British Land Property Management Limited

1 Triton Square & St Anne's

Air Quality Assessment Addendum

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1 Introduction

1.1 Context

Ove Arup and Partners Ltd (Arup) has been commissioned by British Land Property Limited (British Land) to prepare an addendum to the air quality assessment which accompanied a planning application for the Proposed Development at 1 Triton Square in the London Borough of Camden (LBC).

LBC requested dispersion modelling be carried out to assess the air quality to which new residential users of the proposed development will be exposed and required mitigation be proposed. It was also requested that the residual risk level to construction impacts, after the application of mitigation, be specified.

2 Assessment Methodology

2.1 Operational Assessment Method

2.1.1 Road traffic

The screening of traffic data in the air quality assessment showed that the additional traffic generated by the proposed development fell below the threshold given in the 2015 Land-Use Planning & Development Control guidance document[1] produced by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM).

The new residential receptors lie at the corner of Longford Street and Laxton Place, which are roads with low volumes of traffic. They are located 150m from Osnaburgh Street (A4201), 170m from Euston Road (A501) and 220m from Hampstead Road (A400). As such, the local impact of those major roads will be negligible, however, the impact of the major and minor roads is well represented by the Defra background concentrations which are in line with monitored urban background concentrations.

2.1.2 Combustion Plant

Heating and hot water for the new development will be supplied by five 750kW thermal output boilers with the exit flue 4.1m above level of the plant maintenance and 1m above the local roof.

The plant to be used are likely to be Hoval UltraGas 900D boilers and data from these plant have been used in the modelling. It has been assumed as a very conservative (pessimistic) assumption that all the boilers operate at 100% load, continuously, all year.

2.1.3 Dispersion Modelling Procedure for Combustion and Fume Cupboard Emissions

Emissions from the boilers were modelled using an industry standard atmospheric dispersion model, ADMS 5 (version 5.1.2.0), to calculate resulting concentrations of NO_2. As the boilers are proposed to be gas-fired, emissions of particulate matter would be negligible and therefore this pollutant has been scoped out of the assessment.

The modelling procedure was as follows:

- Information on stack dimensions and position, and boiler operating conditions, were obtained for the Proposed Development;
- Appropriate data to describe meteorological conditions in the vicinity of the Site was obtained, as discussed in section 2.1.7 for the year 2015;

[1] EPUK/IAQM (2015) Land-Use Planning & Development Control: Planning for Air Quality

- A receptor grid of potentially sensitive locations was identified in the vicinity of the installation;
- Information on buildings surrounding the development was obtained;
- The above information was used as input to the dispersion model;
- The dispersion model was run to determine pollutant concentrations in the vicinity of the Site. The interpretation of the results was based on the modelled concentrations at potential receptor locations; and
- The study results were compared with the relevant assessment criteria.

The model calculates NO_x concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NO_x 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 NO_x or NO. A suitable NO_x to NO_2 conversion has been applied to the modelled NO_x concentrations in order to determine the impact of the NO_x emissions on ambient concentrations of NO_2. This assessment followed the methodology set out by the EA which states it should be assumed as a worst case scenario that 70% of long-term and 35% of short-term NO_x concentrations will convert to NO_2[2].

2.1.4 Boiler Emissions

The efflux and emissions data for each boiler are given in Table 1. Five identical boilers located at the same point have been modelled.

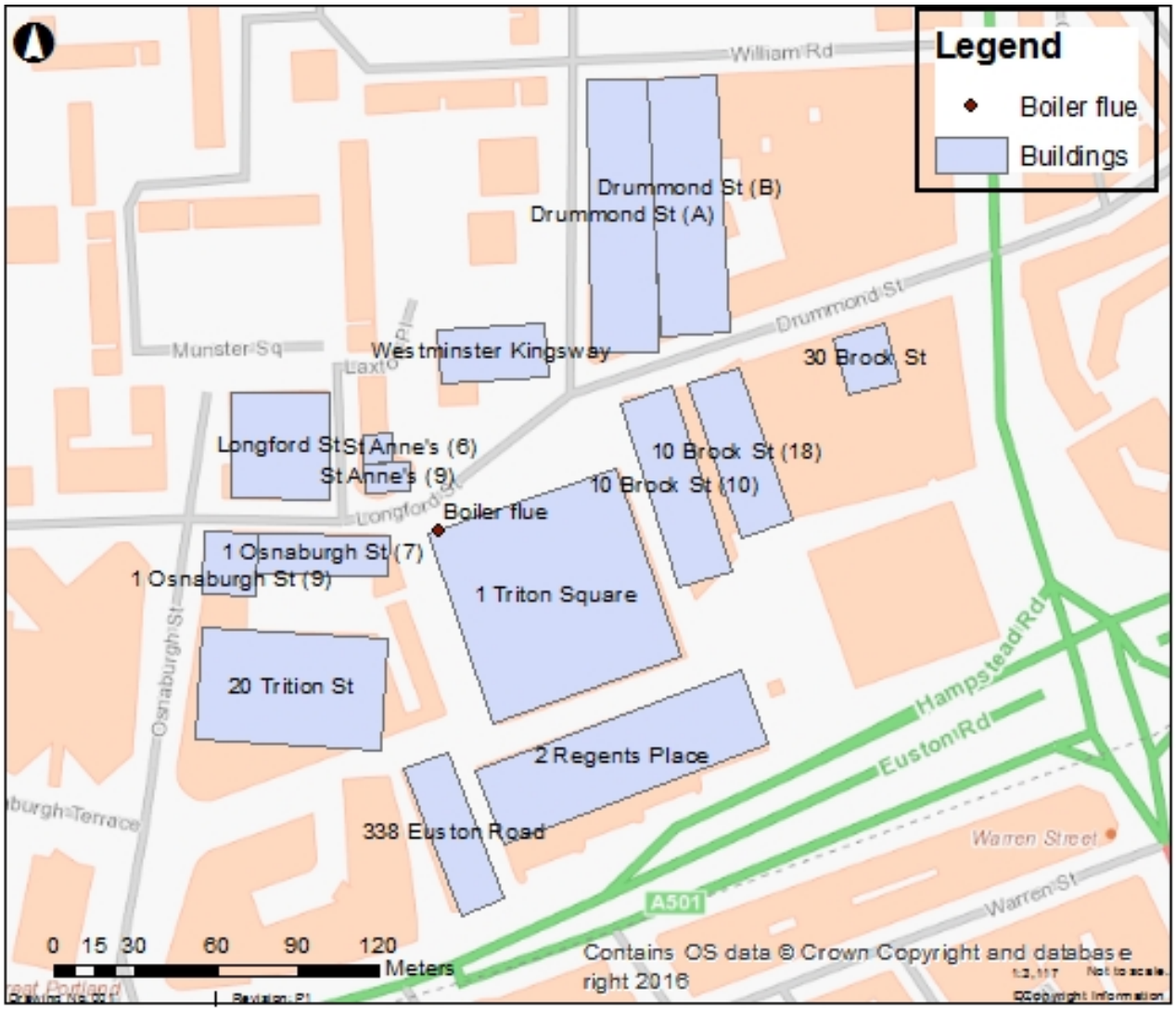
The location of the proposed boiler flue and the surrounding buildings are shown in Figure 1.

Table 1: Boiler efflux and emissions data for each boiler

Parameter	Units	Boiler parameters
Height	m	42.45
Flue diameter	m	0.2
Flue gas efflux velocity	m/s	11.7
Temperature	˚C	71
NO_X emission rate	g/s	0.0088

[2] Environment Agency; *Air Quality Modelling and Assessment Unit, Conversion ratios for NO_x and NO_2*

Figure 1: Modelled stacks and buildings



2.1.5 Sensitive Receptors

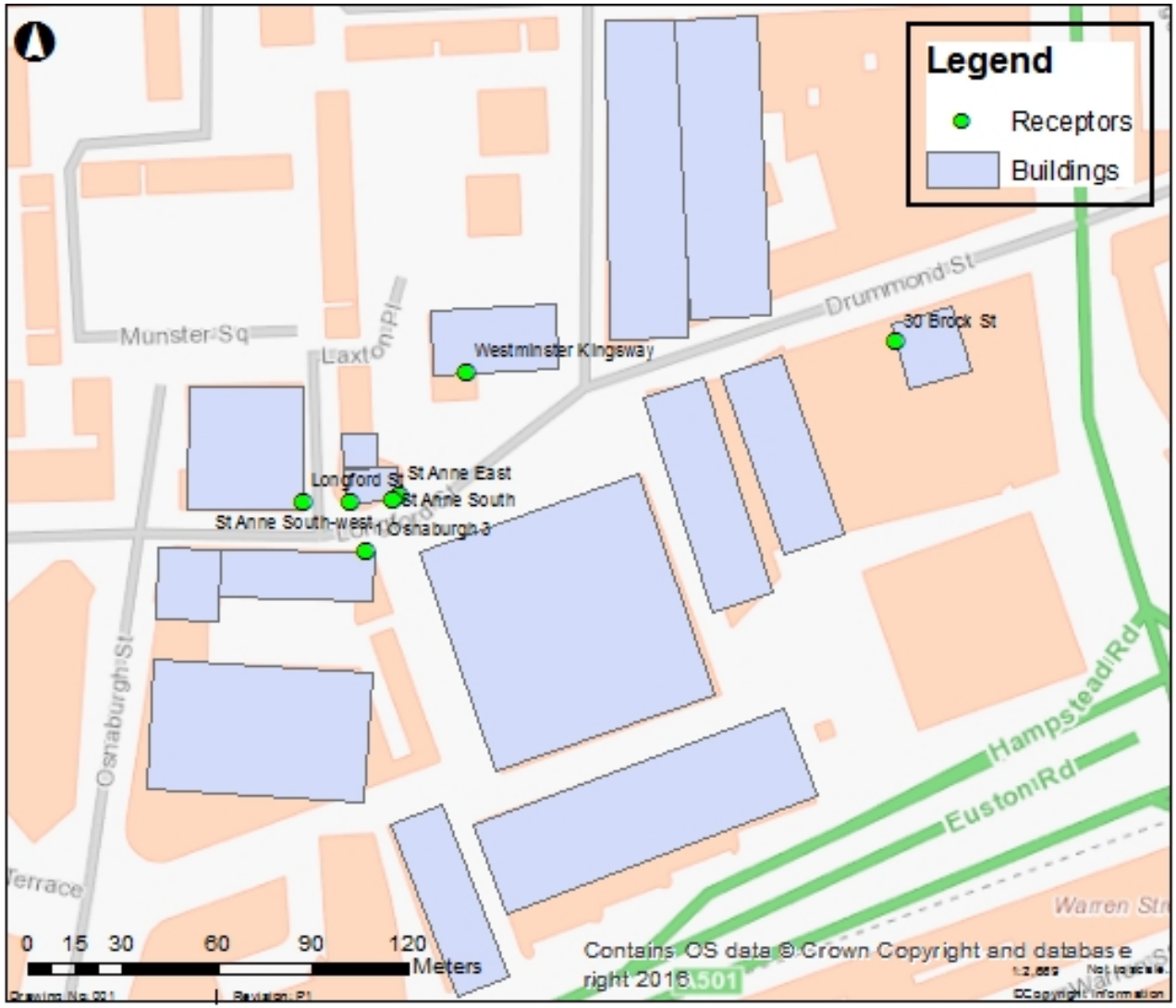
Sensitive receptors have been selected at worst case locations in the area surrounding the Site and are shown in Figure 2. Their details are presented in Table 2.

Receptors R1 to R9 represent the new residential receptors on the site of the St Anne's church and church centre. R10 to R15 represent existing residential receptors. Receptors have been modelled at a range of heights to represent the roof terrace and sixth floor terrace. The development also has (open) balconies facing the streets. A height of 1.5m was used to represent human inhalation height above any floor level.

Table 2: Sensitive receptors

Receptor name	Receptor ID	OS Grid Ref.		Height (m)	Existing or Future
		X	Y		
St Anne East 1	R1	529006	182397	28.5	Future
St Anne East 2	R2	529006	182397	19.5	Future
St Anne East 3	R3	529006	182397	1.5	Future
St Anne South 1	R4	529004	182395	28.5	Future
St Anne South 2	R5	529004	182395	19.5	Future
St Anne South 3	R6	529004	182395	1.5	Future
St Anne South-west 1	R7	528991	182395	28.5	Future
St Anne South-west 2	R8	528991	182395	19.5	Future
St Anne South-west 3	R9	528991	182395	1.5	Future
1 Osnaburgh 1	R10	528995	182380	26.5	Existing
1 Osnaburgh 2	R11	528995	182380	14.0	Existing
1 Osnaburgh 3	R12	528995	182380	1.5	Existing
30 Brock St	R13	529163	182445	42.3	Existing
Longford St	R14	528976	182395	17.0	Existing

Figure 2: Sensitive receptors



2.1.6 Buildings

The presence of buildings can affect dispersion, but complex building arrays are not well-represented by models such as ADMS, while dispersion under a range of meteorological conditions is not well modelled by the computational fluid dynamics models which can represent the details of geometry well. A sensitivity analysis was carried out to test which buildings should be modelled.

Table 3 gives the parameters of the buildings close to the boiler flue at 1 Triton Square and the buildings are shown in Figure 1. All of these buildings were included in the model as rectangles rather than their actual more complex shapes, as ADMS 5 can only accept input buildings that are rectangular or circular in cross-section.

ADMS models buildings by making one effective building from the buildings input to the model, subject to certain criteria. When the model was run with all the buildings, and 1 Triton Square as the "main" building, the effective building was up to 177m by 150m, and enclosed the receptors at St. Anne's. For this reason the model results reported here are those with just 1 Triton Square modelled, which is likely to capture the impact of the 1 Triton Square boiler on new receptors at St. Anne's appropriately.

Table 3: Buildings parameters

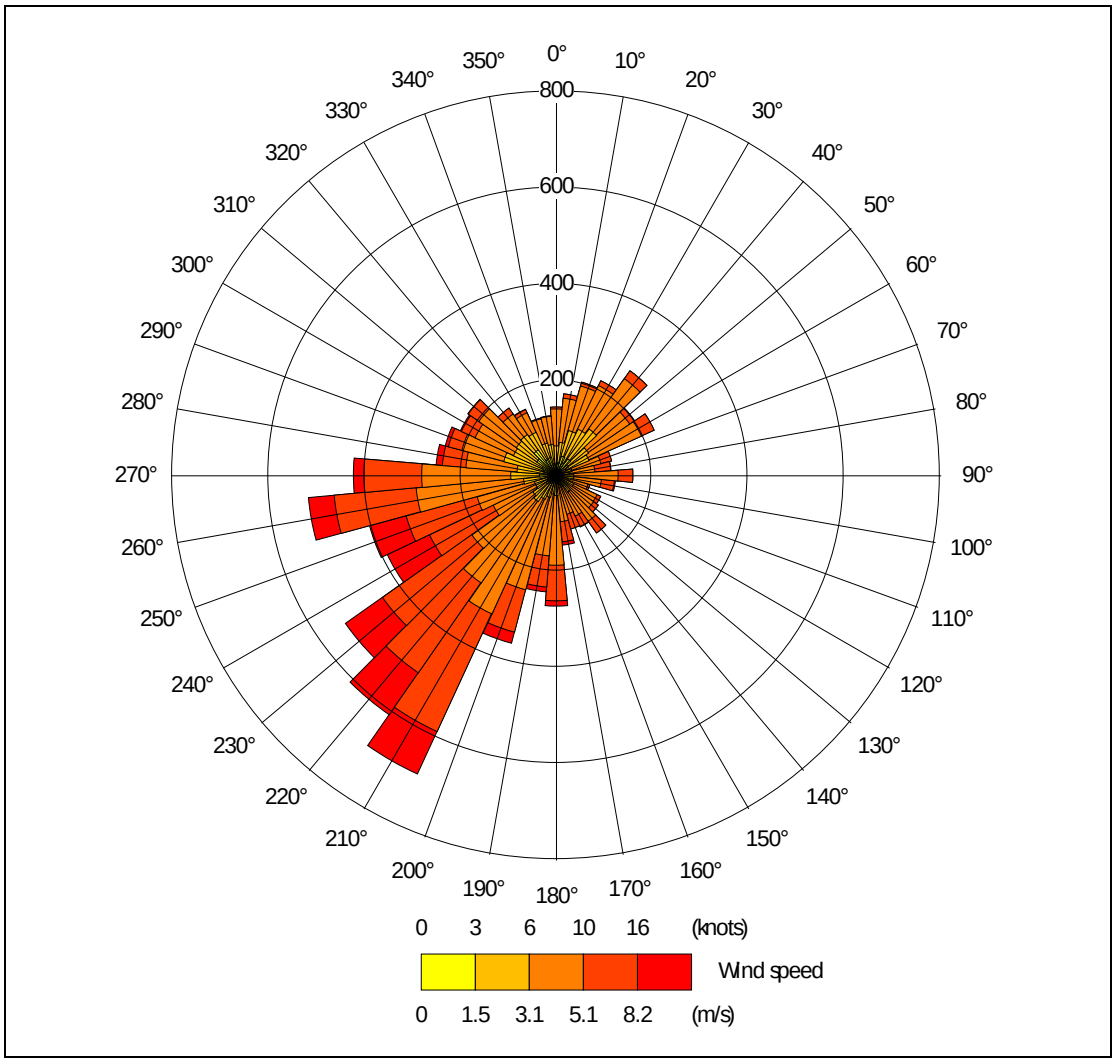
Building name	OS Grid Ref. X	OS Grid Ref. Y	Height (m)	Length (m)	Width (m)	Angle of building (degrees)
1 Triton Square	529059	182357	42.3	73.8	73.6	71
2 Regents Place	529084	182297	32.0	104.9	29.7	69
10 Brock St (10)	529104	182397	47.0	20.2	71.3	72
10 Brock St (18)	529127	182410	66.0	20.1	59.8	71
30 Brock St	529174	182444	112.0	21.7	19.9	164
St Annes (9)	528997	182401	10.0	10.4	17.0	176
St Annes (6)	528994	182411	10.0	10.7	11.1	178
Westminster Kingsway	529036	182446	17.0	39.8	20.2	87
20 Trition St	528962	182323	42.0	69.1	41.0	93
1 Osnaburgh St (7)	528974	182372	25.0	15.3	48.7	181
1 Osnaburgh St (9)	528939	182369	60.0	23.1	19.6	182
Longford St	528958	182412	18.0	39.0	36.4	181
338 Euston Road	529022	182269	80.0	17.0	58.0	69
Drummond St (A)	529084	182497	17.0	101.0	24.9	179
Drummond St (B)	529109	182501	17.0	94.7	25.7	177

2.1.7 Meteorological Data

Meteorological data used in this assessment was measured at Heathrow Airport meteorological station over the period 1st January 2015 to 31st December 2015 (inclusive). Heathrow Airport is located approximately 20km south-west of the

proposed development. This meteorological site is considered the most suitable for this assessment. Figure 3 shows the wind rose for the 2015 data. It can be seen that the predominant wind direction is south-westerly.

Figure 3: Heathrow Airport wind-rose, 2015



Defra's LAQM.TG16 guidance recommends that the meteorological data file is tested within 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 exceedences. The guidance recommends that meteorological data should only be used if the percentage of usable hours is greater than 75% and preferably 90%.

The 2015 meteorological data from Heathrow Airport includes more than 99% of usable data. This is above the 90% threshold and this data therefore meets the requirement of the Defra guidance.

2.1.8 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 > 1 million' with a corresponding value of 100m.

2.1.9 Background Concentrations

Background concentrations refer to the existing levels of pollution in the atmosphere, produced by a variety of sources, such as roads and industrial processes. The Defra website provides estimated background air pollution data for each 1x1km OS grid square for each local authority area. Background maps are available for the base year of 2013 and have been projected to estimate concentrations for each year from 2013 to 2030. The background concentration data is described in section 3.1.

3 Baseline

3.1 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 current year of 2015 and the first year of opening of the proposed development, 2019, have been taken from the latest Defra maps[3] and are presented in Table 4 and Table 5 respectively for the grid square in which the Proposed Development is located.

In 2015, 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 predicted to be below 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 16%-19% to the total NO_X concentration.

Table 4: Estimated background pollutant concentrations for 2016

OS grid square		Annual mean concentration (µg/m^3)			
X	**Y**	**NO_x**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
529500	182500	79.3*	43.6	22.2	15.8

Note:*Major local roads contribute 15.2µg/m^3

Table 5: Estimated background pollutant concentrations for 2019

OS grid square		Annual mean concentration (µg/m^3)			
X	**Y**	**NO_x**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
529500	182500	67.9*	38.7	21.5	15.1

Note:*Major local roads contribute 10.7µg/m^3

[3] Defra, http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html, Accessed September 2016

4 Operational Assessment

4.1.1 Predicted NO_2 Concentration Results

Predicted annual mean NO_2 concentrations at the sensitive receptors are shown in Table 6. The results show the maximum contribution of the boilers to NO_2 concentrations is 0.16µg/m^3 and that is predicted at the existing residential receptors at 30 Brock Street. 30 Brock Street lies in the predominantly downwind direction from the flue. The maximum predicted concentration at the new residential receptors is 0.13 µg/m^3, which is less than 0.5% of the air quality objective.

Assuming 2015 background levels of NO_2 persist, the concentration at the St Anne's receptors would exceed the concentrations at all receptors would be above the NO_2 annual mean air quality objective of 40µg/m^3, reaching 43.7µg/m^3 at St Anne's. If background concentrations decrease as predicted by Defra, the objective would not be exceeded at any residential receptor. The maximum predicted concentration at St Anne's would be 38.8µg/m^3.

Table 6: Predicted annual mean NO_2 concentrations (µg/m^3)

Receptor name	Receptor ID	Height (m)	Predicted process contribution (µg/m^3)	Total concentration (2015 background) (µg/m^3)	Total concentration (2019 background) (µg/m^3)
St Anne East 1	R1	28.5	0.13	43.7	38.8
St Anne East 2	R2	19.5	0.13	43.7	38.8
St Anne East 3	R3	1.5	0.13	43.7	38.8
St Anne South 1	R4	28.5	0.12	43.7	38.8
St Anne South 2	R5	19.5	0.12	43.7	38.8
St Anne South 3	R6	1.5	0.12	43.7	38.8
St Anne South-west 1	R7	28.5	0.09	43.7	38.8
St Anne South-west 2	R8	19.5	0.09	43.7	38.8
St Anne South-west 3	R9	1.5	0.09	43.7	38.8
1 Osnaburgh 1	R10	26.5	0.12	43.7	38.8
1 Osnaburgh 2	R11	14.0	0.12	43.7	38.8
1 Osnaburgh 3	R12	1.5	0.12	43.7	38.8
30 Brock St	R13	42.3	0.16	43.8	38.9
Longford St	R14	17.0	0.08	43.7	38.8

5 Mitigation

5.1 Construction

The dust emitting activities were assessed in the air quality assessment to be high risk. The mitigation proposed were the site specific mitigation measures for *high risk* sites according to the IAQM guidance. High risk mitigation measures were included as a precautionary measure. For the activity-specific measures, the relevant highly recommended and desirable mitigation has been recommended to ensure best practice is followed for all on site activities. The measures proposed in the air quality assessment are included as part of the Construction Management Plan for the site which has been submitted with this application.

After application of these measures the impact of the construction dust and PM_{10} would be reduced to negligible and not significant.

5.2 Operation

The predicted impact of the boiler emissions is negligible. Whether new residential receptors are exposed to concentrations greater than the air quality objective depends on the extent to which background concentrations reduce. It is proposed that all the new dwellings have mechanical ventilation, filtering the air intake to remove particulates and using a carbon filter to reduce NO_2 concentration. It is proposed that the balconies be left open.

6 Conclusion

This report forms an addendum to the air quality assessment which accompanied the planning application for the Proposed Development at 1 Triton Square & St Anne's in the London Borough of Camden (LBC). LBC requested dispersion modelling be carried out to assess the air quality to which new residential users of the proposed development will be exposed and required mitigation be proposed. It was also requested that the residual risk level to construction impacts, after the application of mitigation, be specified.

The dust emitting activities were assessed in the air quality assessment to be high risk. After application of the mitigation measures specified in the report the impact of the construction dust and PM_{10} would be reduced to negligible and not significant.

The predicted impact of the boiler emissions is negligible. Whether new residential receptors are exposed to concentrations greater than the air quality objective depends on the extent to which background concentrations reduce. It is proposed that all the new dwellings have mechanical ventilation, filtering the air intake to remove particulates and using a carbon filter to reduce NO_2 concentration. It is proposed that the balconies be left open.