it is likely that there were also exceedances of the NO_2 hourly mean air quality objective.

Table 12: Monitored annual mean NO_2 concentrations at diffusion tube monitoring sites in the City of London (2015-2017) within 1.5km of the proposed development

Site	**Site Type**	**Site OS Grid Ref**		**Annual mean NO_2 concentration ($\mu g/m^3$)**		
		X	**Y**	**2015**	**2016**	**2017**
St. Bartholomew's Hospital courtyard	Urban background	531901	181571	38	**49**	-
St. Andrew's Church, Queen Victoria St	Roadside	531851	180962	**53**	**56**	-
St. Dunstan's Church, Fleet St	Roadside	531235	181155	**87**	**81**	-
New Change Street	Kerbside	532136	181210	-	**66***	-
150 Cheapside	Kerbside	532139	181296	-	**59**	-
BT Building (St Martin's-le-Grand)	Kerbside	532127	181360	-	**62***	-
Noble Street (corner with Gresham St)	Roadside	532205	181429	-	**48**	-
King Edward Street	Kerbside	532036	181373	-	**55***	-
St Paul's Bus Stop (Cannon St)	Kerbside	532107	181085	-	**70***	-
Air Quality Objective				**40**		

Note - exceedances of the annual mean objective are highlighted as **bold**

'*' – data capture is below 75%

Figure 8 presents the locations of the diffusion tubes within approximately 1.5km of the proposed development.

Figure 7: Automatic (continuous) monitoring locations close to the Site

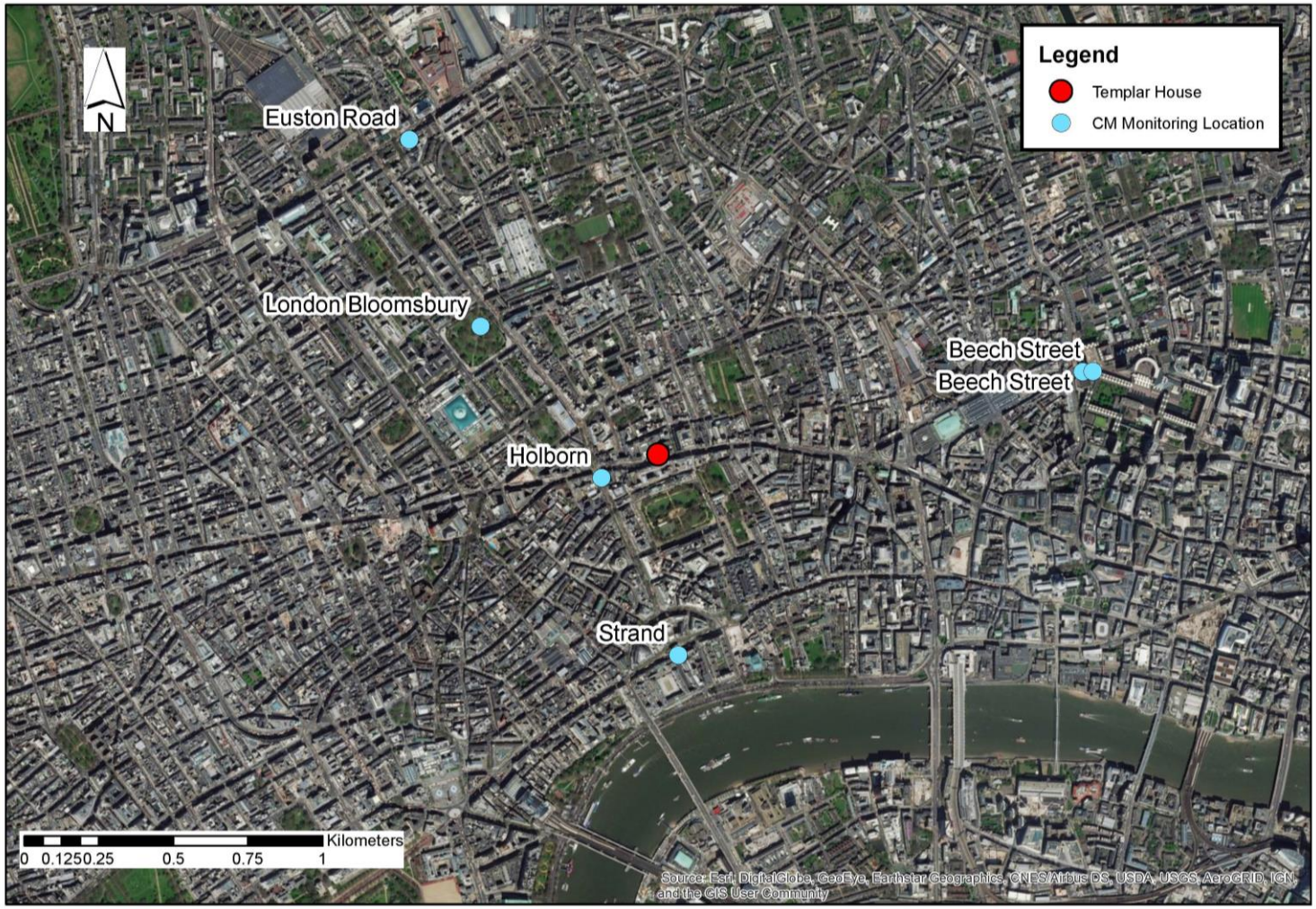
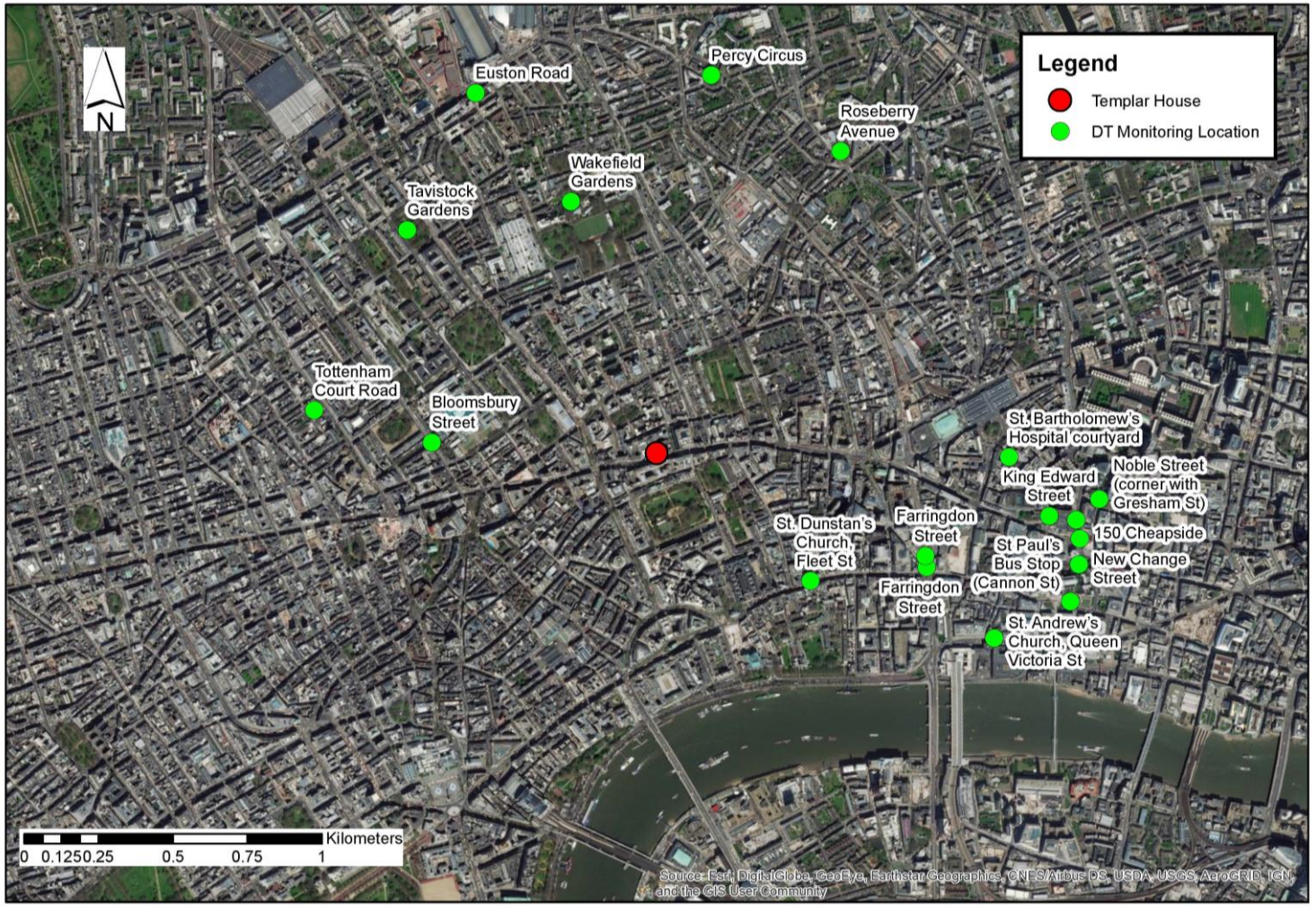


Figure 8: Diffusion tube monitoring locations close to the Site



3.3 Background Concentrations

The Defra website includes estimated background air pollution data for each 1km by 1km OS grid square in the UK. Background concentrations for the modelled baseline year of 2016 and the first year of opening of the proposed development, 2019, have been taken from the latest Defra maps[15] and are presented in Table 13**Error! Reference source not found.** and Table 14 respectively for the grid square in which the Proposed Development is located.

In 2017, background concentrations are estimated to be above the air quality objective for annual mean NO_2 but below the air quality objective for PM_{10}. In 2019 the NO_2 concentration is also predicted to be above the air quality objective value of 40µg/m^3. In both years Defra estimate that the impact of the most local major roads contributes approximately 27%-33% to the total NO_X concentration.

A background of 50.7µg/m^3, the value for 2016 has been used in the modelling.

Table 13: Estimated background pollutant concentrations for 2016

OS grid square		**Annual mean concentration (µg/m^3)**			
X	**Y**	**NO_x**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
530500	181500	94.8	**50.7**	21.3	13.7
Air quality objective (µg/m^3)		**-**	**40**	**40**	**25**

Table 14: Estimated background pollutant concentrations for 2019

OS grid square		**Annual mean concentration (µg/m^3)**			
X	**Y**	**NO_x**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
530500	181500	72.5*	41.6	20.4	12.8
Air quality objective (µg/m^3)		**-**	**40**	**40**	**25**

Note:* Motorway, Trunk A roads and Primary A roads contribute 19.7µg/m3

[15] Defra, https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015; Accessed January 2018

4 Operational Assessment

4.1 Traffic Assessment

4.1.1 Model Verification

The model verification exercise used Holborn NO_2 monitoring data (the closest continuous monitor to the proposed site).

Monitoring results from 2016 for this location were obtained and the road contribution to the total NOx concentration calculated for use in the verification process. The model verification exercise was undertaken following the methodology contained in LAQM.TG (16). A comparison of monitored and modelled annual mean NO_2 concentrations for 2016 is shown in Table 15. The percentage difference between the monitored and modelled result is -19%.

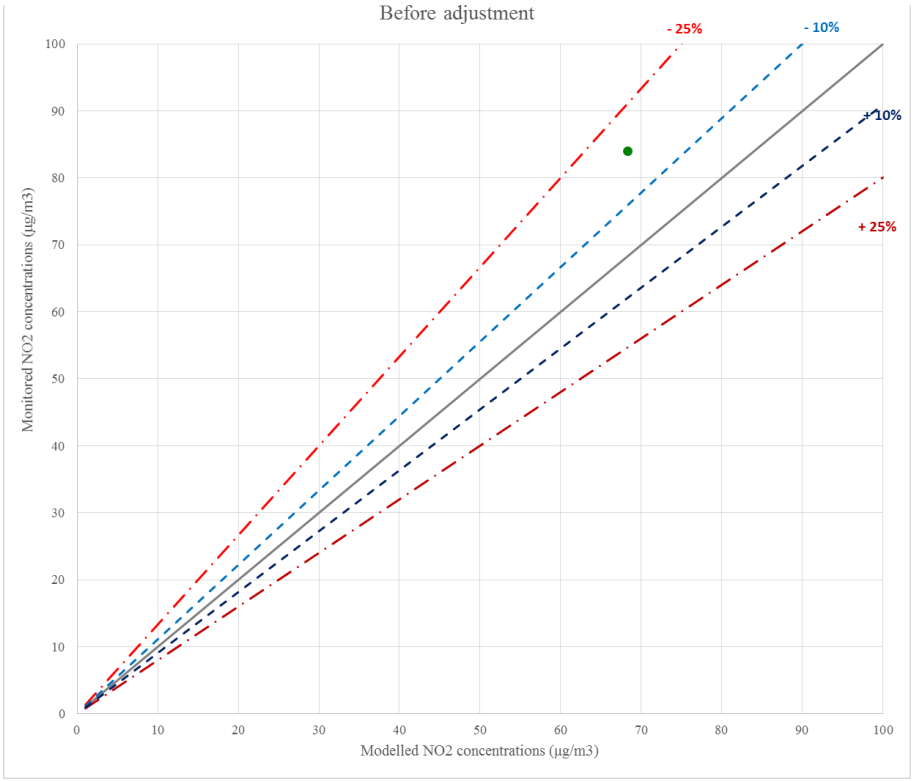
A model adjustment exercise has been carried out, and an adjustment factor of 2.08 has been applied to modelled results. A graphical comparison of the monitored and modelled annual mean NO_2 concentrations before and after adjustment are shown in Figure 9.

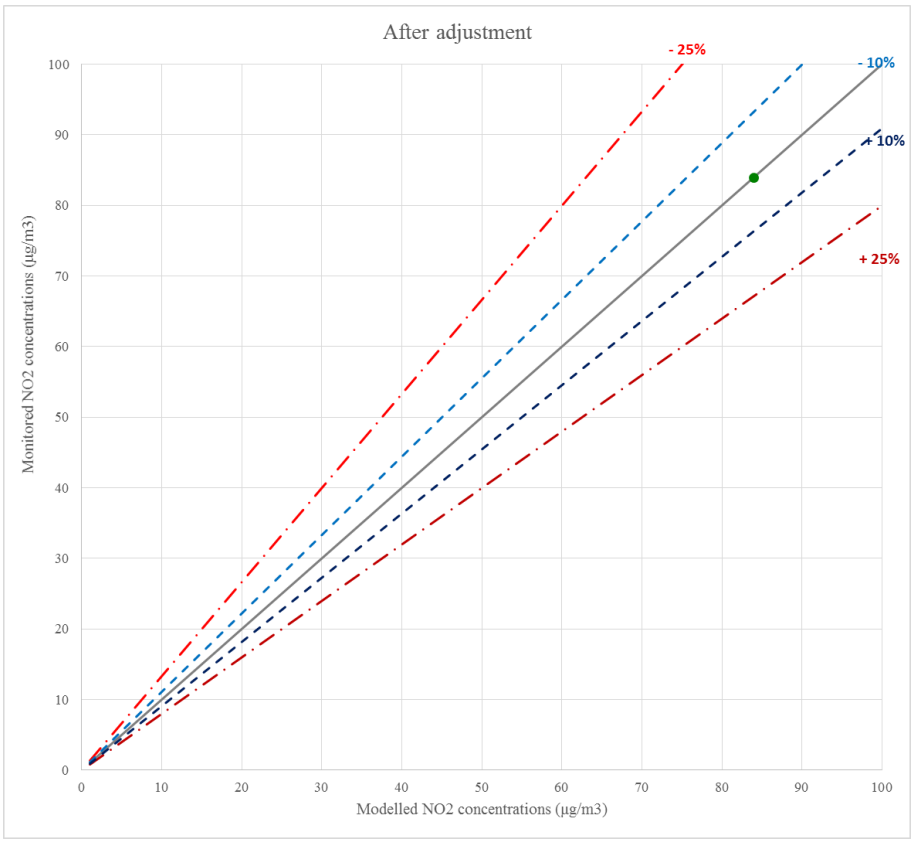
Table 15: Comparison of modelled and monitored annual mean NO_2 concentrations ($\mu g/m^3$)

Site ID	Site type	Background NO_2 concentration ($\mu g/m^3$)	Monitored NO_2 concentration ($\mu g/m^3$)	Modelled NO_2 concentration ($\mu g/m^3$)	% Difference (Modelled - Monitored)/ Monitored
KC59	Kerbside	50.7	84.0	68.3	-19%

All the results of NO_2 due to traffic presented in this report are verified values.

Figure 9: Monitored and modelled annual mean NO_2 concentrations before and after adjustment





4.1.2 Modelled Results

The predicted concentrations at the receptors due to traffic are shown in Table 16. The maximum predicted concentration is 79.0µg/m^3 at street level at 246 – 280 High Holborn. This is close to but lower than the monitored concentration at Holborn kerbside monitor (84.0µg/m^3). Predicted concentrations at Templar House are predicted to vary from 54.8µg/m^3 at street level to 50.8µg/m^3 at roof level. At roof level the road traffic impact is 0.1µg/m^3, which is negligible.

Table 16: Predicted annual mean NO_2 concentrations (µg/m^3) due to traffic

Receptor name	Receptor ID	Height (m)	Predicted process contribution (µg/m^3)	Total NO_2 concentration (µg/m^3)
Templar House 1	A1	45.5	0.1	50.8
Templar House 2	A2	22.75	0.8	51.5
Templar House 3	A3	1.5	3.7	54.4
Templar House 4	B1	45.5	0.1	50.8
Templar House 5	B2	22.75	0.8	51.5
Templar House 6	B3	1.5	4.1	54.8
Templar House 7	C1	45.5	0.1	50.8
Templar House 8	C2	22.75	0.8	51.5
Templar House 9	C3	1.5	2.2	52.9
90 High Holborn 1	D1	36	0.3	51.0
90 High Holborn 2	D2	18	1.3	52.0
90 High Holborn 3	D3	1.5	2.5	53.2
65 – 70 Red Lion St. 1	E1	25	0.8	51.5
65 – 70 Red Lion St. 2	E2	12.5	1.7	52.4
65 – 70 Red Lion St. 3	E3	1.5	2.3	53.0
90 High Holborn 1	F1	36	0.3	51.0
90 High Holborn 2	F2	18	1.4	52.1
90 High Holborn 3	F3	1.5	3.8	54.5
75 High Holborn 1	G1	25	0.8	51.5
75 High Holborn 2	G2	12.5	2.1	52.8
75 High Holborn 3	G3	1.5	3.8	54.5
51 – 40 Eagle St. 1	H1	23	0.8	51.5
51 – 40 Eagle St. 2	H2	11.5	1.5	52.2
51 – 40 Eagle St. 3	H3	1.5	1.8	52.5
20 – 28 Red Lion St. 1	I1	23	0.7	51.4
20 – 28 Red Lion St. 2	I2	11.5	1.3	52.0
20 – 28 Red Lion St. 3	I3	1.5	1.5	52.2
54 – 61 Red Lion St. 1	J1	23	0.7	51.4
54 – 61 Red Lion St. 2	J2	11.5	1.1	51.8

54 – 61 Red Lion St. 3	J3	1.5	1.3	52.0
20 Sandland St. 1	K1	18	0.5	51.2
20 Sandland St. 3	K2	9	1.1	51.8
20 Sandland St. 2	K3	1.5	1.4	52.1
71 High Holborn 1	L1	45	0.2	50.9
71 High Holborn 2	L2	22.5	0.8	51.5
71 High Holborn 3	L3	1.5	2.5	53.2
246 – 280 High Holborn 1	M1	31	0.5	51.2
246 – 280 High Holborn 2	M2	15.5	22.9	73.6
246 – 280 High Holborn 3	M3	1.5	28.3	79.0
283 – 289 High Holborn 1	N1	35	0.3	51.0
283 – 289 High Holborn 2	N2	17.5	1.3	52.0
283 – 289 High Holborn 3	N3	1.5	13.3	64.0
300 – 309 High Holborn 1	O1	28	0.5	51.2
300 – 309 High Holborn 2	O2	14	1.7	52.4
300 – 309 High Holborn 3	O3	1.5	12.9	63.6
50 – 54 High Holborn 1	P1	31	0.8	51.5
50 – 54 High Holborn 2	P2	15.5	1.3	52.0
50 – 54 High Holborn 3	P3	1.5	1.5	52.2
94 – 99 High Holborn 1	Q1	31	0.5	51.2
94 – 99 High Holborn 2	Q2	15.5	1.9	52.6
94 – 99 High Holborn 3	Q3	1.5	7.1	57.8
94 – 99 High Holborn 4	R1	31	0.5	51.2
94 – 99 High Holborn 5	R2	15.5	1.7	52.4
94 – 99 High Holborn 6	R3	1.5	3.0	53.7
16 – 32 Proctor St. 1	S1	31	1.3	52.0
16 – 32 Proctor St. 2	S2	15.5	2.1	52.8
16 – 32 Proctor St. 3	S3	1.5	2.4	53.1

4.2 Combustion Plant Assessment

4.2.1 Modelled Results

Table 17 shows the predicted long term and short term NO_2 concentrations at the receptors due to the combustion plant. The maximum predicted annual mean concentration is 0.13µg/m^3, predicted at receptors A1, A2 and A3[16] on Templar

[16] A feature of the ADMS 5 modelling of buildings is that concentrations in the "cavity region", in the lee of the building are assumed constant with height and this can over-estimate concentrations at lower levels of a tall building.

House. As the concentration is less than 0.2μg/m^3, according to the IAQM significance test the impact is negligible and therefore **not significant**.

The maximum predicted 99.79th percentile concentration is 0.79μg/m^3, predicted at receptors E1, E2 and E3 at 65 – 70 Red Lion St. As the concentration is less than 20μg/m^3, according to the IAQM significance test the impact is negligible and therefore **not significant**.

Table 17: Predicted annual mean NO_2 concentrations (μg/m^3) due to the boilers

Receptor name	**Receptor ID**	**Height (m)**	**Annual mean NO_2 concentration (μg/m^3)**	**99.79th percentile concentration (μg/m^3)**
Templar House 1	A1	45.5	0.13	0.69
Templar House 2	A2	22.75	0.13	0.69
Templar House 3	A3	1.5	0.13	0.69
Templar House 4	B1	45.5	0.12	0.67
Templar House 5	B2	22.75	0.12	0.66
Templar House 6	B3	1.5	0.12	0.66
Templar House 7	C1	45.5	<0.01	<0.01
Templar House 8	C2	22.75	<0.01	<0.01
Templar House 9	C3	1.5	<0.01	<0.01
90 High Holborn 1	D1	36	0.07	0.66
90 High Holborn 2	D2	18	0.07	0.66
90 High Holborn 3	D3	1.5	0.07	0.66
65 – 70 Red Lion St. 1	E1	25	0.12	0.79
65 – 70 Red Lion St. 2	E2	12.5	0.12	0.79
65 – 70 Red Lion St. 3	E3	1.5	0.12	0.79
90 High Holborn 1	F1	36	0.07	0.64
90 High Holborn 2	F2	18	0.07	0.64
90 High Holborn 3	F3	1.5	0.07	0.64
75 High Holborn 1	G1	25	<0.01	<0.01
75 High Holborn 2	G2	12.5	<0.01	<0.01
75 High Holborn 3	G3	1.5	<0.01	<0.01
51 – 40 Eagle St. 1	H1	23	0.02	0.38
51 – 40 Eagle St. 2	H2	11.5	0.02	0.37
51 – 40 Eagle St. 3	H3	1.5	0.02	0.37
20 – 28 Red Lion St. 1	I1	23	0.03	0.46
20 – 28 Red Lion St. 2	I2	11.5	0.03	0.49
20 – 28 Red Lion St. 3	I3	1.5	0.03	0.48
54 – 61 Red Lion St. 1	J1	23	0.01	0.33
54 – 61 Red Lion St. 2	J2	11.5	0.01	0.34
54 – 61 Red Lion St. 3	J3	1.5	0.01	0.35

20 Sandland St. 1	K1	18	0.02	0.28
20 Sandland St. 3	K2	9	0.02	0.26
20 Sandland St. 2	K3	1.5	0.02	0.26
71 High Holborn 1	L1	45	0.06	0.69
71 High Holborn 2	L2	22.5	0.03	0.35
71 High Holborn 3	L3	1.5	0.03	0.42
246 – 280 High Holborn 1	M1	31	0.02	0.32
246 – 280 High Holborn 2	M2	15.5	0.02	0.32
246 – 280 High Holborn 3	M3	1.5	0.02	0.32
283 – 289 High Holborn 1	N1	35	0.02	0.48
283 – 289 High Holborn 2	N2	17.5	0.01	0.23
283 – 289 High Holborn 3	N3	1.5	0.01	0.22
300 – 309 High Holborn 1	O1	28	0.01	0.25
300 – 309 High Holborn 2	O2	14	0.01	0.18
300 – 309 High Holborn 3	O3	1.5	0.01	0.16
50 – 54 High Holborn 1	P1	31	0.02	0.27
50 – 54 High Holborn 2	P2	15.5	0.01	0.19
50 – 54 High Holborn 3	P3	1.5	0.01	0.19
94 – 99 High Holborn 1	Q1	31	0.03	0.69
94 – 99 High Holborn 2	Q2	15.5	0.03	0.69
94 – 99 High Holborn 3	Q3	1.5	0.03	0.69
94 – 99 High Holborn 4	R1	31	0.01	0.64
94 – 99 High Holborn 5	R2	15.5	0.01	0.65
94 – 99 High Holborn 6	R3	1.5	0.01	0.65
16 – 32 Proctor St. 1	S1	31	0.01	0.61
16 – 32 Proctor St. 2	S2	15.5	0.01	0.61
16 – 32 Proctor St. 3	S3	1.5	0.01	0.61

5 Mitigation

5.1 Operation

The applicant has designed in mitigation following the GLA's Supplementary Planning Guidance on Sustainable Design and Construction, following the energy hierarchy and proposing low NOx boilers. Their effect has been shown to be not significant at any receptor and therefore no further mitigation is required or proposed.

6 Conclusion

This addendum to the air quality assessment which accompanied a planning application for the Proposed Development at Templar House, High Holborn, London Borough of Camden (LBC) assessed impact at the development of traffic and the proposed combustion plant, and assessed the impact of the combustion plant on nearby receptors.

The assessment is conservative in several respects, in particular it has assumed no improvement in background concentrations and vehicle emissions between 2016, the year modelled, and the first year of opening of the Site.

Development consented from 2014 within 500m of the Site have been reviewed for installation of a boiler or CHP. The only potentially significant scheme is the one at Beckley House, 71 High Holborn. In this application communal heating and domestic hot water production was replaced by individual low NOx boilers. Therefore, there are no committed developments to be modelled explicitly.

The London Council's Air Quality Planning Guidance at paragraph 2.4 describes domestic and commercial sources as area sources. Modelling nearby commercial and domestic sources as an area source would double count the impact of the sources, and therefore a contribution would have to be subtracted from the background concentration beforehand. As the background concentration already includes the impact of nearby combustion sources they have not been modelled explicitly, but have used the unchanged background.

6.1 Significance of Effects

The maximum predicted annual mean concentration is 0.13µg/m^3, predicted at receptors A1, A2 and A3 on Templar House. As the concentration is less than 0.2µg/m^3, according to the IAQM significance test the impact is negligible and therefore **not significant**.

The maximum predicted 99.79th percentile concentration is 0.79µg/m^3, predicted at receptors E1, E2 and E3 at 65 – 70 Red Lion St. As the concentration is less than 20µg/m^3, according to the IAQM significance test the impact is negligible and therefore **not significant**.

According to the London Council's Air Quality and Planning Guidance, in areas where the predicted total concentration is over 5% more than the air quality objective for NO_2, i.e. higher than 42µg/m^3, that:

> "Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further.
>
> Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures."

At roadside locations in the vicinity of the Site 42µg/m^3 is exceeded due to existing traffic sources. The applicant has designed in mitigation following the GLA's Supplementary Planning Guidance on Sustainable Design and Construction, following the energy hierarchy and proposing low NOx boilers.

In the previous report the proposed development was shown to be Air Quality Neutral.

Overall the proposed development has been found to be not significant in terms of effect on air quality.