9 Air Quality

9.1 Introduction

9.1.1 This chapter of the ES was prepared by Mayer Brown Ltd and assesses the Development for the Site suitability for residential health and amenity and any potential air quality impacts on the local area as a result of the Development.

9.1.2 The chapter is supported by Appendix 9.1: Air Quality Assessment.

Competence

9.1.3 This impact assessment was prepared by Raquel Villasante, an environmental consultant and an Associate of the Institute of Air Quality Management (IAQM) and a member of the Institution of Environmental Science (IES) and Andrea Hughes, BSc MSc who is a member of both IAQM and IES. Raquel primarily undertakes environmental monitoring and modelling and Andrea has worked in the environmental assessment industry for 18 years, specialising in the field of air quality assessment.

9.2 Legislation, Planning Policy and Guidance

9.2.1 The legislation, policy and guidance which has been used in the production of this assessment is summarised below and set out in detail within Appendix 9.1.

Legislation Context

- The Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC[1];
- The Air Quality Standards Regulations 2010[2];
- The Environment Act 1995[3];
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[4]; and
- Non-Road Mobile Machinery Regulations[5].

Planning Policy Context

National

- The National Planning Policy Framework (NPPF)[6] (updated February 2019)[7];
- The National Planning Practice Guidance – Air Quality[8]; and
- The National Planning Practice Guidance – Environmental Impact Assessment[9].

Regional

- The London Plan (2016)[10];
- The Draft London Plan showing minor suggested changes (2018)[11];
- The Mayor’s Air Quality Strategy (MAQS)[12];
- Sustainable Design and Construction Supplementary Planning Document (2016)[13]; and
- London Environment Strategy[14].

9.2.2 The relevant London Plan policies are:

- Policy 5.1 'Climate change mitigation';
- Policy 5.2 'Minimising carbon dioxide emissions';
- Policy 5.3 Sustainable design and construction;
- Policy 6.3 Assessing the effects of development on transport capacity; and
- Policy 7.14 Improving Air Quality and under planning decisions.

Local

- Barnet's Local Plan – Core Strategy (2012)[15];
- Barnet's Local Plan – Development Management Policies (2012)[16];
- Sustainable Design and Construction Supplementary Planning Document (2016)[17]; and
- LB Barnet's Planning Brief for Pentavia Retail Park, Mill Hill[18].

Guidance

9.2.3 The following guidance has also been taken in to consideration in the development of this chapter:

- Planning Practice Guidance[19];
- Defra UK-Air The Local Air Quality Management Tools[20];
- DCLG AQM Background Maps[21];
- GLA London Local Air Quality Management (LLAQM) Technical Guidance, TG (16)[22];
- GLA The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance[23];
- GLA Air Quality Neutral (AQN) Planning Support Update: GLA 80371 (Air Quality Consultants and Environ, 2014)[24];
- GLA Sustainable Design and Construction Supplementary Planning Guidance (SPG)[25];
- EPUK and IAQM Land-Use Planning and Development Control: Planning for Air Quality (2017)[26];
- IAQM Guidance on the assessment of dust from demolition and construction (IAQM Construction Guidance)[27];
- National Atmospheric Emissions Inventory[28]; and
- London Council Air Quality and Planning Guidance[29].

9.3 Assessment Methodology

Consultation

9.3.1 As set out in Chapter 2: EIA Methodology, a scoping note was submitted to the GLA, which confirmed topics that would be assessed during the EIA process. The scope and approach for this assessment was informed by an earlier scoping study, subsequent 2016 ES and 2017 ES Addendum. LB Barnet and the GLA did not raise an additional potential effects for consideration during the EIA process and therefore the proposed scope was considered to be acceptable for the Development. Table 9.1

summarises key comments raised by consultees of relevance to this assessment and how the assessment responded to them.

Table 9.1: Consultation Response Summary

Consultee (Date) and Comment	Response
LB Barnet	
Commented upon the significant pollutant sources of the adjoining M1 and A1 Watford Way, which could potentially affect any new receptors associated with the Development. It was requested that any detrimental air quality effects identified were to be fully addressed and that any mitigation works proposed were required to be assessed for their effectiveness.	The requirements set out within the scoping opinion were taken into account within the assessment.
LB Barnet Scientific Services - e-mail (8 January 2016)	
Email consultation with members of Barnet Scientific Services took place in order to discuss and agree the siting of the real time air quality monitor and placement of diffusion tubes.	These requirements were taken into account during the subsequent siting of the monitoring equipment.
LB Barnet Scientific Services – pre-application meeting (11 November 2016)	
Meeting with LB Barnet including a representative of the Scientific Services. Discussed the Site issues and the concerns over air quality.	A detailed suite of on-site monitoring was agreed to quantify the existing levels of air pollutants. This included the siting of a real-time nitrous oxide monitor, a tapered element oscillating microbalance (TEOM) particulate monitor and nine NO_2 diffusion tubes located around the Site (Figure 9.1).
Greater London Authority - planning report (5 December 2016)	
Concerns were raised regarding air quality within the children's and young person's play areas and over aspects of the air quality mitigation design. A request was made that the air quality neutral assessment use transport factors for outer London, rather than inner London. Further detail was requested on the adopted modelling approach and of any proposed offsetting measures.	The children's and young person's play areas were assessed and this is presented in this assessment. Details of the mitigation measures proposed, in particular the scheme of whole house ventilation for all units with air intake taken from areas of 'clean' air, are provided in section 9.5. The full Air Quality Neutral Assessment, which uses transport factors for outer London, is included in Appendix 9.1. Further details on the adopted modelling approach was supplied in an email to the GLA on 19th December 2016 and subsequent discussions.
LB Barnet consultation comments received 9 December 2016	
Further technical inputs into the dispersion model were requested and the preferred mitigation options were put forward. An assessment of	All guidance suggested was applied, excepting the Technical Guidance Note D1 (Dispersion) 'Guidelines on Discharge Stack Heights for Polluting Emissions'

Consultee (Date) and Comment	Response
construction dusts was also requested. Further detail on the achievement of air quality neutrality was requested along with a scheme for air pollution mitigation measures. A list of suitable guidance to be applied was given. Details of the boilers specified were requested prior to installation and air quality assessment of the proposed Cogeneration plant was also requested. Further discussions with the GLA air quality officer were requested.	which is out of print and considered by Defra to have the potential for underestimation of chimney heights. Further technical inputs were provided along with: boiler parameters that are in line with the requirements of the London Plan SPG, an air quality assessment of the Cogeneration Plant and more detail of the proposed mitigation measures (Appendix 9.1).
Greater London Authority - email correspondence (19 December 2016), telephone correspondence (10 January 2017), email correspondence (9 March 2016), further telephone correspondence (20 March 2017)	
Mayer Brown's email and specific concerns were discussed. Further information was provided verbally on the modelling methodology applied, the further works proposed and the scheme of mitigation regarding whole house ventilation. The GLA was generally satisfied, but wished to review the works in further detail before commenting further.	The requested further information was provided and the approach agreed upon. Further discussions were undertaken within the design team with regards to providing fully sealed windows on facades facing the M1/A1 Watford Way (see section 9.5). All requirements discussed were taken into account in this assessment.
LB Barnet (13 March 2017)	
Concerns raised related to: location of Mechanical Ventilation and Heat and Recovery (MVHR) intakes and the need for filtration systems within the MVHR. It was also requested that windows were sealed where NO_2 outside are likely to be excess of objective levels.	Letter response provided 28 March 2017 confirmed that: intakes were at balcony level on the inner facade where air quality was estimated to be between 16% and 30% below objective levels depending on height; filtration was not deemed necessary given the estimated pollution levels at the inlet locations; and agreed that facades would be sealed for locations exceeding NO_2 objective levels. Further discussion was provided on the need to maintain the ability for purge ventilation.
Greater London Authority (4 December 2018)	
A peer review document, prepared by AQ Consultants, of the submitted air quality assessment works to date was provided.	The comments made within the review and the requests for further supporting data were incorporated in this assessment.

Study Area and Scope

Spatial Scope

9.3.2 The spatial scope for air quality was set by identifying those receptors, which could be affected by virtue of traffic or emissions associated with the Development. These receptors include residential properties, schools, nurseries and other potentially sensitive existing and future / proposed receptors within the Site and surrounding area and are illustrated Figure 9.2.

9.3.3 The assessment of air quality effects upon identified sensitive receptors was based on the following:

- Establishing baseline air quality conditions and identifying sensitive receptors in the vicinity of the Site;
- Assessing air quality emissions and the magnitude and significance of dust levels generated during the demolition and construction works associated with the Development;
- Assessing the suitability of the Site for residential development in terms of the baseline and future air quality;
- Considering air quality effects associated with the Development including road traffic and Cogeneration Plant and boiler emission sources;
- Identifying necessary and appropriate mitigation; and
- Assessing the significance of any residual air quality effects.

9.3.4 The main pollutants of concern associated with road traffic emissions are NO_2 and PM_{10} due to their adverse impact on human health. LB Barnet have declared an AQMA for the NO_2 annual mean and the PM_{10} daily mean for the entire borough due to elevated concentrations at Golders Green Bus Station and at High Street locations. The assessment focuses on these pollutants.

Temporal Scope

9.3.5 Assessment was undertaken on the current architectural design of the Development and for future years 2021 and 2026. Since the GLA call in of the planning application, further discussion with the GLA and TfL was undertaken, and this approach was agreed, as set out in Chapter 7: Traffic and Transport. The assessment years are as follows:

- The Baseline Year 2016;
- The Future Baseline Year + Committed Development 2021;
- The Future Baseline Year + Committed Development 2021 + Development;
- The Future Baseline Year + Committed Development 2026; and
- The Future Baseline Year + Committed Development 2026 + Development.

Establishing Baseline Conditions

9.3.6 An examination of the existing air quality information for the area, and discussion with LB Barnet Environmental Health, indicated that pollutant levels exceed objectives at locations along the M1 and A1 Watford Way and that they were likely to be exceeded in the vicinity of the Site.

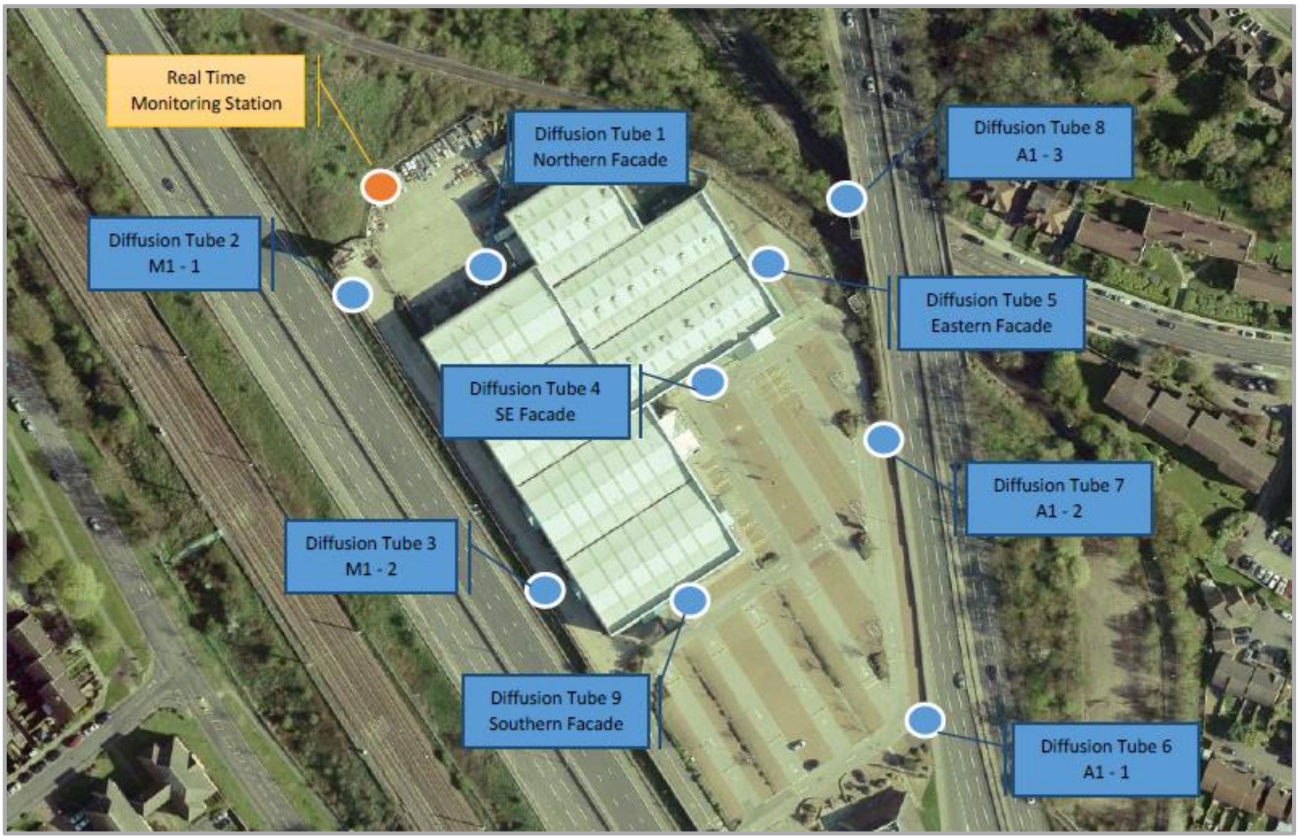
9.3.7 The baseline conditions for the Site and surrounding area were established using the following sources of information:

- Consultation with Barnet's Scientific Services;
- LB Barnet Air Quality Annual Status Report[30];
- Automated 2016 Station data from Air Quality England (AQE);
- Local monitored data within the public domain;

- Site specific monitoring data; and
- Site specific modelled data.

9.3.8 Site specific air quality information was obtained between 18 February and 17 May 2016, using a real-time nitrous oxide and TEOM particulate monitor and nine NO_2 diffusion tubes. This information enabled the likely Air Pollution Exposure Criteria (APEC) to be established and the validation and calibration of the air dispersion model to be completed. This helped to inform any required mitigation strategies. Figure 9.1 provides the air quality monitoring locations.

Figure 9.1: Site Monitoring Locations



9.3.9 Future traffic related air quality is anticipated to improve within Defra prediction models and modelling tools. However, concerns regarding the evidence base for these tools has led to a precautionary approach whereby it is assumed that the future baseline air quality will not improve. This was the approach taken here with the result that 2016 data was used for baseline modelling throughout the assessment process.

9.3.10 The following potentially sensitive receptors, during demolition and construction and once the Development is complete and occupied, were considered:

- During demolition and construction:
  - residents and commercial users of nearby properties (within 350m of the Site boundary); and
  - the Barnet AQMA as indicated by receptors located on Bunns Lane.
- Once the Development is complete and occupied:

- future residents on Site; and
- the Barnet AQMA as indicated by receptors located on Bunns Lane.

Identifying Likely Significant Effects

Construction and Demolition

Construction Dust

9.3.11 There are a number of human receptors within 350m of the Site boundary. A dust assessment was undertaken to identify and minimise potential dust effects. The detailed assessment methodology is set out in Appendix 9.1.

9.3.12 The IAQM Construction Guidance sets out a five-step process to assess the potential impacts of construction dust pre-mitigation, provide mitigation measures specific to the risk and assess the post-mitigation impacts. This approach is broadly replicated within the GLA's Control of Dust and Emissions during Construction and Demolition SPG and provides detail for a clear and concise construction dust assessment.

9.3.13 The assessment procedure is as follows:

- Screen the requirement for a more detailed assessment;
- Assess the risk of dust impacts of the four types of construction activities (demolition, earthworks, construction and trackout), taking into account:
  - the scale and nature of the works, which determines the potential dust emission magnitude; and
  - the sensitivity of the area.
- Determine the site-specific mitigation for the potential activities;
- Examine the residual effects and determine whether or not these are significant; and
- Prepare the construction dust assessment.

9.3.14 In the process of screening the need for a detailed assessment, the following criteria were used:

"An assessment will normally be required where there is:

a 'human receptor' within 350m of the boundary of the site; or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

an 'ecological receptor' within 50m of the boundary of the site; or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)."

9.3.15 This initial screening process highlighted the need for a more detailed assessment. The assessment of the scale and nature of the works and the sensitivity of the area is set out in the Construction Assessment of Effects section.

Construction Phase Traffic Emissions

9.3.16 The IAQM and Environmental Protection UK (EPUK) guidance sets out the criteria which is applied to the quantum of HGV (or heavy-duty vehicles - HDV) movements within an AQMA in order to establish if an air quality assessment is required. The trigger value is advised as:

"a change of HDV flows of more than 25 AADT within or adjacent to an AQMA".

9.3.17 It is anticipated that peak construction traffic for the Development is likely to be associated with the demolition and enabling works (Chapter 5: Demolition and Construction) and includes for up to 12 HGVs (24 vehicle movements) during a 24-hour period. Therefore, it is considered that this number of vehicles movements is not high enough to have the potential to cause a significant adverse effect for any local air quality sensitive receptors. As a result, demolition and construction phase road traffic emissions were not considered further within this assessment.

Construction Phase Non-Road Mobile Machinery (NRMM)

9.3.18 Emissions from NRMM will be temporary and localised and will be controlled via the application of the NRMM standards and through good practice mitigation measures (CEMP). For that reason, construction phase NRMM emissions were not anticipated to be significant and therefore were not modelled or considered any further in this assessment.

Operational Development

Rail Emissions

9.3.19 The Midland Main Line Railway runs to the west of the Site alongside the M1. A review was undertaken of the influence that this may have on local air quality. Whilst there is no local PM_{10} data available for this location, Figure 9.3 and Table 9.10 demonstrate that the closest LB Barnet NO_2 diffusion tube monitor to the rail line is PNB5. The value for this diffusion tube was used, along with other site-specific data, to represent a worst-case baseline value. Therefore, it is considered that the influence of the railway line was accommodated within the modelling study.

Road Traffic Emissions

9.3.20 Effect due road traffic emissions associated with the Development were quantified by modelling the traffic flows associated with the proposed scenarios and assessing the difference in pollutant concentrations at specified receptor locations. Traffic data was provided by Velocity Transport Planning and was derived in line with the requirements of the LB Barnet and TfL.

9.3.21 The modelling tool which was used was the dispersion model ADMS Roads. ADMS models are modern dispersion models with an extensive published track record of use in the UK for the assessment of local air quality effects, including model validation and verification studies. Further details of the modelling protocol and assumptions used are set out in Appendix 9.1.

9.3.22 This model uses the following input data:

- Hourly average traffic speeds - derived from London Atmospheric Emissions Inventory (LAEI) and local knowledge;
- 2016 baseline surveyed traffic data provided by Velocity Transport Planning;
- 2021 assessment year traffic data (including committed) with and without the Development, provided by Velocity Transport Planning;
- 2026 assessment year traffic data (including committed) with and without the Development, provided by Velocity Transport Planning;
- 2016 surveyed data for the M1 obtained from the Department for Transport website;
- 2016 data for the A1 Watford Way provided by Velocity Transport Planning;

- Latest relevant Emission Factor Toolkit (v8.0);
- Geo-referenced mapping data; and
- Hourly sequential ADMS format MET data for the closest suitable site of Heathrow, for the year 2016.

9.3.23 Where locations are potentially affected by changes in traffic as a result of Development, the guidance provided by EPUK and IAQM was used to determine the relevance of these changes. The guidance includes criteria which indicate that assessment is required where it is likely that there will be:

"A change in light duty vehicles (LDV) flows of…more than 100 AADT within or adjacent to an AQMA"

9.3.24 A review of the anticipated Development traffic data indicated that these criteria were likely to apply to receptors on:

- Bunns Lane;
- Page Street;
- The Broadway;
- Watford Way;
- Lawrence Street;
- A1 Adjacent;
- Pursely Road;
- Watford Way; and
- Great North Way.

9.3.25 As a result, detailed dispersion modelling was undertaken at sensitive locations adjacent to these roads. These receptor locations are illustrated within Figure 9.2 and the locations are listed in Table 9.2. The findings of this modelling are set out in Section 9.7, Tables 9.12 – 9.15 and 9.30 – 9.31.

Figure 9.2: Local Receptor Locations

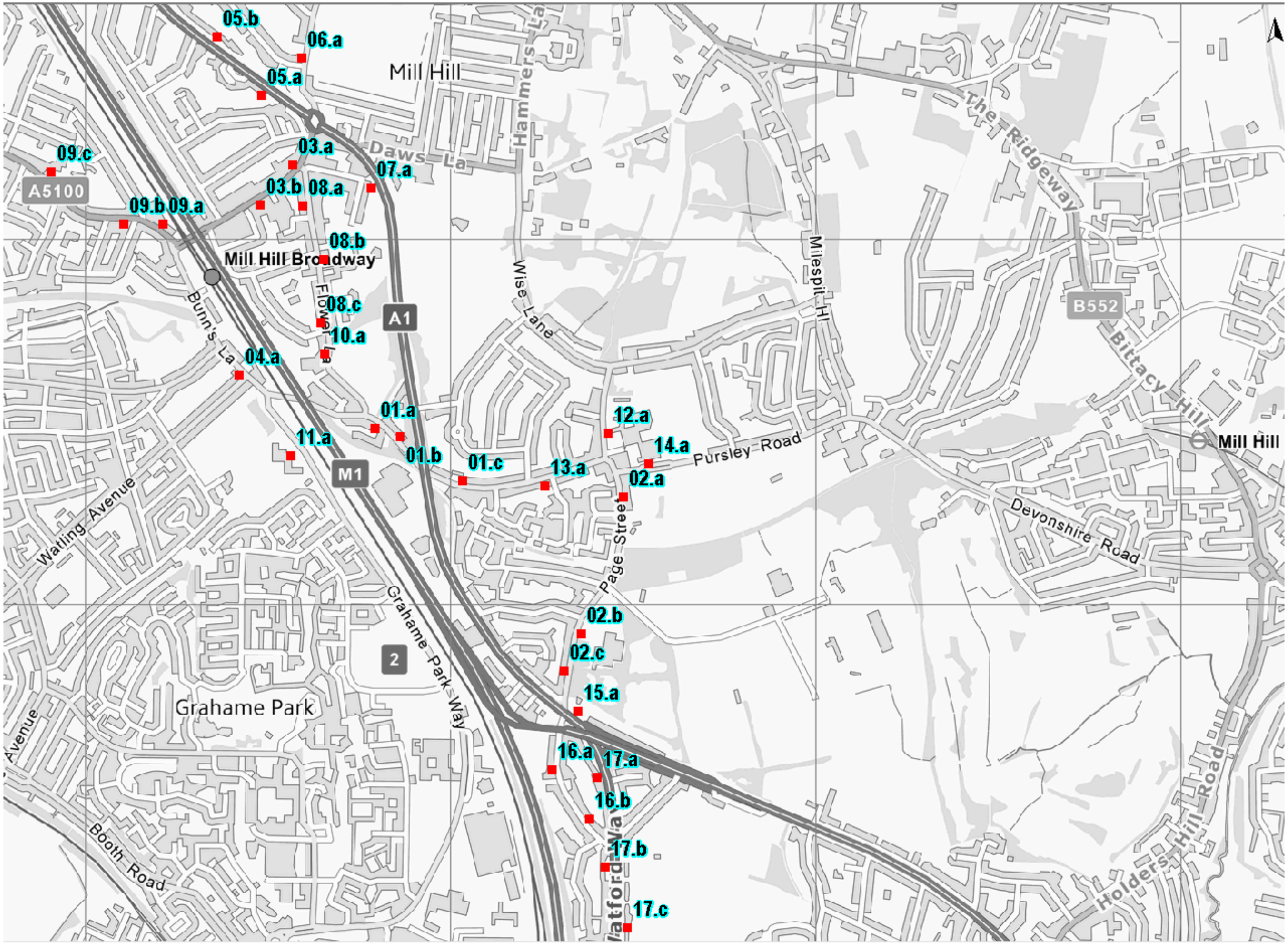


Table 9.2: Receptor Locations

Receptor Number	Receptor Location
01.a	95 Bunns Ln
01.b	86 Bunns Ln
01.c	54 Bunns Ln
02.a	Mardale Court
02.b	49 Page St
02.c	9 Page St
03.a	97-101 The Broadway
03.b	The Old Garages
04.a	9 Bunns Lane
05.a	A1 adjacent
05.b	582 Watford Way
06.a	198 Lawrence Street
07.a	1 Hartley Close
08.a	12 Flower Lane
08.b	37 Flower Lane
08.c	64 Flower Lane
09.a	2 Hale Lane
09.b	39 Hale Lane
09.c	68 Hale Lane
10.a	80 Flower Lane
11.a	33 Grahame Park Way
12.a	145 Page Street
13.a	39 Bunns Lane
14.a	12a Pursley Road
15.a	487 Watford Way
16.a	51 Hall Lane
16.b	14 Hall Lane
17.a	449 Watford Way
17.b	375 Watford Way
17.c	332 Watford Way

Site Suitability

9.3.26 The effect of the proposed building facades upon existing road traffic emissions was assessed within the ADMS model by modelling the M1 and A1 Watford Way as 'canyon' environments, using the new 'Advanced Canyon' technique within ADMS Roads. Whilst the road corridors are not classic canyons, they can be described in this way for the purpose of modelling, albeit with one very low, and one very high canyon wall. This method replicates the pollutant dispersion behaviour adjacent to the Development facade and the ability of pollutants to overtop the facade into the amenity/play space.

9.3.27 Assessment was undertaken for the following environments:

- Courtyard amenity/play space areas at ground level;
- Courtyard amenity/play space areas at successive storey heights;
- Block facades facing the M1/A1 Watford Way at ground level; and
- Block facades facing the M1/A1 Watford Way at successive storey heights.

9.3.28 The NO_2 levels associated with the Development layout were assessed using emission factors for the year 2016, albeit taken from the latest emission factor toolkit (V8.0). This is because, whilst it is assumed that future road emissions will be an improvement on current conditions, application of current road traffic emission rates provides an accepted precautionary approach. Only NO_2 concentrations were assessed for site suitability as this is the main pollutant of concern for which validation data is available. The relative fluctuation of NO_2 around the Site will be indicative of likely similar findings for PM_{10} and $PM_{2.5}$, albeit these will be at a lower level.

Undercroft Car Park Emissions

9.3.29 Parking within the Site will be located at the lower ground level. The car park will therefore require appropriate ventilation. This will be achieved with passive ventilation from air within the central amenity spaces which is then vented to the service road. Residents and workers within the lower ground floor parking area are provided with suitable external air. Any car fumes are vented to a location where residents are not anticipated to be exposed.

Operational Energy Centre Plant Emissions

9.3.30 The Energy Centre (EC) is proposed to comprise one Cogeneration unit and two low NO_x boilers. The suggested specifications for these plants were indicated by the project building engineers Chapman BDSP. The specific modelling assumptions are provided in Appendix 9.1.

9.3.31 Discrete dispersion modelling was undertaken to establish the potential for effects from the Energy Centre upon both site-specific receptors and those further afield. The modelling tool which was used was the dispersion model ADMS-Roads Extra, and the specific inputs, parameters and assumptions used are set out in detail within Appendix 9.1. Discussion of the locations modelled is set out under the Operational Assessment of Effects section.

Air Quality Neutral/Positive Emissions

9.3.32 An air quality neutral/positive assessment was undertaken, which examines both building and road traffic emissions associated with the Development for the achievement of Air Quality Neutrality/Positivity.

9.3.33 The GLA AQN Planning Support Update set out that PM_{10} emissions need only be considered for oil and solid fuel use, which is not the case at this Site. Therefore, only NO_x emissions were considered in the assessment.

9.3.34 Total Building Emissions were obtained from the Building Engineers for examination against the requirements of the Mayor's Sustainable Design and Construction SPG. This required the establishment of 'benchmarks' for Site building emissions which are achieved by multiplying the Gross Floor Area (sqm) of the various land uses by the building emission factors provided in the guidance. The Total Building Emissions were compared to the benchmark emissions to assess whether the Development's building emissions are negative, neutral or positive.

9.3.35 Transport emissions were assessed using air quality neutral/positive methods by multiplying the number of residential units for the Development by emission factors to obtain the Transport Emissions Benchmarks for NO_x and PM_{10}.

9.3.36 The Total Transport Emissions were calculated by multiplying the total distance travelled by the relevant emission factors for NO_x and PM_{10}. The Total Transport Emissions were compared with the benchmarked emissions to assess whether the Development's transport emissions are negative, neutral or positive. Further detail is provided in section 9.7 and Appendix 9.1.

Cumulative effects

9.3.37 Details of the schemes included in the cumulative assessment is set out in Chapter 2: EIA Methodology. The effects of the Development in combination with cumulative scheme was assessed by the inclusion of the traffic associated with these schemes within the future years' scenarios.

Determining Effect Significance

Demolition and Construction

9.3.38 The IAQM method for the assessment of construction dusts requires an initial assessment of the likely dust emission magnitude. This is then applied to the sensitivity of the area with regards to:

- dust soiling effects;
- human health effects; and
- ecological effects.

9.3.39 Table 9.3 provides the criteria for establishing the magnitude of dust emission.

Table 9.3: IAQM Dust Emission Magnitude Criteria

Construction Activity	Dust Emission Magnitude Scale		
	Small	Medium	Large
Demolition	Total building volume <20,000m^3, construction material with low potential for dust release, demolition activities <10m above ground, works during wetter months.	Total building volume 20,000-50,000m^3, potentially dusty construction material, demolition activities 10-20m above ground level.	Total building volume >50,000m^3, potentially dusty material, on-site crushing and screening, activities >20m above ground level.
Earthworks	Total site area <2,500sqm, soil type with large grain size, <5 heavy earth moving vehicles active at one time,	Total site area 2,500-10,000sqm, moderately dusty soil type, 5-10 heavy earth moving vehicles	Total site area >10,000sqm, potentially dusty soil type, >10 heavy earth moving vehicles active at one time,

Construction Activity	Dust Emission Magnitude Scale		
	Small	Medium	Large
	bunds <4m high, total material moved <20,000t, works during wetter months.	active at one time, bunds 4-8m high, total material moved 20,000-100,000t.	bunds >8m high, total material moved >100,000t.
Construction	Total building volume <25,000m^3, construction material with low potential for dust release.	Total building volume 25,000-100,000m^3, potentially dusty construction material, on site concrete batching.	Total building volume >100,000m^3, on site concrete batching, sandblasting.
Trackout	<10 HDV* outwards movements in any one day, surface material with low potential for dust release, unpaved road length <50m.	10-50 HDV outward movements in any one day, moderately dusty surface material, unpaved road length 50-100m.	>50 HDV outward movements in any one day, potentially dusty surface material, unpaved road length >100m.

* HDV – Heavy Duty Vehicle (>3.5t),

Note – In each case, not all the criteria need to be met, and that other criteria may be used if justified.

9.3.40 Table 9.4 provides a summary table for defining the sensitivity of the area with regards to human health, soiling potential and ecological effects.

Table 9.4: IAQM Factors for Defining the Sensitivity of an Area

Area Sensitivity	Human Receptors	Ecological Receptors
High	Very densely populated area, 10-100 dwellings within 20m of site. Annual mean concentrations of PM_{10} close to/in exceedance of the national objective (40 µg m^{-3}). Very sensitive receptors, e.g. residential properties, hospitals, schools, care homes.	Internationally or nationally designated site, the designated features may be affected by dust soiling. A location where there is dust sensitive species present.
Medium	Densely populated area, 1-10 dwellings within 20m of site. Annual mean concentrations of PM_{10} below the national objective (>28 µg m^{-3}). Medium sensitivity receptors, e.g. office and shop workers.	Nationally designated site where the features may be affected by dust deposition. A location with a particularly important plant species where its dust sensitivity is unknown.
Low	Sparsely populated area, 1 dwelling within 20m of site. Annual mean concentrations well below the national objectives (<28 µg m^{-3}). Low sensitivity receptors, e.g. public footpaths, playing fields, shopping streets.	Locally designated site where the features may be affected by dust deposition.

9.3.41 Whilst these criteria are derived from those set out by IAQM, professional judgement requires that a further category is considered necessary for this Site. This may be considered as 'driver safety' and relates to the proximity of the A1 Watford Way and M1. This and the above criteria were applied within the assessment of construction dust risk.

Completed and Occupied Development

9.3.42 The significance of any predicted change in local air quality, based on background pollutant concentrations and predicted traffic flows, can be established through the consideration of the following factors:

- the geographical extent (local, district or regional) of impacts;
- their duration (temporary or long term);
- their reversibility (reversible or permanent);
- the magnitude of impact in pollution concentrations;
- the exceedance of standards (e.g. AQS objectives); and
- changes in pollutant exposure.

9.3.43 When determining both the significance of exposure to air pollution and the levels of mitigation required, consideration should be given to the Air Pollution Exposure Criteria (APEC) specified within the London Councils Air Quality and Planning Guidance**Error! Bookmark not defined.** in assessing the sensitivity of the Site. The APEC criteria is set out in Table 9.5.

Table 9.5: Definitions of Site Sensitivity – Air Pollution Exposure Categories

Sensitivity/Value	Applicable Range PM_{10}	Applicable Range PM_{10}
High (APEC C)	Annual mean: > 5% above national objective.	Annual mean: > 5% above national objective. 24 hr: > 1-day more than national objective.
Medium (APEC B)	Annual mean: between 5% below or above national objective.	Annual mean: between 5% above or below national objective. 24 hr: between 1-day above or below national objective.
Low (APEC A)	Annual mean: > 5% below national objective.	Annual mean: > 5% below national objective. 24 hr: > 1-day less than national objective.

9.3.44 Air quality is not well suited to the rigid application of a generic significance matrix to determine the overall significance of a development. Individual receptor sensitivity should also be taken into account. Therefore, professional judgement should be employed throughout, and should include for site specific considerations.

9.3.45 The assessment process takes into account:

- the magnitude of the change (% change of annual mean concentration);
- the concentration relative to the AQS objectives (above or below the objective); and
- the direction of change (adverse or beneficial).

9.3.46 The 2017 IAQM/EPUK guidance has provided impact criteria which are based upon the change in concentration resulting from the Development as a percentage of the objective levels (or Air Quality

Assessment Levels – AQAL). In this case, these are NO_2 and PM_{10} annual mean objective levels of 40 µg m^{-3}. These were adapted to correspond with the impact descriptors being used throughout this chapter and are presented in Table 9.6.

Table 9.6: Impact Descriptors for Individual Receptors

Long-term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Objective Level			
	<1 Negligible	2-5 Low	6-10 Medium	>10 High
Increase with scheme				
Negligible	Negligible	Negligible	Minor	Moderate
75% or less of AQAL (<30 µg m^{-3})	Negligible	Minor	Moderate	Moderate
Low 76-94% of AQAL (30-38 µg m^{-3})	Minor	Moderate	Moderate	Major
Medium 95-102% of AQAL (38-41 µg m^{-3})	Minor	Moderate	Moderate	Major
High 103-109% of AQAL (41 - 44 µg m^{-3})	Moderate	Moderate	Major	Major
Very High 110% or more of AQAL (>44 µg m^{-3})	Moderate	Major	Major	Major

9.3.47 Table 9.7 demonstrates how the proposed significance of potential effects was justified against the magnitude of impacts and the sensitivity of the receptor.

Table 9.7: Significance Matrix

Sensitivity/Value of Receptor	Magnitude of Impact			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

Energy Centre

9.3.48 The EPUK and IAQM Air Quality Planning Guidance notes that for point source emissions, the impacts resulting from short term peak concentrations of those pollutants that can affect health through inhalation are of most concern. It notes that the Environment Agency uses a threshold criterion of

10% of the short-term Air Quality Action Level as a screening criterion for the maximum short-term impact. It concludes that this is a reasonable value to take and adopts it as a basis for defining an impact that is sufficiently small in magnitude to be regarded as having an insignificant effect.

9.3.49 The short-term Air Quality Action Level for NO_2 is 200 µg/m^3. Short-term effects have been modelled as the 99.79th percentile of the short-term annual mean. In accordance with the guidance issued by EPUK, IAQM and the Environment Agency, any short-term concentrations associated with the emissions from the Energy Centre which are of 20 µg/m^3 or less will be considered insignificant.

Evidence Assumptions and Limitations

Monitoring

9.3.50 The baseline survey work was undertaken by the Transport Research Laboratory. Survey work of this nature is potentially subject to human or laboratory error. This was controlled by the use of a survey company accredited to both ISO9001:2008 and ISO14001:2004 standards and analysis of diffusion tubes within the UKAS accredited laboratory GRADKO.

Modelling

9.3.51 A list of the modelling assumptions made during this exercise is set out within Appendix 9.1. The transport modelling assessment focuses on modelling annual mean concentrations. This is due to it being inherently more difficult to make satisfactory predictions for short-term behaviour of pollutants within this environment than it is to model an annual mean value. Modelling of point source emissions of the Energy Centre however, are modelled as short-term concentrations, as discussed above.

9.3.52 Notwithstanding, a calculation was also undertaken of the likely annual average NO_2 concentrations associated with the use of the Energy Centre. This has enabled a consideration of the combined air quality effects of the Energy Centre and traffic changes associated with the Development as a whole.

9.3.53 A validation exercise was undertaken on the transport model. The results are set out in Appendix 9.1.

9.4 Baseline Conditions

Local Air Quality Management

9.4.1 As noted, the whole of the LB Barnet has been an AQMA for the NO_2 annual mean objective and PM_{10} objective since 2001. In 2010, the AQMA was amended to include the one-hour mean for NO_2 due to elevated concentrations at Golders Green Bus Station and at High Street locations. This assessment has focused on the examination of annual means as discussed above. It is generally accepted that exceedance of annual mean is an indication of likely exceedance of the hour mean also.

Automatic Monitoring

9.4.2 LB Barnet undertakes automatic background monitoring of NO_2 and PM_{10} at two locations within the borough; Tally Ho Corner (ABN1) and Chalgrove School (ABN2). The most recent ratified results for these locations (provided by LB Barnet and available on AQE web page) are provided in Table 9.8.

Table 9.8: Automatic Monitored Concentrations

Site No.	Site Name	Site type	2016/2017 – NO_2 (µg/m^3)	2016/2017c – PM_{10} (µg/m^3)

ABN1	Tally Ho Corner	Kerbside	38.8/50.0	23/21.3
ABN2	Chalgrove School	Urban Background	28.0/29.0	18/18

Non-Automatic Monitoring

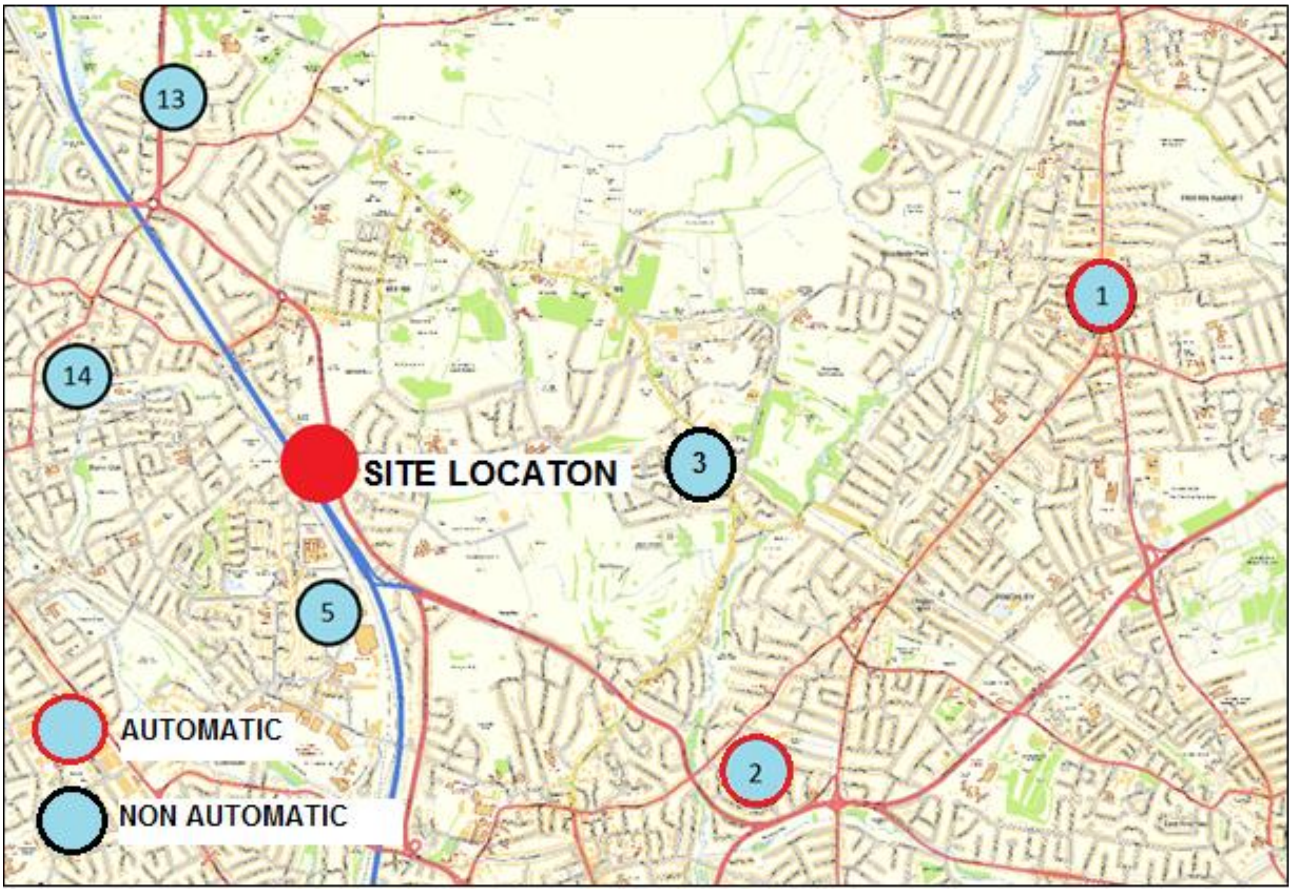
9.4.3 LB Barnet also undertakes non-automatic monitoring of NO_2 across the Borough with the use of 15 diffusion tubes. The most recently published results for the 4 closest tubes to the Site are set out in Table 9.9

Table 9.9: Non-Automatic Monitored Concentrations

Site No.	Site Name	Site type	2016/2017 – NO_2 ($\mu g/m^3$)
PNB 3	Sanders Lane Allotments	Urban Background	21.5/21.0
PNB 5	St James Catholic High School	Urban Background	27.9/27.7
PNB 13	Courtland Avenue, A1	Roadside	36.7/30.1
PNB 14	William Hill, Station Road Edgware	Urban Centre	55.7/50.9

9.4.4 It should be noted that whilst ratified 2017 data was available at the time of assessment; 2016 data was used as a baseline within the modelling processes. The rational for this is provided within Appendix 9.1. The locations set out in Table 9.9 are illustrated in Figure 9.3.

Figure 9.3: LB Barnet Local Monitoring Locations

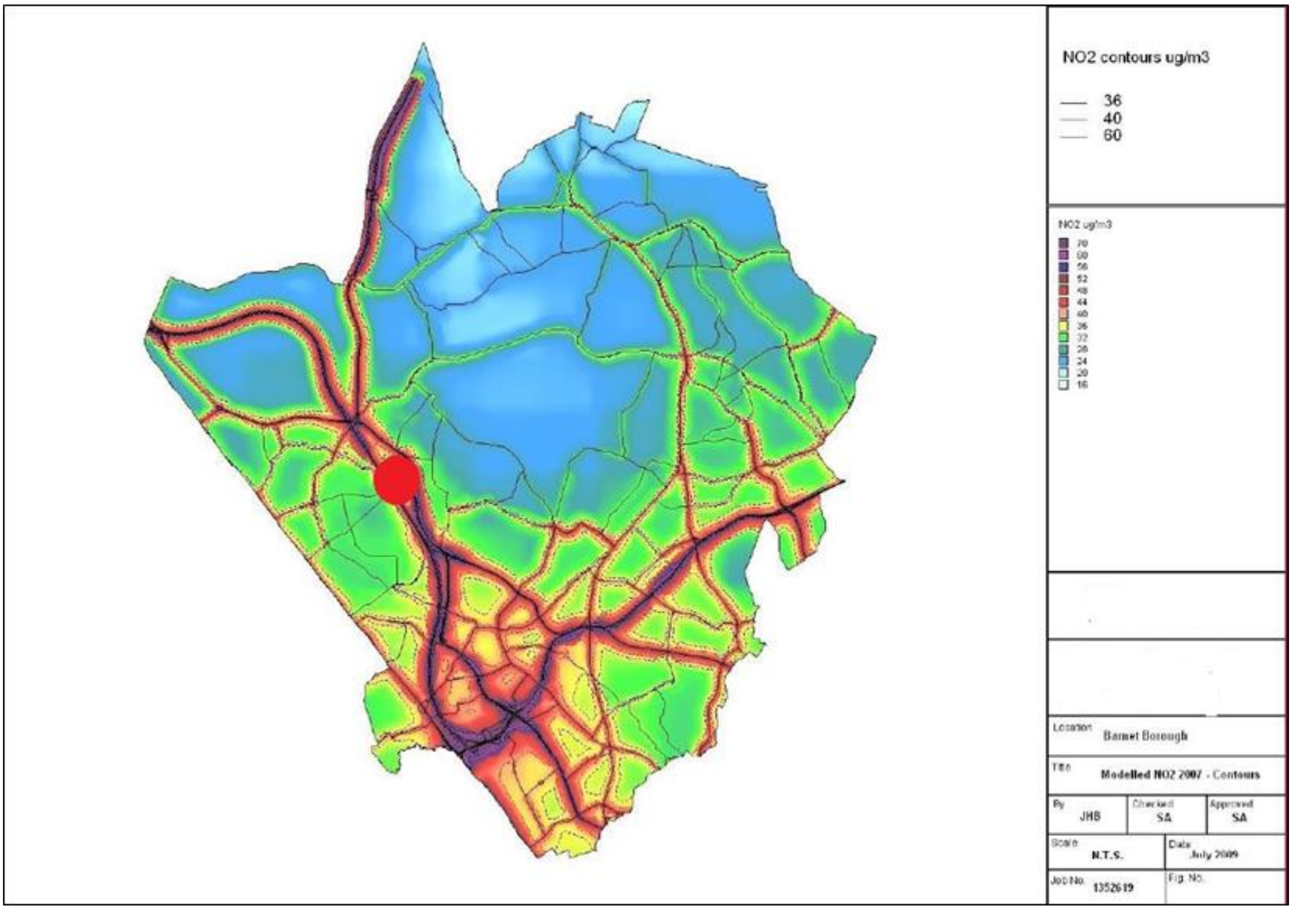


9.4.5 The limited PM_{10} monitoring results indicate that this pollutant is not considered of concern due to the local monitored results being below the 40 µg/m^3 annual mean objective.

9.4.6 The monitored NO_2 levels indicate that the Site is located in an area which experiences high pollution concentrations. Whilst there were no monitoring locations at the Site, the close proximity of the A1 and M1 indicate that it is likely that NO_2 concentrations would be above the annual mean objective of 40 µg/m^3 in close proximity to the road at this location.

9.4.7 This is supported by air quality dispersion modelling undertaken by LB Barnet in 2007 as illustrated in Figure 9.4. It is evident from LB Barnet's modelling exercise that NO_2 concentrations range from 70 to 36 µg/m^3 at the Site, with the majority of the Site appearing to be above the 40 µg/m^3 annual mean objective at that time.

Figure 9.4: LB Barnet Modelled NO_2 Concentrations for 2007



9.4.8 The results of the LB Barnet's monitoring and modelling were compared against the APEC. This review of the predicted pollution levels based on the existing monitored and modelled data potentially puts the Site in APEC C, which indicates that the area is highly sensitive.

Background Data for Modelling

9.4.9 The two sets of corresponding urban background data for NO_2 available from sites ABN2 and PNB3 indicate a worst case 2016 background NO_2 value of 28µg/m^3. This was used in the roadside dispersion modelling exercises within this study. ABN2 also collects data for PM_{10} and this was also used. However, no monitored values are available for $PM_{2.5}$. Therefore, estimates of these values were obtained from the Defra background mapping tool which provides a modelled indication of pollutant background concentrations within the closest appropriate 1 x 1km grid squares to the Site (X:521500, Y:191500 : X:522500, Y:191500).

9.4.10 The NO_2, PM_{10}, and $PM_{2.5}$ background concentrations used within the modelling process are provided in Table 9.10.

Table 9.10: Background Pollutant Concentrations for Roadside Dispersion Modelling

Pollutant	2016 Background Concentrations ($\mu g/m^3$)	Data Source
NO_2	28.0	Local LB Barnet Monitored Data
PM_{10}	18.0	Local LB Barnet Monitored Data
$PM_{2.5}$	13.8	Defra Background Mapping Tool

Baseline Monitoring and Modelling

Local Monitoring

9.4.11 Further local air quality monitoring was undertaken in the vicinity of the Site. This is considered in further detail below.

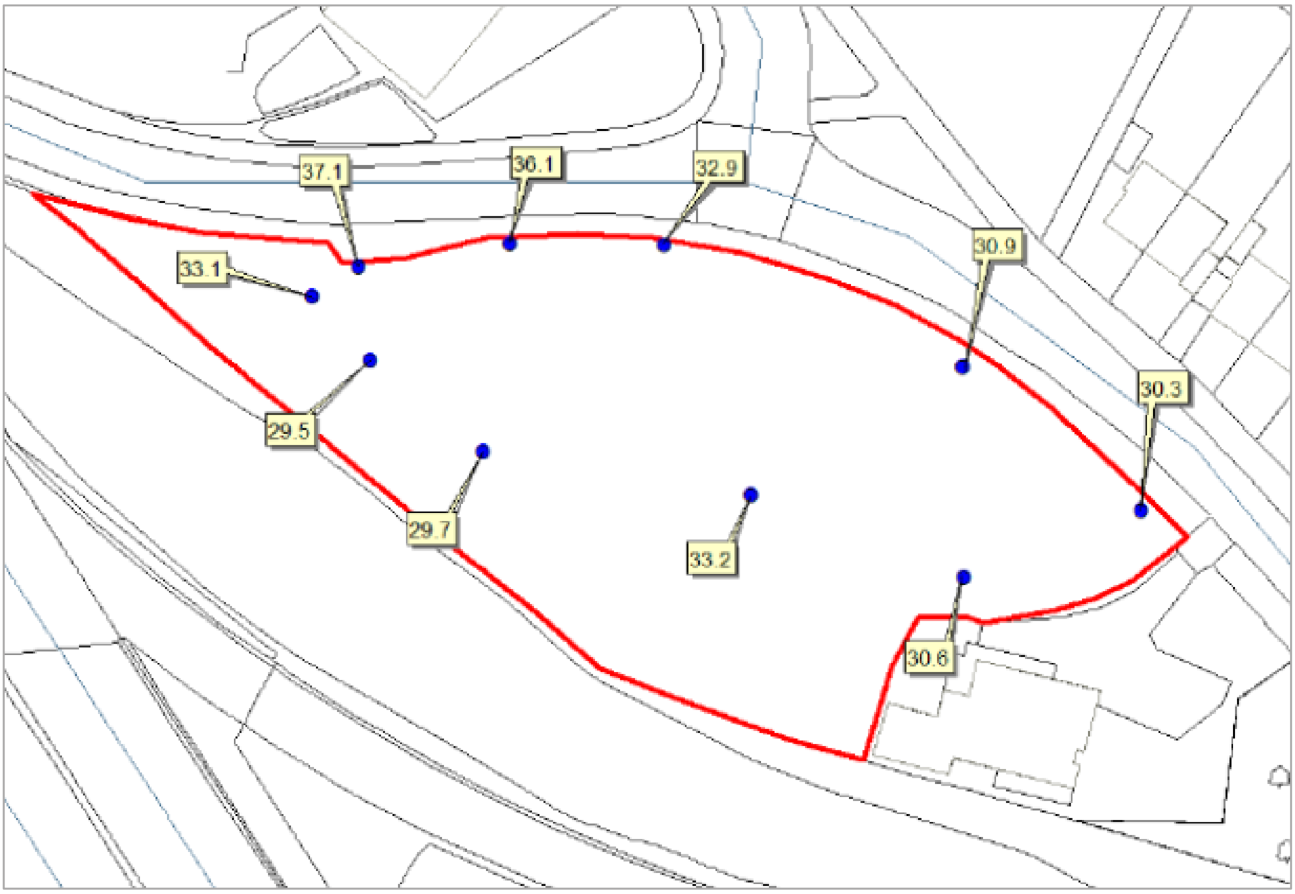
Bunns Lane

9.4.12 In 2010, six months of NO_2 diffusion tube data was collected for the Churchill Place development (former Fire Station residential redevelopment) immediately to the north of the Site, off Bunns Lane. This site is located between the M1 and A1 Watford Way, and as such would be considered subject to similar levels of air pollution. The Bunns Lane site in relation to the Site and M1/A1 Watford Way and the diffusion tube results are illustrated in Figure 9.5 and Figure 9.6. The results were reproduced from the Entran Air Quality Assessment[31] for this site.

Figure 9.5: Bunns Lane Site is Relation to the Pentavia Retail Park and M1/A1 Watford Way

Source: Entran (2011)

Figure 9.6: Bunns Lane Monitoring Results



Source: Entran (2011)

9.4.13 It is understood from the Entran report that the figures cited above were annualised to represent an equivalent annual mean and bias adjusted.

9.4.14 These figures indicate that within approximately 40m of the M1, NO_2 levels were found to be 33 µg/m^3. Within approximately 80m of the A1 Watford Way, they were found to be 30 µg/m^3. These values put the Bunns Lane development within APEC A. These values and conclusions are taken as indicative of the Site conditions.

Site Specific Monitoring

9.4.15 Given the Site's location between these two highly trafficked roads, it was considered necessary to undertake site specific monitoring to confirm the existing baseline and to feed into detailed dispersion modelling.

9.4.16 In March 2016, a real time monitor was located to the north of the Site at a location which would be clearly influenced by both the M1 and A1 Watford Way, but which was not likely to be influenced by alternative sources of air pollution such as car park movements.

9.4.17 In addition, a suite of diffusion tubes were located both at the boundary of the Site with the M1 and A1 Watford Way and across the Site. These locations were agreed in advance with the Environmental Health Officers of LB Barnet and are illustrated in Figure 9.1.

9.4.18 This monitoring was undertaken for three months, as agreed with LB Barnet, between March and May 2016. The collated data was annualised by comparison with the most local automated monitoring station with a full data set for 2015 which was located at Priory Park, Harrow. An annualisation factor of 0.9 was derived and applied. A summary of the results is set out Table 9.11.

Table 9.11: Annualised Site Data

Calibration Point	Annualised Monitored Site Data (2016)
Real Time Monitor	33.9
DT 1: Northern facade	34.2
DT 2: M1 – 1	52.0
DT3: M1 – 2	43.8
DT4: SE facade	30.4
DT5: Eastern facade	36.8
DT6: A1 – 1	52.4
DT7: A1 – 2	61.3
DT8: A1 – 3	62.3
DT9: Southern facade	31.1
Average Site value (not including motorway adjacent)	33.3
Average motorway adjacent value	54.4

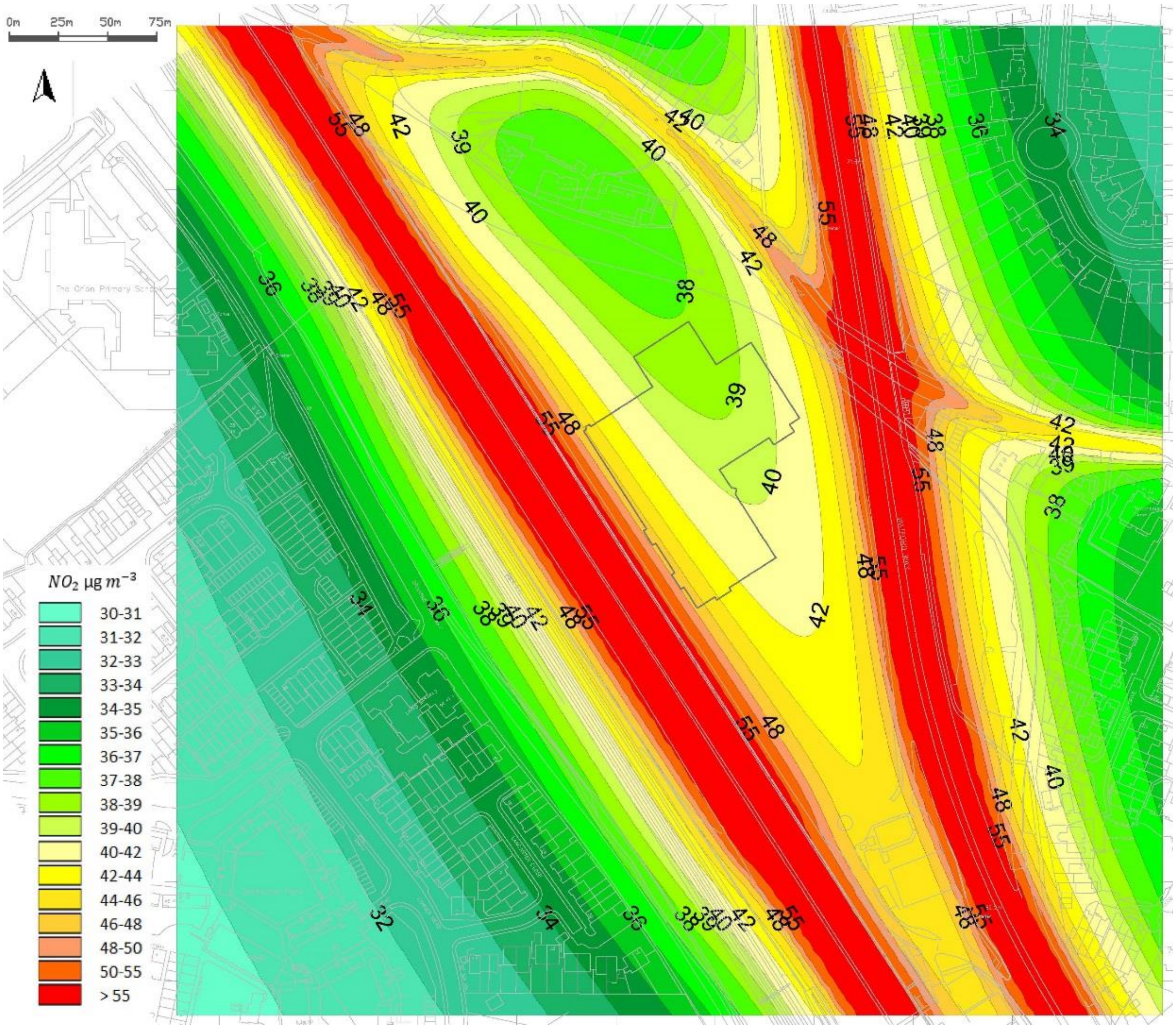
9.4.19 This data provides a good comparison to the Bunns Lane results and confirms that as expected, the readings adjacent to the M1 and A1 are in excess of the 40ug/m^3 NO_2 objective levels. However, they also indicate that locations within the Site, at what will be residential amenity locations, are well within the objective levels.

9.4.20 Therefore, based upon these values, the central Site area would be considered to be within APEC A and as such air quality would not be grounds for refusal. It is also noted that areas of the Site which are bounded by the M1 and A1 Watford Way are likely to be within APEC C and could be considered for refusal without suitable mitigation.

Site Specific Modelling

9.4.21 The findings of the site-specific pollutant monitoring (Table 9.12) were used along with traffic data obtained for the M1 and A1 Watford Way and the background data (Table 9.11) to model 2016 contour plans for the Site. These are illustrated in Figure 9.7.

Figure 9.7: 2016 Baseline Site NO_2 Contours



9.4.22 It is noted from the site-specific air quality monitoring (Table 9.12) that the average value across the central Site areas is 33.3µg/m^3, in accordance with Table 9.6, this classifies the site as being of 'low sensitivity'. This is also confirmed by the modelling (Figure 9.7) and noting the typical model over estimation at central site locations of 12.5%. This demonstrates that the Site falls within APEC A and that there would be no air quality grounds for refusal within the central areas of this Site.

9.4.23 At locations in the immediate proximity of the motorway locations, the average monitored NO_2 values were 54.4 µg/m^3. In accordance with Table 9.6 this classifies these areas as being of very high sensitivity. Modelling indicates concentrations of ~48.8 µg/m^3. Once the typical model underestimate of -11% at this type of location is taken into account, this is nearly 30% above objective levels, placing these locations in 'highly' sensitive APEC C. As a result of this and other noise considerations, the Development would only be accepted here with a MVHR system with sealed windows enabling residents to avoid poor air quality.

Local Baseline Modelling

9.4.24 Table 9.12 illustrates the 2016 modelled baseline for the specific locations which are illustrated in Figure 9.2.

Table 9.12: 2016 Modelled Baseline

Receptor Number	Receptor Location	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
01.a	95 Bunns Ln	39.4	19.7	14.5
01.b	86 Bunns Ln	39.9	19.9	14.6
01.c	54 Bunns Ln	37.6	19.5	14.4
02.a	Mardale Court	35.3	19.1	14.1
02.b	49 Page St	35.7	19.2	14.1
02.c	9 Page St	35.5	19.2	14.1
03.a	97-101 The Broadway	35.2	19.0	14.0
03.b	The Old Garages	36.9	19.2	14.2
04.a	9 Bunns Ln	38.6	19.3	14.3
05.a	A1	36.3	19.4	14.2
05.b	582 Watford Way	35.9	19.3	14.2
06.a	198 Lawrence St	32.6	18.8	13.9
07.a	1 Hartley Cl	37.9	19.9	14.5
08.a	12 Flower Ln	33.3	18.8	13.9
08.b	37 Flower Ln	33.1	18.8	13.9
08.c	64 Flower Ln	33.5	18.8	13.9
09.a	2 Hale Ln	34.6	19.0	14.1
09.b	39 Hale Ln	34.5	19.1	14.1
09.c	68 Hale Ln	31.4	18.6	13.8
10.a	80 Flower Ln	36.5	19.1	14.1
11.a	33 Grahame Park Way	33.2	18.8	13.9
12.a	145 Page St	31.7	18.6	13.8
13.a	39 Bunns Ln	34.8	19.1	14.1
14.a	12a Pursley Rd	33.0	18.9	14.0
15.a	487 Watford Way	38.1	19.8	14.5
16.a	51 Hall Ln	32.8	18.7	13.9
16.b	14 Hall Ln	32.9	18.8	13.9
17.a	449 Watford Way	36.6	19.5	14.3
17.b	375 Watford Way	35.5	19.3	14.2
17.c	332 Watford Way	36.6	19.5	14.3

Model error range +12.5 to -11.1% depending on location

9.4.25 Table 9.12 demonstrates that existing NO_2 levels at some locations, particularly on Bunns Lane may be at low to medium sensitivity to pollutant increases. This places these locations within APEC B and of potential concern with regards to air quality.

Future Baseline

9.4.26 The assessment years of 2021 and 2026 were assessed within the transport study and so the future air quality baselines were also modelled. The future baseline for 2021 is presented in Table 9.13.

Table 9.13: 2021 Modelled Future Baseline (with committed development)

Receptor Number	Receptor Location	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
01.a	95 Bunns Ln	39.9	19.8	14.5
01.b	86 Bunns Ln	40.4	20.0	14.6
01.c	54 Bunns Ln	38.0	19.6	14.4
02.a	Mardale Court	35.6	19.2	14.1
02.b	49 Page St	36.0	19.2	14.2
02.c	9 Page St	35.8	19.2	14.2
03.a	97-101 The Broadway	35.5	19.1	14.1
03.b	The Old Garages	37.3	19.2	14.2
04.a	9 Bunns Ln	39.1	19.4	14.3
05.a	A1	36.7	19.4	14.3
05.b	582 Watford Way	36.2	19.3	14.2
06.a	198 Lawrence St	32.8	18.8	13.9
07.a	1 Hartley Cl	38.3	19.9	14.6
08.a	12 Flower Ln	33.5	18.8	13.9
08.b	37 Flower Ln	33.3	18.8	13.9
08.c	64 Flower Ln	33.8	18.8	13.9
09.a	2 Hale Ln	34.9	19.1	14.1
09.b	39 Hale Ln	34.8	19.1	14.1
09.c	68 Hale Ln	31.6	18.6	13.8
10.a	80 Flower Ln	36.9	19.1	14.1
11.a	33 Grahame Park Way	33.5	18.8	13.9
12.a	145 Page St	32.0	18.7	13.8
13.a	39 Bunns Ln	35.2	19.2	14.2
14.a	12a Pursley Rd	33.3	18.9	14.0
15.a	487 Watford Way	38.5	19.9	14.6
16.a	51 Hall Ln	33.0	18.8	13.9

Receptor Number	Receptor Location	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
16.b	14 Hall Ln	33.1	18.8	13.9
17.a	449 Watford Way	37.0	19.6	14.4
17.b	375 Watford Way	35.8	19.3	14.2
17.c	332 Watford Way	37.0	19.6	14.4

Model error range +12.5 to -11.1% depending on location

9.4.27 Table 9.13 demonstrates that when assuming no improvements to background air quality, by 2021 air quality on Bunns Lane is likely to have deteriorated further so that the area may become highly sensitive to pollutant increases with additional locations such as the Old Garages, Hartley Close, Flower Lane and Watford Way approaching or exceeding objective levels.

Table 9.14: 2026 Modelled Future Baseline (with committed development)

Receptor Number	Receptor Location	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
01.a	95 Bunns Ln	40.0	19.8	14.6
01.b	86 Bunns Ln	40.4	20.0	14.6
01.c	54 Bunns Ln	38.1	19.6	14.4
02.a	Mardale Court	35.6	19.2	14.1
02.b	49 Page St	36.1	19.2	14.2
02.c	9 Page St	35.9	19.2	14.2
03.a	97-101 The Broadway	35.6	19.1	14.1
03.b	The Old Garages	37.4	19.3	14.2
04.a	9 Bunns Ln	39.2	19.4	14.3
05.a	A1	36.7	19.4	14.3
05.b	582 Watford Way	36.3	19.4	14.2
06.a	198 Lawrence St	32.8	18.8	13.9
07.a	1 Hartley Cl	38.4	20.0	14.6
08.a	12 Flower Ln	33.5	18.8	13.9
08.b	37 Flower Ln	33.3	18.8	13.9
08.c	64 Flower Ln	33.8	18.8	13.9
09.a	2 Hale Ln	34.9	19.1	14.1
09.b	39 Hale Ln	34.8	19.1	14.1
09.c	68 Hale Ln	31.6	18.6	13.8
10.a	80 Flower Ln	37.0	19.1	14.1

Receptor Number	Receptor Location	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
11.a	33 Grahame Park Way	33.5	18.8	13.9
12.a	145 Page St	32.0	18.7	13.8
13.a	39 Bunns Ln	35.2	19.2	14.2
14.a	12a Pursley Rd	33.3	19.0	14.0
15.a	487 Watford Way	38.7	19.9	14.6
16.a	51 Hall Ln	33.1	18.8	13.9
16.b	14 Hall Ln	33.2	18.8	13.9
17.a	449 Watford Way	37.0	19.6	14.4
17.b	375 Watford Way	35.8	19.3	14.2
17.c	332 Watford Way	37.0	19.6	14.4

Model error range +12.5 to -11.1% depending on location

9.4.28 Table 9.14 demonstrates that by 2026, if background air quality remains at current levels and traffic increases in line with predicted growth factors and committed development, air quality is likely to continue to deteriorate adjacent to busy roads. However, the majority of the areas assessed adjacent to the local road network are likely to remain within objective levels.

Summary of Receptors and Sensitivity

9.4.29 An assessment of existing and potential future receptor sensitivity is provided below. This is based on the 2016 baseline (Table 9.12) and 2026 baseline (Table 9.14) NO_2 levels as interpreted via Table 9.6.

Table 9.15: Summary of Receptor Sensitivity

Receptor	Existing (2016)	Future (2026 with committed and development traffic)
95 Bunns Ln	Medium	Medium
86 Bunns Ln	Medium	Medium
54 Bunns Ln	Low	Medium
Mardale Court	Low	Low
49 Page St	Low	Low
9 Page St	Low	Low
97-101 The Broadway	Low	Low
The Old Garages	Low	Low
9 Bunns Ln	Medium	Medium
A1	Low	Low
582 Watford Way	Low	Low
198 Lawrence St	Low	Low

Receptor	Existing (2016)	Future (2026 with committed and development traffic)
1 Hartley Cl	Low	Medium
12 Flower Ln	Low	Low
37 Flower Ln	Low	Low
64 Flower Ln	Low	Low
2 Hale Ln	Low	Low
39 Hale Ln	Low	Low
68 Hale Ln	Low	Low
80 Flower Ln	Low	Low
33 Grahame Park Way	Low	Low
145 Page St	Low	Low
39 Bunns Ln	Low	Low
12a Pursley Rd	Low	Low
487 Watford Way	Medium	Medium
51 Hall Ln	Low	Low
14 Hall Ln	Low	Low
449 Watford Way	Low	Low
375 Watford Way	Low	Low
332 Watford Way	Low	Low

9.4.30 This review of the change in receptor sensitivity over time indicates that a number of local areas will become more sensitive to poor air quality by 2026.

9.5 Scheme Design and Management

Demolition and Construction

9.5.1 IAQM guidance recommends standard measures for mitigating the impacts of dust during construction and demolition. The Mayor's SPG: The Control of Dust and Emissions during Construction and Demolition will be adhered to. Table 9.16 lists the standard 'highly recommended' mitigation measures that should be incorporated during construction and demolition. The full Construction Dust Risk Assessment and a table containing detailed mitigation measures is set out in Appendix 9.1.

Management Measures

- A Dust and Air Quality Management Plan for the demolition and construction phase will be produced and submitted in advance of demolition and construction works which would incorporate mitigation measures for good site practice to be followed, as outlined within the IAQM, BRE and GLA guidance.
- Industry standard practice mitigation measures for site plant will be employed.

- To minimise the likelihood of vehicle congestion, monitoring and control of all vehicles entering and exiting the Site will be maintained.
- Standard mitigation measures (as specified in the GLA and IAQM guidance) would be implemented during the demolition and construction work.
- In addition to the above, the following management practices should be applied:
    - Display the head or regional office contact information, and the name and contact details of person(s) accountable for air quality on the site boundary;
    - Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
    - Log all air quality complaints, identify the cause(s), take appropriate measures to reduce emissions in a timely manner, and record all measures taken. Make the complaints log available to the Local Authority when requested;
    - Carry out regular on-site and off-site inspections to monitor dust soiling effects, with cleaning to be provided if necessary. Increase the frequency of inspections when activities with a high potential to produce dust are being carried out.

Operational Development

9.5.2 A number of environmental design and standard management measures are expected to be employed for the Development to minimise impacts once the Development is complete and occupied. Table 9.17 summarises the environmental design and standard management measures which will be implemented through the Development.

Design Measures

- The use of the scheme design as a barrier to protect residential health an amenity within the central amenity/play spaces;
- Provision of MVHR systems to protect residents from poor air quality, with air of suitable quality obtained from balcony level within the central amenity space;
- Venting of car park air exchanges away from amenity/play space locations;
- Cogeneration Plan and boiler system designed in accordance with the GLA Sustainable Design Construction SPG to ensure compliance with air quality neutrality; and
- Specification of ultra-low NO_x boilers to ensure compliance with air quality neutrality.

9.6 Demolition and Construction

Assessment of Effects

9.6.1 The indicative delivery programme for the Development is approximately 48 months with enabling works commencing in the third quarter of 2019 and completion in the third quarter of 2023. Whilst construction details have not yet been finalised, a dust risk assessment was carried out.

Construction Dust

9.6.2 During the demolition and construction phase, there is the potential for dust to cause annoyance, nuisance and health effects to sensitive receptors, both human and ecological, located close to the Site. In addition, the major M1 and A1 Watford Way roads may also be considered as sensitive receptors with regards to the need to ensure that drivers are not adversely affected by dust.

9.6.3 The construction activities associated with the Development can be separated into four types to reflect their different potential impacts. These are:

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

9.6.4 The dust risk assessment is set out in Appendix 9.1.

9.6.5 The effects identified are considered to be temporary, adverse and ranging from negligible to minor once the application of management measures outlined in Table 9.16 (and further described within the Construction Dust Risk Assessment within Appendix 9.1) are applied.

Mitigation and Residual Effects

Construction Dust

9.6.6 Once the mitigation measures outlined in Table 9.16 (and further described within the Construction Dust Risk Assessment within Appendix 9.1) are applied, no significant adverse effects are predicted during the construction of the Development. Therefore, no additional mitigation is prescribed.

9.6.7 The residual effects will remain as stated above.

9.7 Completed Development

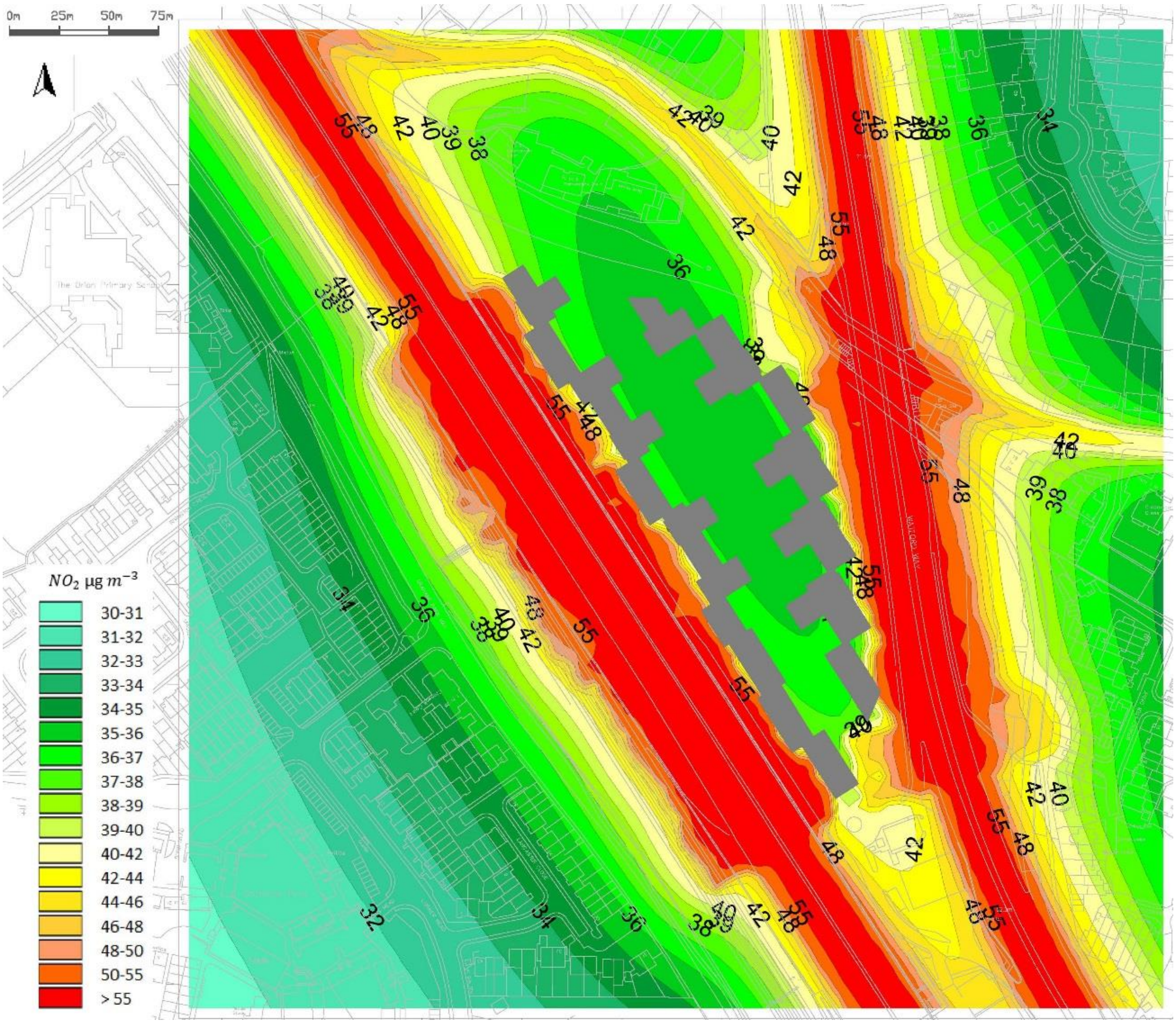
Assessment of Effects

9.7.1 This section provides a description of the likely significant effects of the completed Development on the environment and the suitability of the Site for residential health and amenity.

Modelling Site Suitability

9.7.2 The effect of the Development layout on current Site NO_2 levels is illustrated in Figure 9.8 and discussed below.

Figure 9.8: Influence of Building Facade upon Site NO_2 Levels (2026)



9.7.3 When Figure 9.8 is compared with Figure 9.7 'Baseline Site Air Quality', it demonstrates that the levels of NO_2 within the proposed amenity areas are reduced by between 2 and 6µg/m^3 by the 'barrier' effect of the facades and are below objective levels. Therefore, in accordance with tables 9.6 and 9.7, the barrier effect is of minor to moderate magnitude in an area of 'low' sensitivity and is therefore of negligible significance.

9.7.4 In contrast, at locations in the immediate proximity to the motorway locations, the typical NO_2 values remain in the region of 54 µg/m^3 which is around 30% above objective levels, placing these locations in APEC C. As a result of this, a MVHR system with sealed windows will be provided in units with aspects on the M1 or A1 Watford Way in order to protect residents from poor air quality.

9.7.5 A further assessment was undertaken of the likely air quality levels adjacent to the building facades at differing heights and locations in the future year assessment of 2026 when the building will be fully occupied. The full data set for this exercise is set out within Appendix 9.1 and the derived graphical representations are presented below. Figure 9.9 illustrates the locations assessed.

Figure 9.9: Development Block NO_2 Assessment Locations

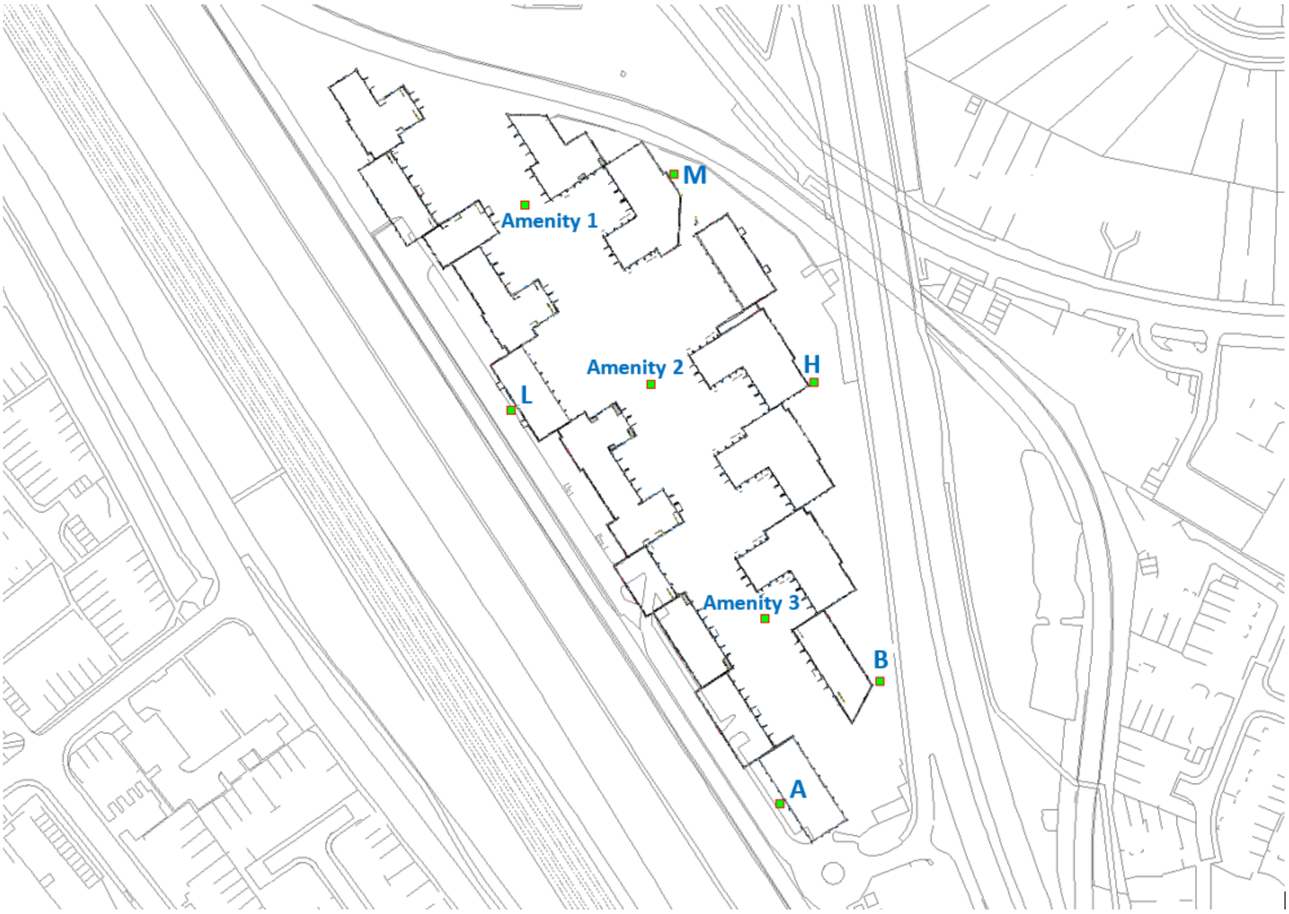
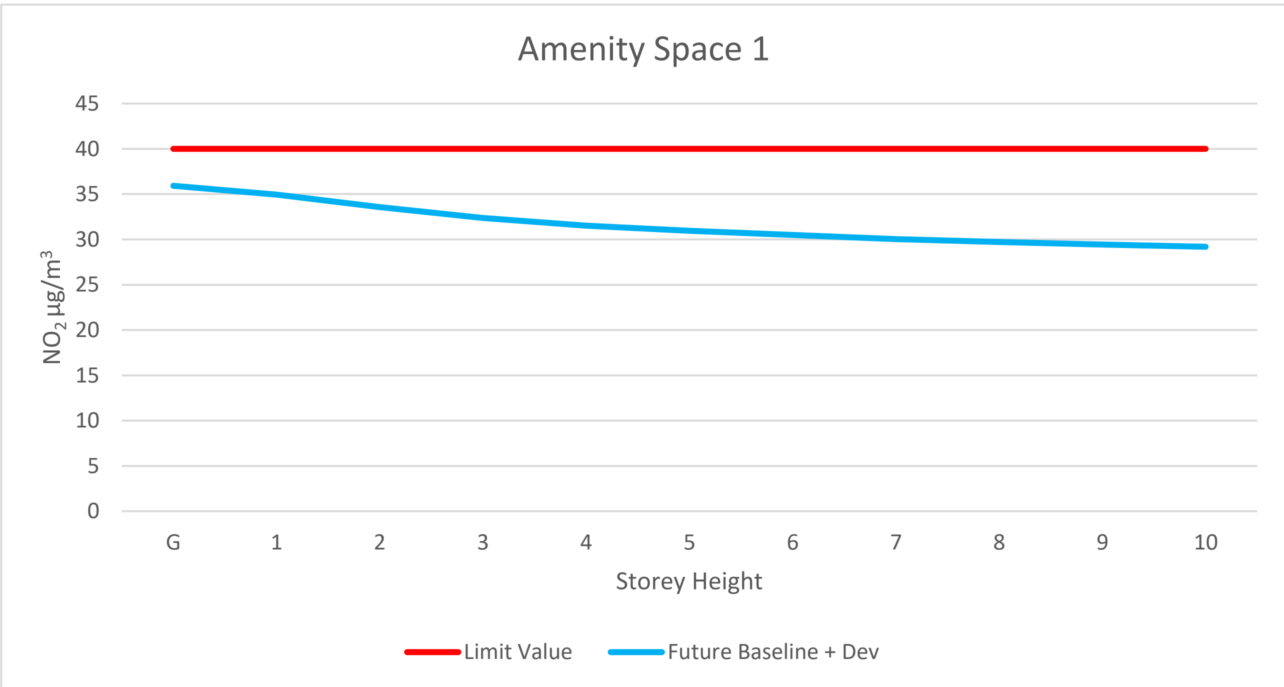
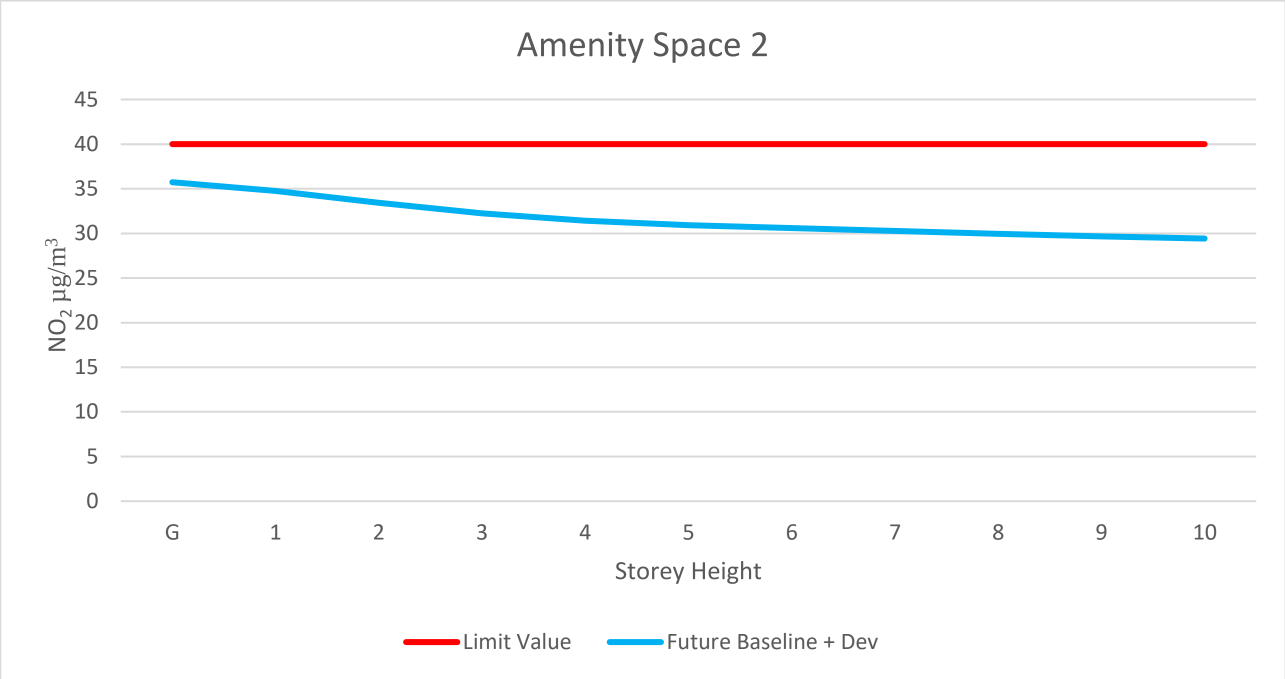


Figure 9.10: Amenity Area 1: 2026 NO_2 Concentration Reduction with Height



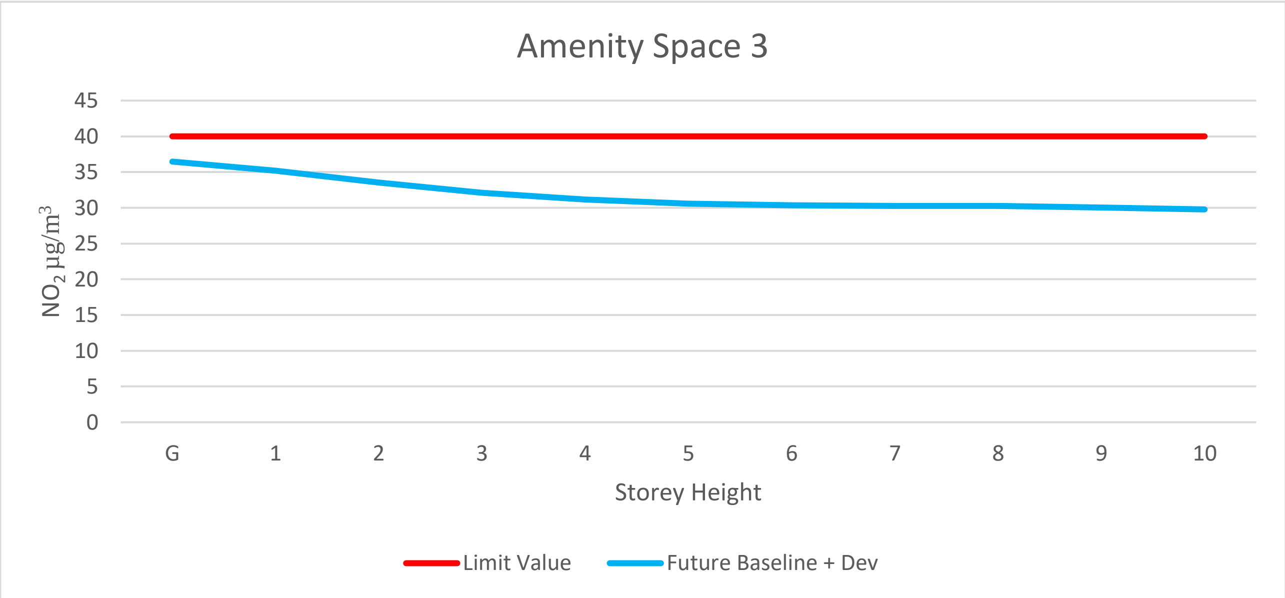
9.7.6 Figure 9.10 above demonstrates that central Amenity Area 1 levels of NO_2 are still within objective levels by 2026 at this location in the future baseline with the Development. In addition, the 'barrier' effect of the proposed facade is observed. Figure 9.10 demonstrates a reduction in pollutant concentration with height (which plateaus at around G+6).

Figure 9.11: Amenity Area 2: 2026 NO_2 Concentration Reduction with Height



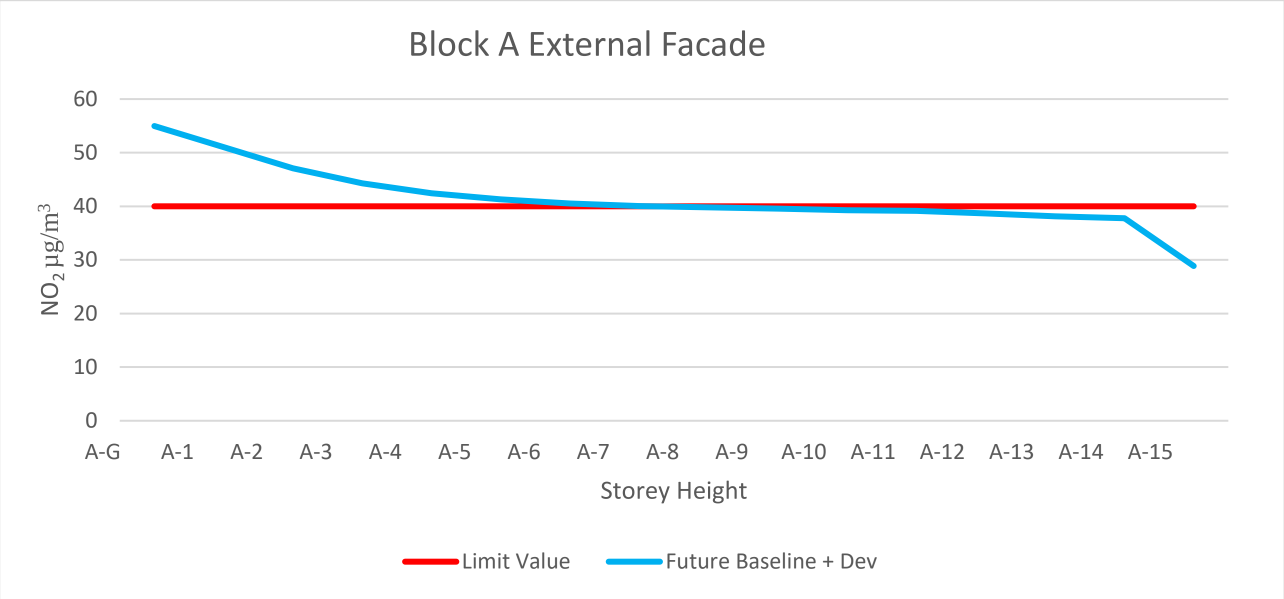
9.7.7 A similar effect is observed within Amenity Area 2 (Figure 9.11). The pollutant concentration plateau is observed to occur around G+7.

Figure 9.12: Amenity Area 3: 2026 NO_2 Concentration Reduction with Height



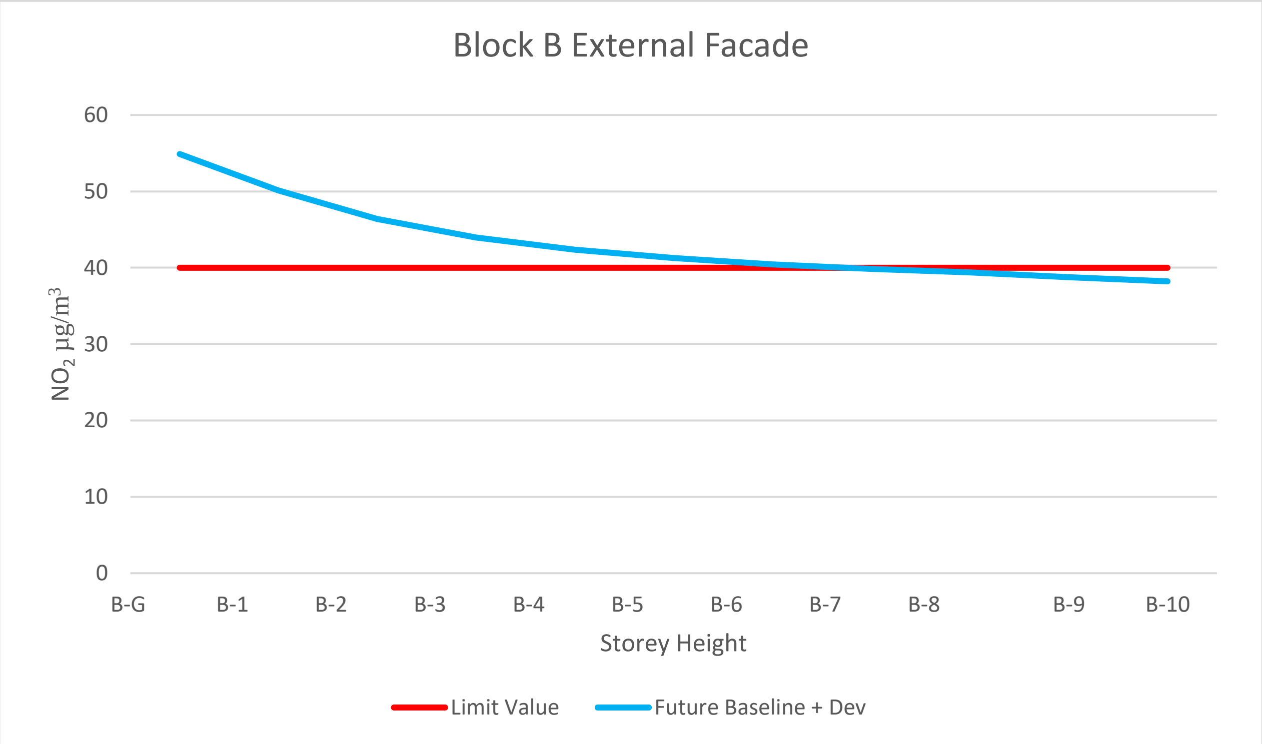
9.7.8 The result for Amenity Area 3 (Figure 9.12) closely replicates that of the other two areas, indicating that air quality across all amenity areas is likely to be very similar and remain below objective levels even with the increased volumes of traffic anticipated in future years.

Figure 9.13: Block A: 2026 NO_2 Concentration Reduction with Height



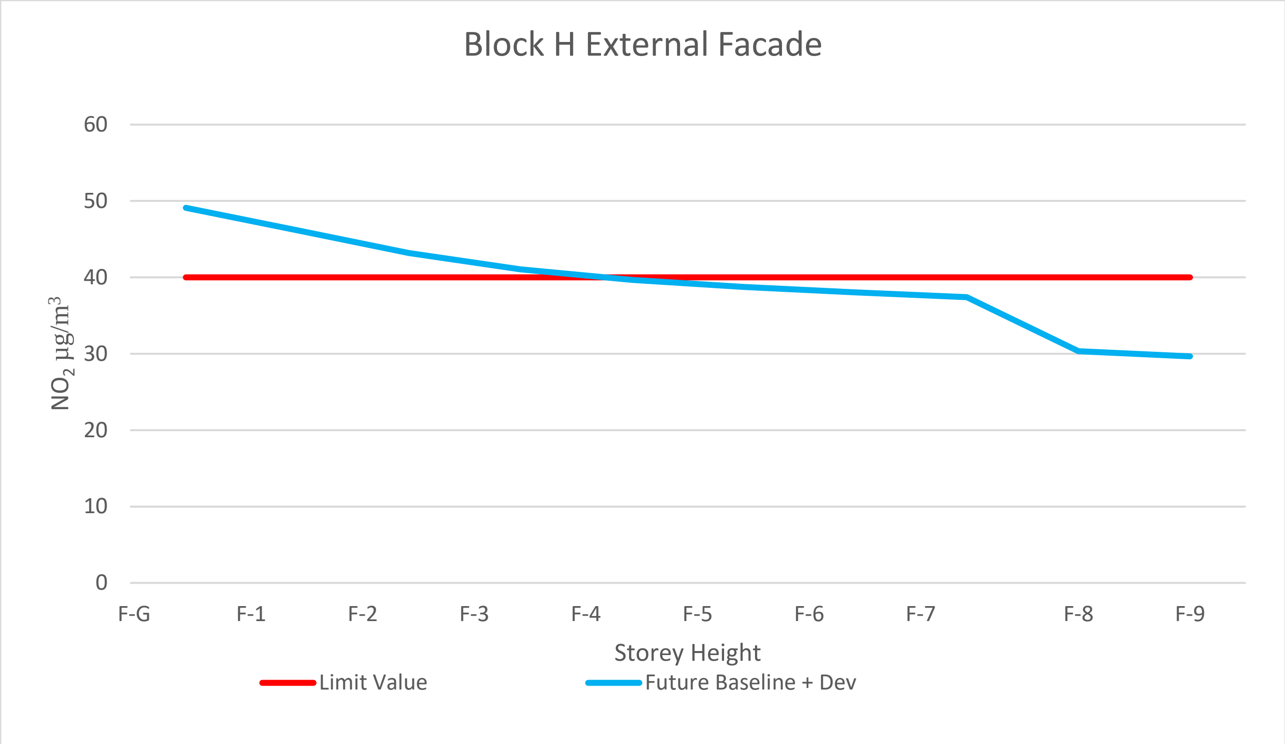
9.7.9 As observed within the Site monitoring, Figure 9.13 above demonstrates that existing roadside NO_2 levels at ground level are in excess of the objective levels at this location. However, it is not intended that there will be any 'receptors' at road side external facade locations. As with the amenity areas, resulting pollutant concentrations are seen to reduce with height, with a drop below pollutant concentration observed at G+14.

Figure 9.14: Block B: 2026 NO_2 Concentration Reduction with Height



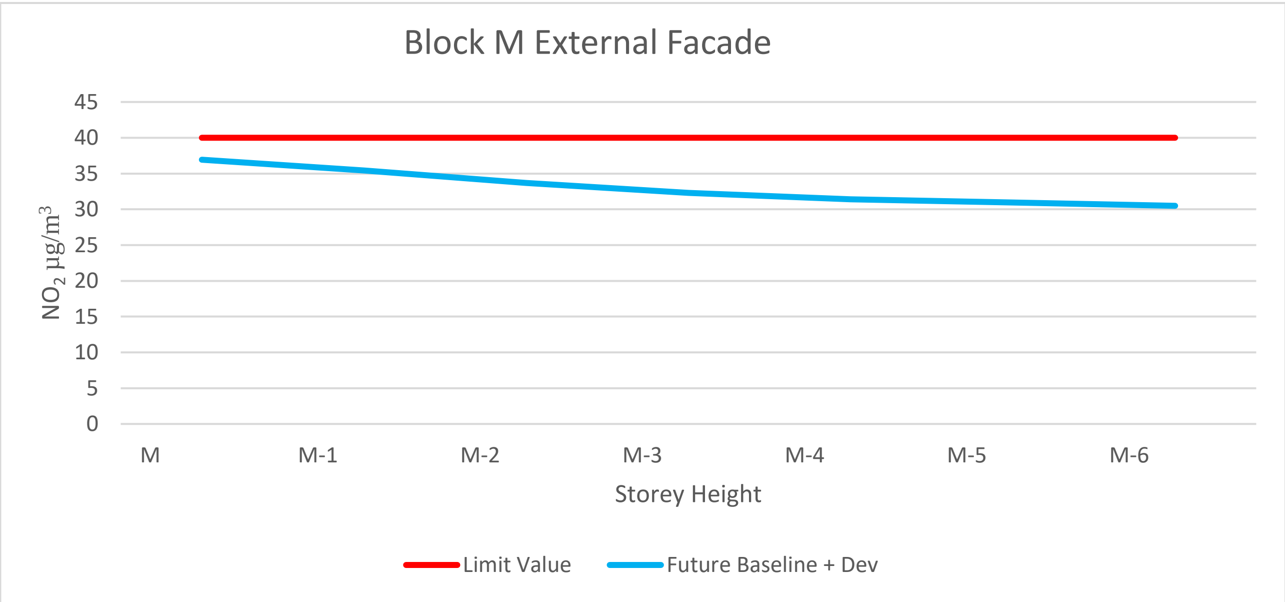
9.7.10 NO_2 concentrations adjacent to Block B (Figure 9.14) are seen to be similar to Block A. A plateau is also observed around G+6 - G+8, however pollutant levels continue to decrease with height.

Figure 9.15: Block H: 2026 NO_2 Concentration Reduction with Height



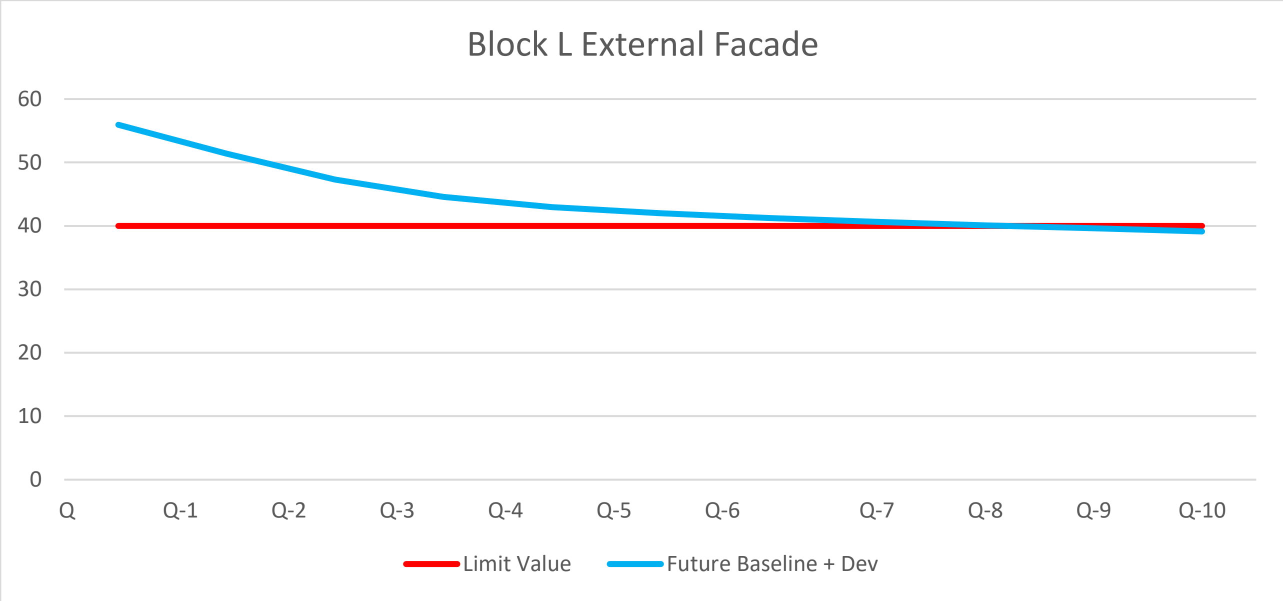
9.7.11 As with other facades, Figure 9.15 demonstrates that ground floor NO_2 concentrations at this location are in excess of objective levels at ground level, however these drop rapidly and it can be seen that pollutant levels drop below the objective by G+4.

Figure 9.16: Block M: 2026 NO_2 Concentration Reduction with Height



9.7.12 Figure 9.16 indicates that Block M external facades are likely to be within objective levels from the ground floor. The plateau effect is again observed from G+5.

Figure 9.17: Block L - 2026 NO_2 Concentration Reduction with Height



9.7.13 Block L is located at the northern end of the Site and is most heavily influenced by the M1. This can be seen in Figure 9.17 in the high NO_2 levels at the ground floor, which remain in excess of the objective until G+7. At this location, close to the M1, NO_2 levels remain close to the objective even at G+10.

9.7.14 As a result of this modelling exercise, it is considered that in central site amenity/play space areas, the residual effect of the building is that there will generally be a permanent and beneficial improvement in air quality.

Roof Terraces

9.7.15 The charts above represent the blocks which are situated with facades in closest proximity to the roads. Of these blocks A, B, and C are seen to be subject to NO_2 levels close the objective at roof height. It is noted that no roof terraces are proposed on these blocks. Roof terraces are proposed on blocks H and M and NO_2 levels are seen to be below objective levels at these locations. However, further bespoke modelling may be required to examine roof level effects in detail.

Modelling Energy Centre Emissions

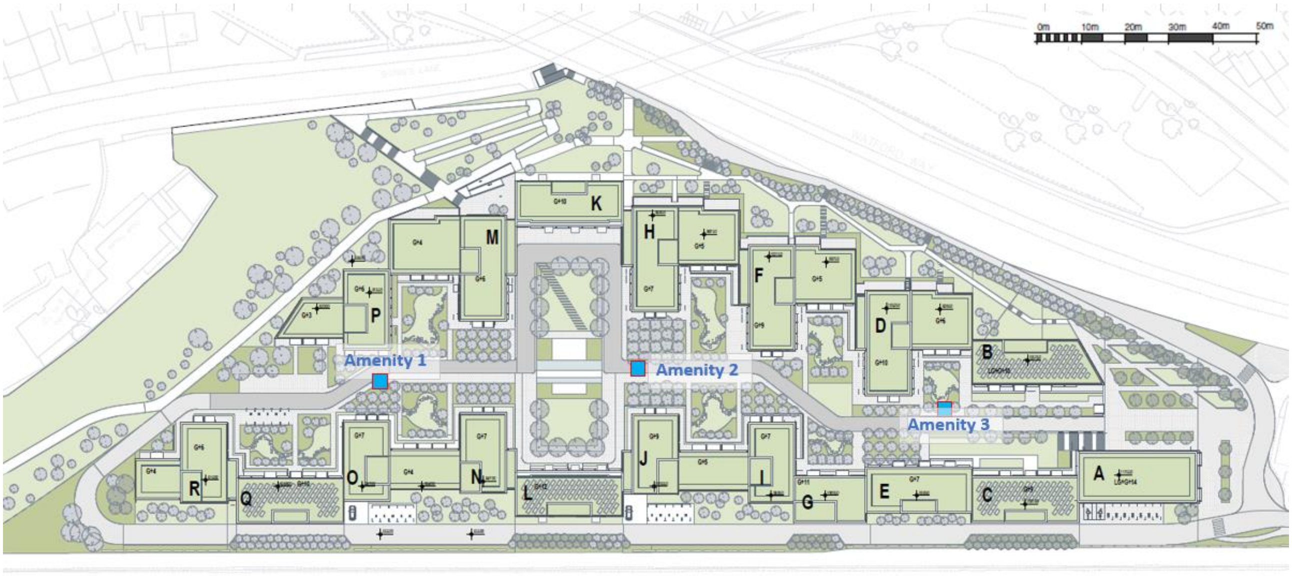
9.7.16 The Site is proposed to be serviced by a low carbon, energy efficient communal heating network which will serve all domestic and non-domestic areas. To this end, a single energy centre on Site will be comprised of a communal gas-fired cogeneration scheme with three back-up natural gas fired boilers for space heating and domestic hot water. Cogeneration plant are often chosen for their ability to reduce carbon dioxide emissions (CO_2), but can often result in an increase in NO_x. Pollutant dispersion modelling was undertaken specifically for Energy Centre NO_x/NO_2 emissions for the following receptors/environments and assumes no mitigation:

1. Central Amenity Areas/Playspaces at Ground Level;
2. Inner façade at successive storey heights; and
3. Wider Local Area.

Central Amenity Areas/Playspaces at Ground Level

9.7.17 These areas were taken to represent those locations where residents may be expected to spend leisure time for extended periods. Detection of Energy Centre emissions was examined at heights of 1.5m from ground level. The location of the receptors examined is set out in Figure 9.18.

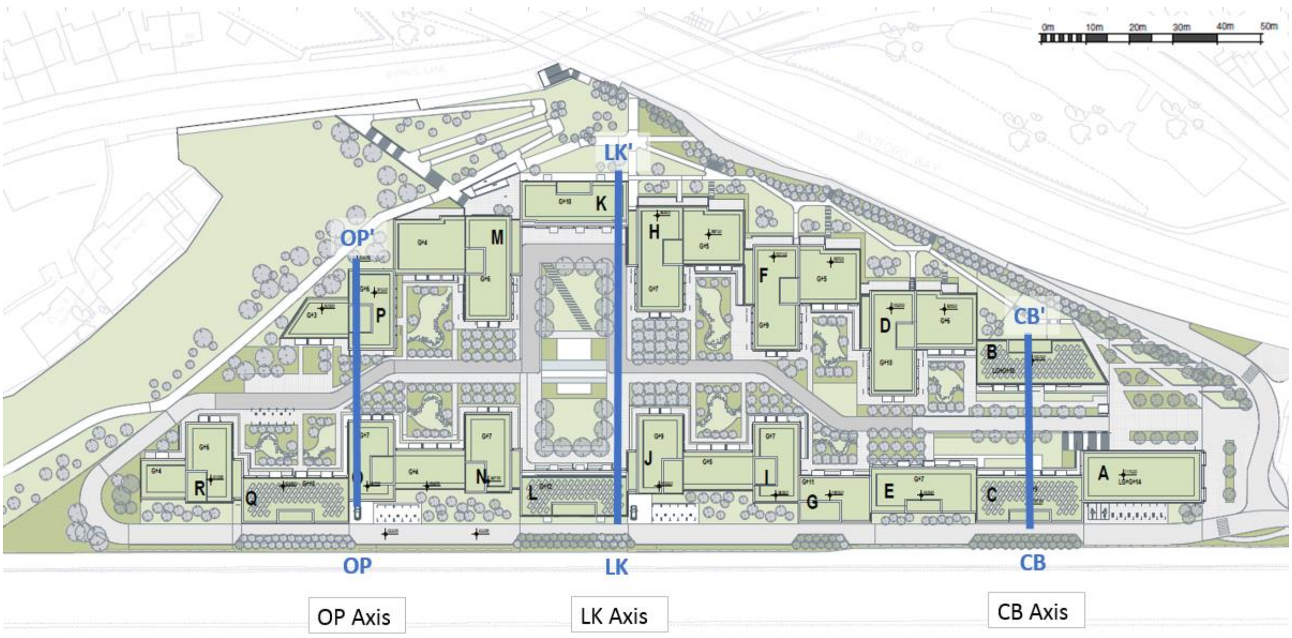
Figure 9.18: Energy Centre Assessment Locations: Central Amenity Areas/Playspaces



Inner facades at successive storey heights

9.7.18 Balconies within the central courtyard areas are also considered as 'amenity space'. Therefore, detection of Energy Centre emissions was undertaken for each inner facade at successive storey heights. Three vertical axes were examined and these are illustrated in Figure 9.19.

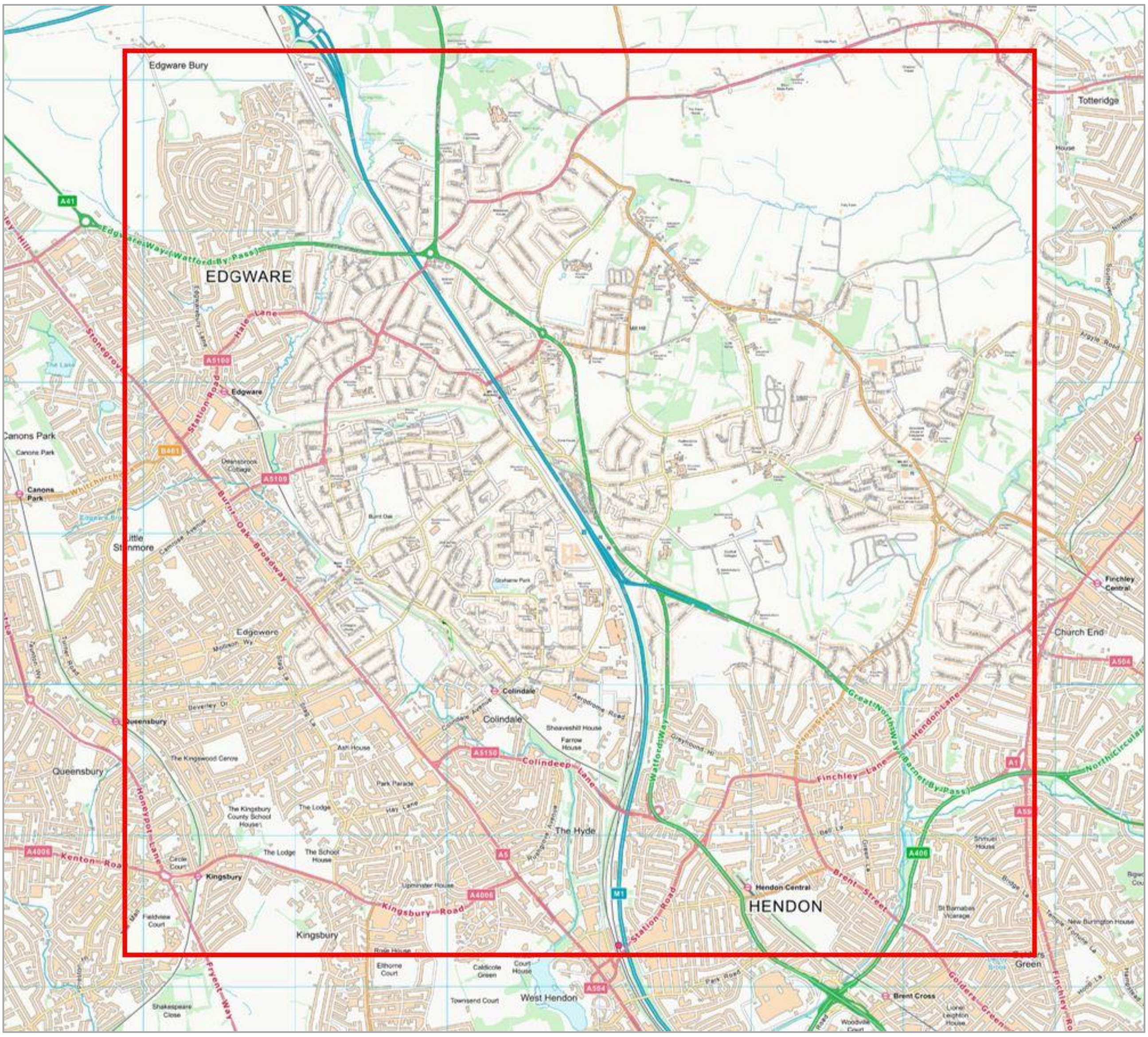
Figure 9.19: Energy Centre Assessment Locations: Inner Facades at Successive Storey Heights



Wider local area (up to 6km2)

9.7.19 Point source emissions are understood to form buoyant 'plumes' which, dependent upon the rate and temperature of emission, diameter and height of stack, can travel significant distances before dispersing. In some cases, local topography and meteorology can cause a plume to 'ground' i.e. reach ground level, before becoming sufficiently dispersed. Therefore, an assessment was applied across a grid of 6km^2 to examine the likelihood of this occurrence. The area examined is illustrated in Figure 9.20.

Figure 9.20: Energy Centre Assessment Locations: Wider Local Area (6km^2)



9.7.20 The findings of the exercise to detect emissions from the Energy Centre within the three identified environments is set out in Table 9.18.

Central Amenity Areas/Playspaces

9.7.21 Table 9.18 demonstrates that short term NO_2 concentrations detected at the three amenity areas, as a result of the Energy Centre, are less than 20 µg/m^3 and so the effect of the Centre on levels of NO_2 within the amenity space is considered to be insignificant.

Table 9.18: Energy Centre Assessment Locations: Central Amenity Areas/Playspaces

Receptor Location	Modelled Short-term NO_2 Concentrations (99.79th percentile) at 1.5m (µg m-3)
Amenity Area 1	1.33
Amenity Area 2	1.78
Amenity Area 3	6.61

Inner facades at successive storey heights

9.7.22 Figures 9.21, 9.22 and 9.23 illustrate the change in NO_2 concentration with height at facade.

Figure 9.21: Energy Centre Assessment Locations: Inner Facades CB Axis

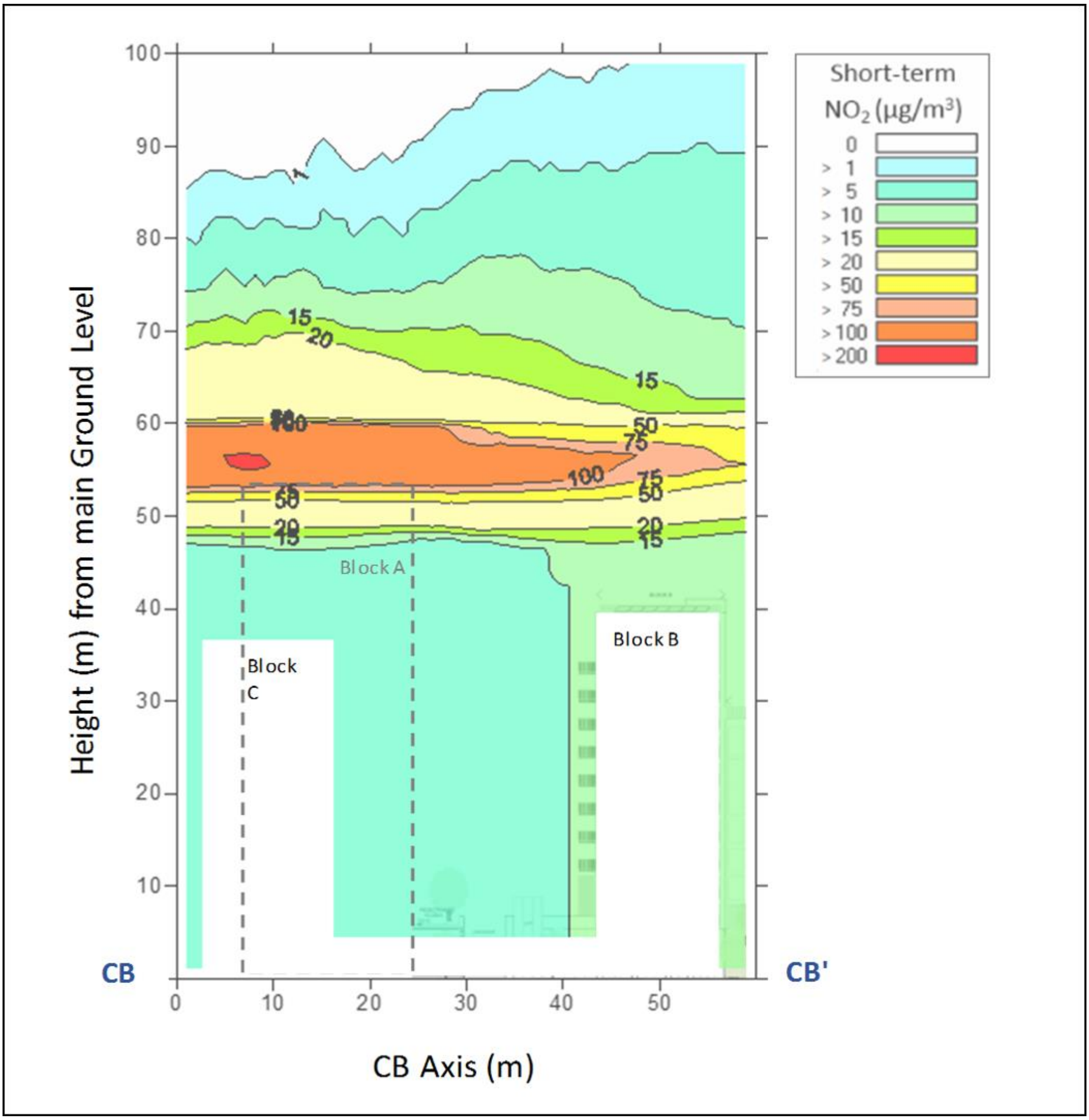
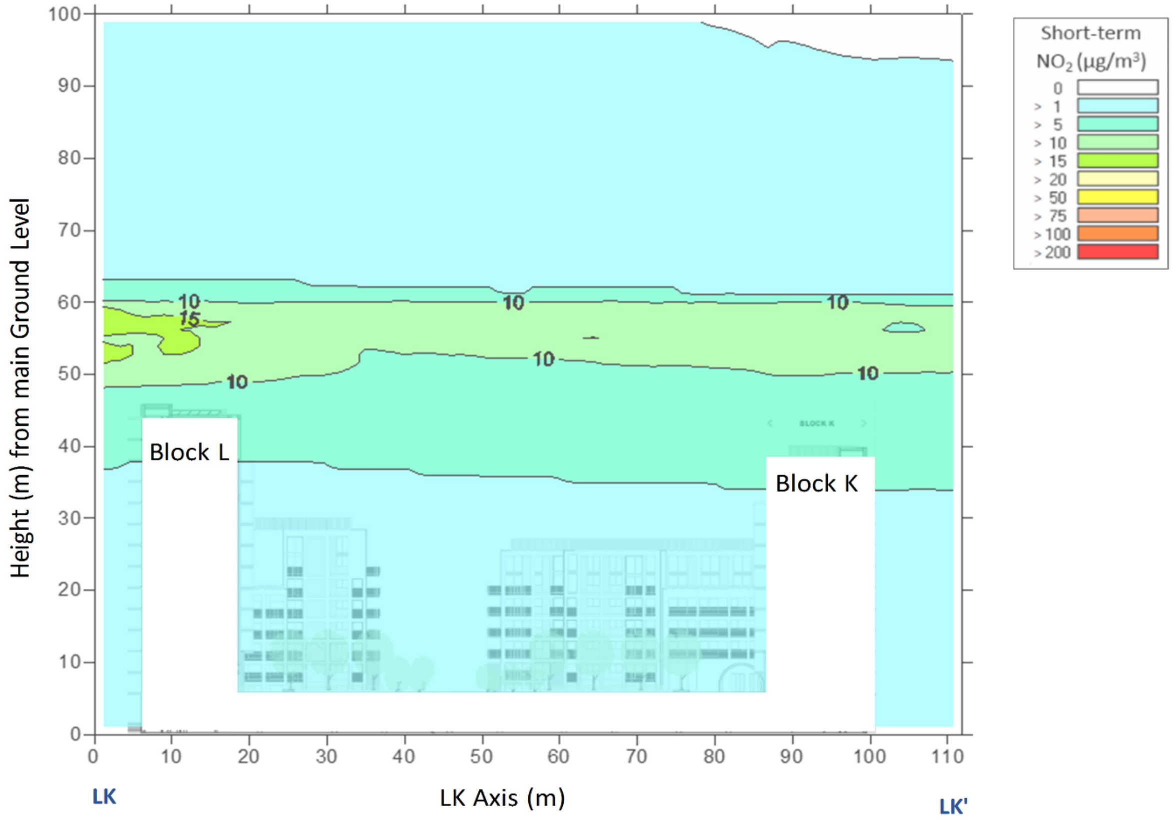
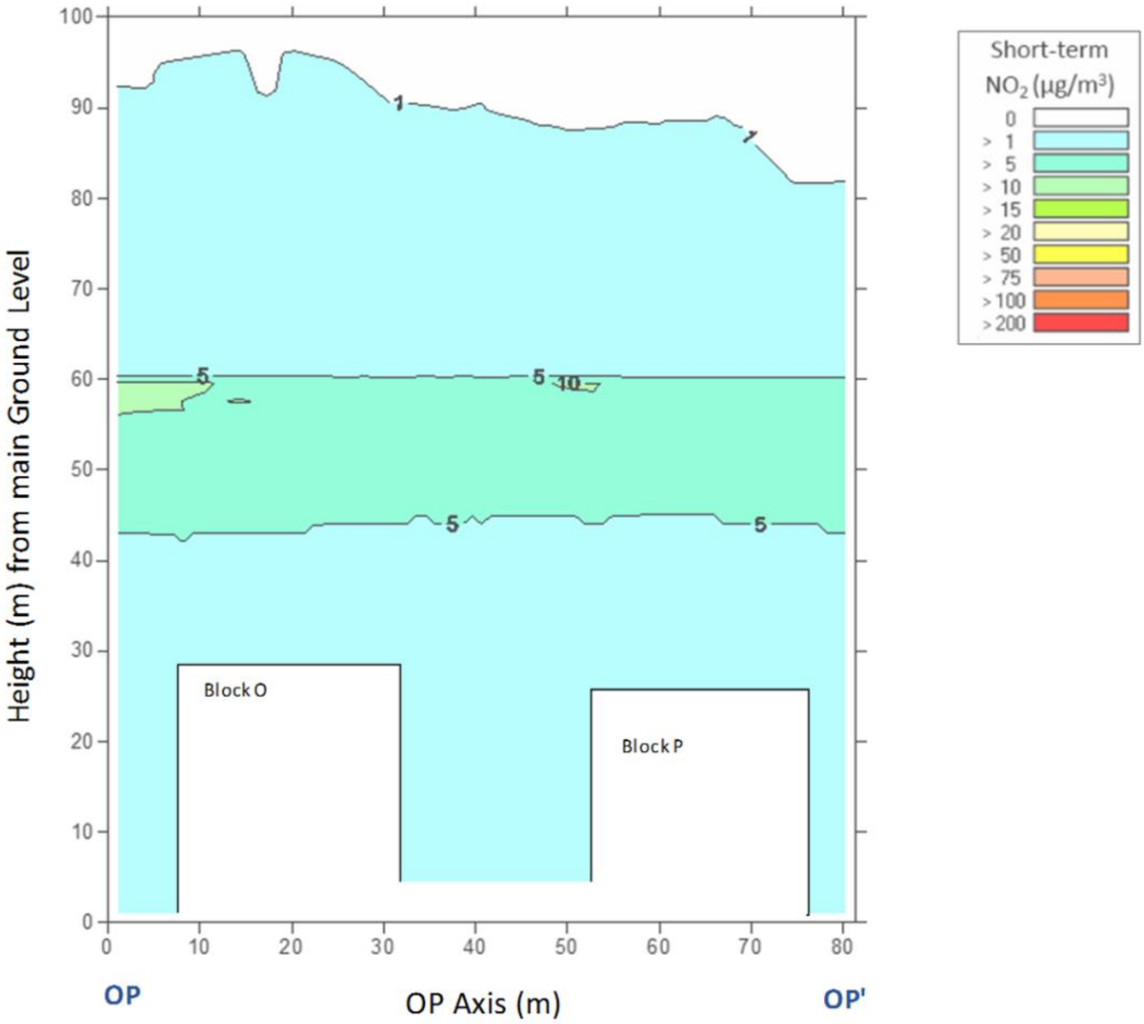


Figure 9.22: Energy Centre Assessment Locations: Inner Facades LK Axis



9.7.23 Figure 9.21 illustrates the axis closest to the stack. Therefore, of the three axes examined, this is where the highest levels of short term NO_2 associated with the Energy Centre are demonstrated within the modelling and where the effect of building downwash can most be clearly seen. However, all three images illustrate that short term NO_2 concentrations at the balcony levels of the inner facades, as a result of the EC are less than 20 µg/m^3 and so, in accordance with EPUK, IAQM and Environment Agency guidance, the effect of the EC on levels of NO_2 at the balcony areas is considered to be insignificant.

Figure 9.23: Energy Centre Assessment Locations: Inner Facades OP Axis.

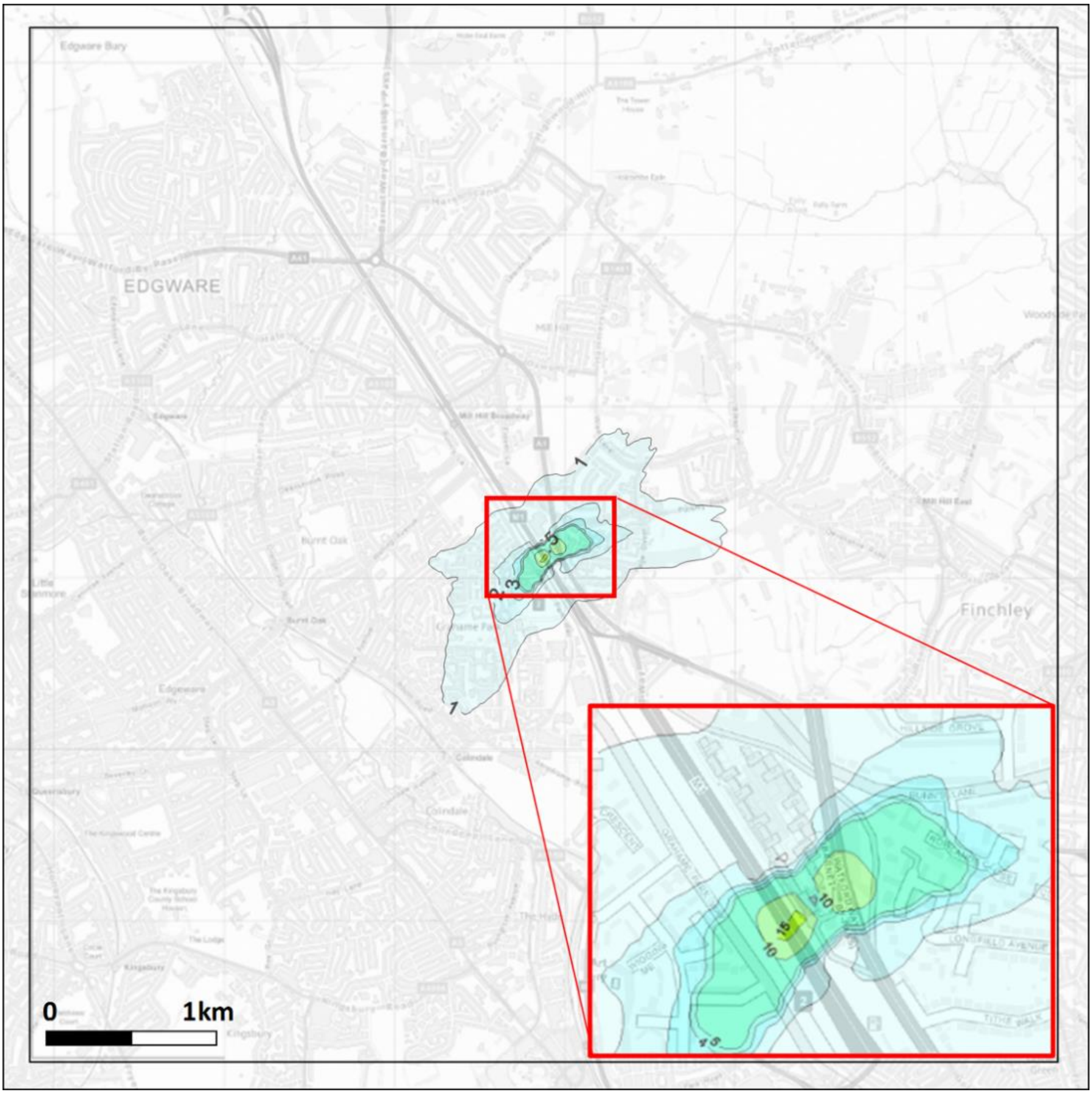


Wider Local Area (6km2)

9.7.24 Figure 9.24 below illustrates the NO_2 plume associated with the Energy Centre over a 6km^2 area (height 1.5m).

9.7.25 This image illustrates that the short term NO_2 concentrations at ground level across a 6km^2 as a result of the EC, are less than 20 µg/m^3 and so are considered to be insignificant.

Figure 9.24: Estimated EC NO_2 Concentrations over $6km^2$



Modelling Air Quality Neutral /Positive

Building Emissions

9.7.26 As noted above, the Site is proposed to be serviced by a low carbon, energy efficient communal heating network. This was examined with regards to air quality neutral/positive requirements in line with GLA guidelines. All parameters examined in the assessment of building neutrality are presented within Appendix 9.1

Combined Heat and Power

9.7.27 The emission standards applied within the Sustainable Design and Construction SPG have been developed based on the latest technology, viability and the implication for CO_2 emissions of any abatement measures to reduce the NO_x and PM_{10} emissions from the plant.

9.7.28 The specific plant proposed for the Energy Centre has not yet been confirmed however, the project engineers Chapman BDSP have provided the likely parameters of the plant to be specified and have confirmed that the plant will not exceed an end of pipe NO_x emissions at 5% 0_2 of more than 50mg/Nm^3 placing it well within the required emission standards.

Boilers

9.7.29 The SPG requires that where individual and/or communal gas boilers are installed in commercial and domestic buildings, they should achieve a NO_x rating of <40 mg kWh.

9.7.30 Three gas boilers are proposed for the Energy Centre. Building service engineers have advised that the boilers will be specified from a range with a maximum NO_x emission of 37mg/kWh in compliance with the SPG.

9.7.31 A Benchmark is obtained for the theoretical building emissions associated with the Site. This was compared to the Total Building Emissions and an assessment of Air Quality Neutrality is made.

9.7.32 On-site emissions are calculated from the Gross Floor Area (sqm) of the Development and the Site emissions associated with the building use (kg/annum) calculated from the energy use kWh/annum and the site-specific emission factors. The detail of the building emission calculation undertaken is set out within Appendix 9.1.

9.7.33 The calculation of the Building Emission Benchmark Factors is set out in Table 9.19.

Table 9.19: Building Emission Benchmark Factors

Receptor Location	Modelled Short-term NO_2 Concentrations (99.79th percentile) at 1.5m (µg m^{-3})
Land Use Class	NO_x (g/m^2)
Class A1	22.6
Class A3 – A5	27.2
Class A2 and Class B1	30.8
Class B2 – B7	36.6
Class B8	23.6
Class C1	70.9
Class C2*	68.5
Class C3*	26.2
D1 (a)	43.0
D1 (b)	75.0
Class D1 (c-h)	31.0
Class D2 (a-d)	90.3
Class D2 (e)	284

*Benchmarks have been calibrated for London (SOURCE: GLA Planning Support Update)

9.7.34 Gross Floor Areas for the Site and were multiplied by the appropriate factors in Table 9.19 to provide the Total Benchmarked Building NO_x Emissions in Table 9.20.

Table 9.20: Benchmarked Building NO_x Emissions.

Land Use Class	GFA (sqm)	BEB Factors	NO_x (kg/annum)
A1 - retail	401	22.6	9.1
A3/A4 - restaurant	322	27.2	8.8
D1 (b) - creche	294	75.0	22.1
C3 - dwelling houses	76306	26.2	1999.2
C3 - ancillary	878	26.2	23.0
B8 - Plant/refuse/bike store	3549	23.6	83.8
B2 - Energy Centre	264	36.6	9.7
B8 - car park	10262	23.6	242.2
Total Benchmarked Building NO_x Emissions		2398 kg/annum	

9.7.35 The total building emissions supplied by the engineers are provided in Table 9.21.

Table 9.21: Total Building Emissions

Energy Centre	g/s	kg/annum
Cogeneration Plant	0.03	946.08
Boiler (x 3)	0.05	1545.3
Total Building Emissions		2523

9.7.36 A comparison of the Benchmarked Building Emissions against the Total Building Emissions is provided in Table 9.22.

Table 9.22: Comparison Between Benchmarked Building Emissions and the Total Building Emissions

Building Emissions	NO_x kg/Annum
Benchmarked Building Emissions	2398
Total Building Emissions	2523
Difference	125

9.7.37 The assessment of building emissions therefore demonstrates that on the worst-case assumption that the co-generation plant will have a NO_x emission of 50mg/Nm^3, the buildings emissions will not reach neutrality. However, it is understood that a Selective Catalytic Reduction System (SCR) which removes NO_x from the plant exhaust will be utilised and this will significantly further reduce the Cogeneration Plant NO_x emissions. Where an SCR system is applied, the Energy Centre will become air quality positive.

Transport Emissions (Air Quality Neutral)

9.7.38 The detail of the assessment process is set out within the GLA AQN Planning Support Update and is summarised below.

9.7.39 Transport emissions are assessed by multiplying the number of residential units and the Gross Floor Areas by use class for the Development, by the emission factors provided in order to obtain the Transport Emissions Benchmarks (TEB) for NO_x and PM_{10}.

9.7.40 TEB factors are available within the SDC SPD and also within the GLAs Air Quality Neutral Planning Support update for the Retail (A1), Office (B1a) and Residential (C3, C4) for CAZ, Inner and Outer London as per Table 9.23.

Table 9.23: Transport Emission Benchmarks Factors

Land Use	Benchmark Factors		
	CAZ	Inner	Outer
NO_x (g/m^2/annum)			
Retail (A1)	169	219	249
Office (B1)	1.27	11.4	68.5
NO_x (g/dwelling/annum)			
Residential (C3)	234	558	1555
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)	40.7	100	267

9.7.41 The Development includes the provision of:

- 844 residential dwellings;
- 723 sqm retail and restaurant space; and
- 294 sqm 'community uses'.

9.7.42 The community use on the Site is allocated as a D1 use class for the purposes of this assessment. In the absence of a D1 benchmark factor for transport emissions, the community use was classified as an office use for the purpose of the Air Quality Neutral/Positive assessment.

9.7.43 Benchmarked transport emissions are established by multiplying the number of residential units and the Gross Floor Area for the Development by the TEB factors provided in Table 9.23. These are presented in Table 9.24.

Table 9.24: Calculation of Benchmarked Transport Emissions

Land Use	GFA sqm/no. of Dwellings	NO_x Transport Emissions Benchmark	NO_x Benchmarked Emissions (kg/annum)
C3	844	1553	1311
Retail	723	249	180
*Community Use	294	68.5	20
Total Benchmarked NO_x Emissions		1511	
Land Use	GFA sqm/no. of Dwellings	PM_{10} Transport Emissions Benchmarks	PM_{10} Benchmarked Emissions (kg/annum)
C3	844	267	225
Retail	723	42.9	31
*Community Use	294	11.8	3
Total Benchmarked PM_{10} Emissions		260	

*Assuming 'Office' benchmark

9.7.44 The Total Transport Emissions of NO_x and PM_{10} are then calculated for the Development. A summary of these calculations and the supporting data provided within the GLA AQN Planning Support Update is set out below.

9.7.45 The (arithmetic mean) journey lengths for residential, office and retail developments derived from the London Travel Demand Surveys (LTDS) are set out in Table 9.25

Table 9.25: 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

*Based on the LTDS destination

Note that these distances are based on a straight line between the origin and destination of a trip, not actual trip lengths

9.7.46 Due to the location of the Development, the third column representing 'Outer' London' was used as requested by the GLA.

9.7.47 The predicted average distance travelled per year is presented in Table 9.26.

Table 9.26: Average Distance Travelled by Car per year

Land Use	GFA sqm/no. of Dwellings	Number of vehicle trips per year*	Average distance travelled per trip (km/trip)**	Distance Travelled (km/year)
C3	844	410990	11.4	4685286
Retail	723	263895	5.4	1425033
Community Use***	294	107310	10.8	1158948

*based on Transport Statement predicted 12hr traffic generation times 365 days

**based on the London Travel Demand Survey for Outer London as shown in the supporting guidance

*** assuming office benchmarking

9.7.48 The Total Transport Emissions have been calculated by multiplying the total distance travelled, by the relevant emission factors for NO_x and PM_{10} set out in Table 9.27.

Table 9.27: Transport Emission Factors

Pollutants	Emissions Factors		
	CAZ	Inner	CAZ
NO_x	0.4224	0.37	0.353
PM_{10}	0.0733	0.0665	0.0606

9.7.49 The Total Transport Emissions are set out in Table 9.28.

Table 9.28: Calculation of Total Transport Emissions

Land Use	Total distance travelled per year (km)	NO_x Transport Emission factor (g/Vehicle-km)	Total NO_x Transport (kg/annum)
C3	4685286	0.353	1654
Retail	1425033	0.353	503
Community Use	1158948	0.353	409
Land Use	Total distance travelled per year (km)	PM_{10} Transport Emission factor (g/Vehicle-km)	Total PM_{10} Transport (kg/annum)
C3	4685286	0.0606	284
Retail	1425033	0.0606	86
Community Use**	1158948	0.0606	70

*based on emission factors provided in Table 10 of GL A80371 air quality neutral planning support

** assuming office benchmarking

9.7.50 The Transport Emissions were compared with the Benchmarked Emissions in order to assess whether the Development results in any additional NO_x or PM_{10} emissions and the results are presented in Table 9.29 below

Table 9.29: Comparison Between Benchmarked Transport Emissions and the Total Transport Emissions

Transport Emissions	PM_{10} kg/Annum
Benchmarked Transport Emissions	260
Total Transport Emissions	441
Difference	+181
Transport Emissions	NO_x kg/Annum
Benchmarked Transport Emissions	1511
Total Transport Emissions	2566
Difference	+1055

9.7.51 Table 9.29 demonstrates that the predicted Total Transport Emissions associated with the Development are expected to be higher than the Benchmarked emissions.

9.7.52 As noted previously the GLA AQN Planning Support Update states that in circumstances where the benchmark is exceeded, mitigation measures to reduce emissions may be applied on-site or off-site.

9.7.53 Is it also noted that the SDC SPG states:

"Developments should be designed to encourage and facilitate walking and cycling and the use of public transport. This will enable air pollutants deriving from a particular development to be minimised. To further support this policy, boroughs should also ensure developments do not exceed local car parking standards."

9.7.54 In relation to this, the Site offers a number of encouragements to model shift or 'Active Travel' as supported by TfL, to encourage residents and Site users away from car use. These are set out in detail within the Framework Travel Plan (FTP) (Appendix 7.1) submitted with the application. The FTP focusses on maximising the potential for sustainable modes of travel. Once the Development proceeds through to occupation, the FTP will be used to develop a Detailed Travel Plan for the Site which will include for:

- Welcome Pack;
- Improved Site Access;
- Incentivisation of Pedestrians and Cyclists;
- Parking Strategy; and
- Delivery and Servicing Plan.

9.7.55 Therefore, it is considered that the above constitute the implementation of 'Active Travel' measures, as requested by the GLA and supported by TfL to encourage model shift away from the car and provide a significant level of mitigation measures as required by Air Quality Neutrality.

Development Traffic

9.7.56 A review of the anticipated Development traffic data indicated that some of the assessment criteria were likely to apply to receptors on local roads. Therefore, an impact assessment was undertaken for the locations identified in Table 9.3 and Figure 9.2.

9.7.57 The transport consultants for the project have provided traffic data in line with the requirements of the LB Barnet for the roads in question for the following scenarios:

- The Baseline Year 2016;
- The Future Baseline Year + Committed Development 2021;
- The Future Baseline Year + Committed Development 2021 + Development;
- The Future Baseline Year + Committed Development 2026; and
- The Future Baseline Year + Committed Development 2026 + Development.

9.7.58 These were applied to the air dispersion model for the local roads for the pollutants of NO_2, PM_{10} and $PM_{2.5}$ in order to assess any effects upon the levels of the pollutants of concern.

9.7.59 The results of this exercise are set out in Table 9.30 and Table 9.31 for NO_2.

Table 9.30: NO_2 Levels 2021 With and Without Development

Receptor No	Receptor Location	2021 Committed Development NO_2 ($\mu g/m^3$)	2021 Committed Development and Pentavia NO_2 ($\mu g/m^3$)	Difference	Difference in respect of AQAL (rounded) (%)
01.a	95 Bunns Ln	39.93	39.96	0.03	0
01.b	86 Bunns Ln	40.38	40.42	0.04	0
01.c	54 Bunns Ln	38.04	38.08	0.04	0
02.a	Mardale Court	35.57	35.62	0.05	0
02.b	49 Page St	36.01	36.06	0.05	0
02.c	9 Page St	35.81	35.88	0.07	0
03.a	97-101 The Broadway	35.53	35.57	0.04	0
03.b	The Old Garages	37.33	37.37	0.04	0
04.a	9 Bunns Ln	39.14	39.17	0.03	0
05.a	A1	36.66	36.72	0.06	0
05.b	582 Watford Way	36.2	36.26	0.06	0
06.a	198 Lawrence St	32.79	32.83	0.04	0
07.a	1 Hartley Cl	38.33	38.42	0.09	0
08.a	12 Flower Ln	33.5	33.53	0.03	0
08.b	37 Flower Ln	33.32	33.34	0.02	0
08.c	64 Flower Ln	33.76	33.78	0.02	0
09.a	2 Hale Ln	34.88	34.89	0.01	0
09.b	39 Hale Ln	34.81	34.82	0.01	0
09.c	68 Hale Ln	31.55	31.56	0.01	0
10.a	80 Flower Ln	36.94	36.96	0.02	0

Receptor No	Receptor Location	2021 Committed Development NO_2 ($\mu g/m^3$)	2021 Committed Development and Pentavia NO_2 ($\mu g/m^3$)	Difference	Difference in respect of AQAL (rounded) (%)
11.a	33 Grahame Park Way	33.47	33.49	0.02	0
12.a	145 Page St	31.95	31.98	0.03	0
13.a	39 Bunns Ln	35.15	35.18	0.03	0
14.a	12a Pursley Rd	33.29	33.33	0.04	0
15.a	487 Watford Way	38.51	38.66	0.15	0
16.a	51 Hall Ln	33.02	33.05	0.03	0
16.b	14 Hall Ln	33.14	33.17	0.03	0
17.a	449 Watford Way	36.95	37	0.05	0
17.b	375 Watford Way	35.78	35.81	0.03	0
17.c	332 Watford Way	36.96	36.99	0.03	0

Model error range +12 to -11% depending on location

Table 9.31: NO_2 Levels 2026 With and Without Development

Receptor No	Receptor Location	2026 Committed Development NO_2 ($\mu g/m^3$)	2026 Committed Development and Pentavia NO_2 ($\mu g/m^3$)	Difference	Difference in respect of AQAL (rounded) (%)
01.a	95 Bunns Ln	40.46	40.5	0.04	0
01.b	86 Bunns Ln	40.93	40.98	0.05	0
01.c	54 Bunns Ln	38.5	38.54	0.04	0
02.a	Mardale Court	35.94	35.99	0.05	0
02.b	49 Page St	36.4	36.45	0.05	0
02.c	9 Page St	36.17	36.24	0.07	0
03.a	97-101 The Broadway	35.84	35.88	0.04	0
03.b	The Old Garages	37.69	37.72	0.03	0
04.a	9 Bunns Ln	39.59	39.61	0.02	0
05.a	A1	37.03	37.09	0.06	0
05.b	582 Watford Way	36.56	36.62	0.06	0
06.a	198 Lawrence St	32.99	33.02	0.03	0
07.a	1 Hartley Cl	38.75	38.84	0.09	0
08.a	12 Flower Ln	33.75	33.79	0.04	0
08.b	37 Flower Ln	33.58	33.61	0.03	0

Receptor No	Receptor Location	2026 Committed Development NO_2 (µg/m^3)	2026 Committed Development and Pentavia NO_2 (µg/m^3)	Difference	Difference in respect of AQAL (rounded) (%)
08.c	64 Flower Ln	34.03	34.06	0.03	0
09.a	2 Hale Ln	35.17	35.19	0.02	0
09.b	39 Hale Ln	35.09	35.11	0.02	0
09.c	68 Hale Ln	31.71	31.72	0.01	0
10.a	80 Flower Ln	37.3	37.33	0.03	0
11.a	33 Grahame Park Way	33.72	33.74	0.02	0
12.a	145 Page St	32.13	32.16	0.03	0
13.a	39 Bunns Ln	35.45	35.47	0.02	0
14.a	12a Pursley Rd	33.54	33.58	0.04	0
15.a	487 Watford Way	38.97	39.12	0.15	0
16.a	51 Hall Ln	33.24	33.27	0.03	0
16.b	14 Hall Ln	33.37	33.39	0.02	0
17.a	449 Watford Way	37.34	37.39	0.05	0
17.b	375 Watford Way	36.13	36.16	0.03	0
17.c	332 Watford Way	37.36	37.39	0.03	0

Model error range +12.5 to -11.1% depending on location

9.7.60 Tables 9.30 and 9.31 above both demonstrate that the potential effect of the Development traffic upon local receptors is typically around 0.01 – 0.15 µg/m^3 of NO_2 for both assessment years. This equates to less than 0.1% of the Air Quality Action Level of 40ug for all pollutants. Generally, this increase is seen to occur in areas which have a low sensitivity to pollutant levels (i.e. pollutant levels are not deemed close to objective levels). However, on Bunns Lane, Hartley Close and Watford Way, which are seen to be potentially approaching or exceeding objective levels, and be in areas of medium sensitivity, these changes are still considered to be minor magnitude and negligible significance.

9.7.61 The low levels of effect noted are indicative of those for both PM_{10} and $PM_{2.5}$ which were so low as to be imperceptible at all locations and have therefore not been reproduced here.

Mitigation and Residual Effects

Site Suitability

9.7.62 All of the baseline data gathered for the Site has indicated that central Site areas are within objective levels, and considered to be of ‘low’ sensitivity, whilst those locations adjacent to the road are expected to significantly exceed NO_2 objectives and considered to be of ‘very high’ sensitivity. Further studies relating to the effects of the Development upon the air quality within the central amenity areas indicate that a barrier effect is expected to occur, reducing pollutant levels further below the objectives at these locations and potentially into areas of ‘negligible’ sensitivity. Pollutant levels are also expected to reduce with height.

9.7.63 Therefore, the residual effects are likely to result in a minor to moderate magnitude changes in areas of low sensitivity in the central amenity areas which in accordance with Tables 9.7 and 9.8 and equates to a permanent and negligible beneficial significance.

9.7.64 Anticipated pollutant levels at the facades facing the roads identify these are locations of high sensitivity. Any concentration changes are likely to also be of moderate to major magnitude but in an area of high sensitivity his will result in change which are likely to be of and moderate to major adverse significance when Tables 9.7 and 9.8 are applied. However, it should be noted that the concept of sensitivity only applies to areas where receptors are regularly present. No amenity space is provided for residents on exposed facades. The MVHR will be provided to protect residents from poor internal air quality at these locations.

Traffic Emissions

9.7.65 With regards to receptors on Bunns Lane, Hartely Close and Watford Way the assessment undertaken has demonstrated that these locations are generally of low to medium sensitivity and that any impacts are anticipated to be potentially of low magnitude Therefore, this change is considered to be negligible potential significance for these receptors.

Air Quality Neutral/Positive

9.7.66 The Air Quality Neutral/Positive assessment of the transport emissions does indicate that the Development transport emissions are not air quality neutral, when compared to benchmarked emissions. As a result, mitigation measures have been proposed in the form of ‘active travel’ measures however, offsetting may also be required.

9.7.67 The Air Quality Neutral/Positive assessment of the building emissions has found these emissions do not reach neutrality without the use of a SCR system. Therefore, the use of an SCR system is proposed as mitigation

Energy Centre

9.7.68 Explicit modelling of the impact of the Cogeneration Plan and associated boilers without the use of an SCR demonstrates that no emissions are detectable as significant on Site or within the wider study area of $6km^2$.

9.8 Cumulative Effects

Demolition and Construction

9.8.1 As previously noted, the main potential effects to air quality due to demolition and construction works would be in relation to dust nuisance. Based on professional judgement, owing to the typical dispersal and deposition rates of dust with distance from their source, only schemes within 350m of the Site boundary would have the potential to cause a cumulative effect. Only a small section of the Grahame Park Estate scheme is within 350m of the Site and this is partially completed. The scheme will implement its own CEMP and dust management plan to mitigate dust nuisance effects. Therefore, dust effects from the Development and the cumulative schemes is considered to be negligible and not significant.

9.8.2 Exhaust emissions from the combined construction traffic of the Development and the cumulative schemes could give rise to cumulative residual effects on local air quality. The extent of the effect would depend upon the amount of overlap between the Developments construction programme and that of the cumulative schemes. It is generally the case that demolition and construction traffic add a very small proportion of additional traffic to the local highway network. The worst-case scenario would be if the construction of the cumulative schemes overlap with the construction of the Development, and use the same, or nearby construction traffic routes. The likely residual cumulative effect is therefore considered to be temporary, short-term, local, adverse and of minor significance at worst. It is assumed that appropriate traffic management measures would be implemented by the cumulative schemes to reduce as much traffic disruption as is practically possible.

9.8.3 In the event that exhaust emissions from the plant operating on the Site and cumulative scheme sites occur concurrently, it is considered that the likely residual cumulative effects would be not significant in the context of the existing adjacent road traffic and exhaust emissions. The likely residual cumulative effect is therefore considered to be temporary, short-term, local, adverse and of negligible significance.

Mitigation, Monitoring and Residual Effects

9.8.4 An assessment has been made of the potential effects associated with the likely construction works to be undertaken. This has concluded that where the mitigation measures suggested within the construction dust risk assessment are applied, residual effects are likely to be negligible to minor adverse.

9.8.5 A review of the proposed levels of construction traffic has concluded that the numbers of vehicles movements proposed is not considered to have the potential to cause a significant adverse effect for any local air quality sensitive receptors.

Completed Development

9.8.6 The Air Quality Assessment is closely linked to the Transport Assessment and the predicted changes in traffic flows. The traffic data used within the Air Quality Assessment for the future year of 2021 and 2026 includes traffic related to other relevant cumulative schemes in the surrounding area and therefore comprises a cumulative effect assessment in this regard.

9.8.7 For these reasons, is it considered that the likely cumulative residual effects of traffic emissions on local air quality from the Development and the cumulative schemes are in areas of medium sensitivity, are considered to be minor magnitude and negligible significance.

9.8.8 The GLA air quality neutral assessment which was undertaken has identified that whilst the building emissions are considered to be ‘air quality neutral’ the traffic emissions are not. Therefore, mitigation measures are required to reduce these emissions are set out in the Framework Travel Plan which forms part of the submission (Appendix 7.1).

9.8.9 The principal of an Energy Centre was assessed for potential effects upon local receptors and those across the wider area. This has concluded that no emissions are detectable as significant within the wider study area

Table 9.33: Summary of Effects of the Development

Effect	Receptor (Sensitivity)	Geographic Scale	Temporal Scale	Significance of Effect (pre-mitigation)	Mitigation and Monitoring	Residual Effect
Construction						
Dust impacts	High	350m	Short-term	Negligible to minor adverse	Implementation of the mitigations identified within the Construction Dust Risk Assessment within a Construction Management Plan	Negligible
Operational Development						
Site Suitability	Low	<200m diameter	Long-term	Minor to moderate beneficial	This is a beneficial effect of the development barrier on the internal amenity area.	Negligible
Energy Centre emissions – on site	Low to Medium	~200m diameter	Long-term	Negligible adverse	SCR System required to achieve Air Quality Positive position against benchmarking	Negligible
Energy Centre emissions – wider areas	Low to Medium	$6km^2$	Long-term	Negligible adverse	SCR System required to achieve Air Quality Positive position against benchmarking	Negligible
Traffic emissions	Low to Medium	~1.5km north-west to ~1.5km south-east (along local road network)	Long-term	Minor to moderate	Implementation of Active Travel within Travel Plan and Offsetting to achieve Air Quality Positive position against benchmarking	Negligible
Cumulative Effects						
Dust Impacts	Low	<350m	Short-term	Negligible to minor adverse	Implementation of the mitigations identified within the	Negligible

					Construction Dust Risk Assessment within a Construction Management Plan	
Energy Centre emissions – wider areas	Low to Medium	$6km^2$	Long-term	Negligible adverse	SCR System required to achieved Air Quality Positive position against benchmarking	Negligible
Traffic emissions	Low to Medium	1km	Long-term	Minor to moderate adverse	Implementation of Active Travel within Travel Plan and Offsetting to achieve Air Quality Positive position against benchmarking	Negligible

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