Hydrock

Hampton Waterworks

Air Quality Assessment

For Waterfall Hampton Investment Ltd

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1. INTRODUCTION

Hydrock have been commissioned by Waterfall Hampton Investment Ltd to prepare an Air Quality Assessment (AQA) to support the planning application for a mixed use development ('Proposed Development'), at Hampton Waterworks, Upper Sunbury Road, Hampton (the 'Site'). The Site is located within the administrative boundary of London Borough of Richmond upon Thames (LBRT). The Site is centred on the National Grid Reference (NGR); x513475, y169490 and shown below in Figure 1.

The Site currently comprises several buildings associated with the Hampton Waster works including Karslake building, storehouse, cottages and the Ruston & Ward building. The Site is situated to the south of Upper Sunbury Road, with Lower Sunbury Road bordering the eastern Site boundary. 5 Waterworks cottage border the Site to the west and Waterworks tanks lie immediately to the south. Hampton library lies approximately 45m to the north, with residential dwellings located north of Upper Sunbury Road to the east and west of the Site.

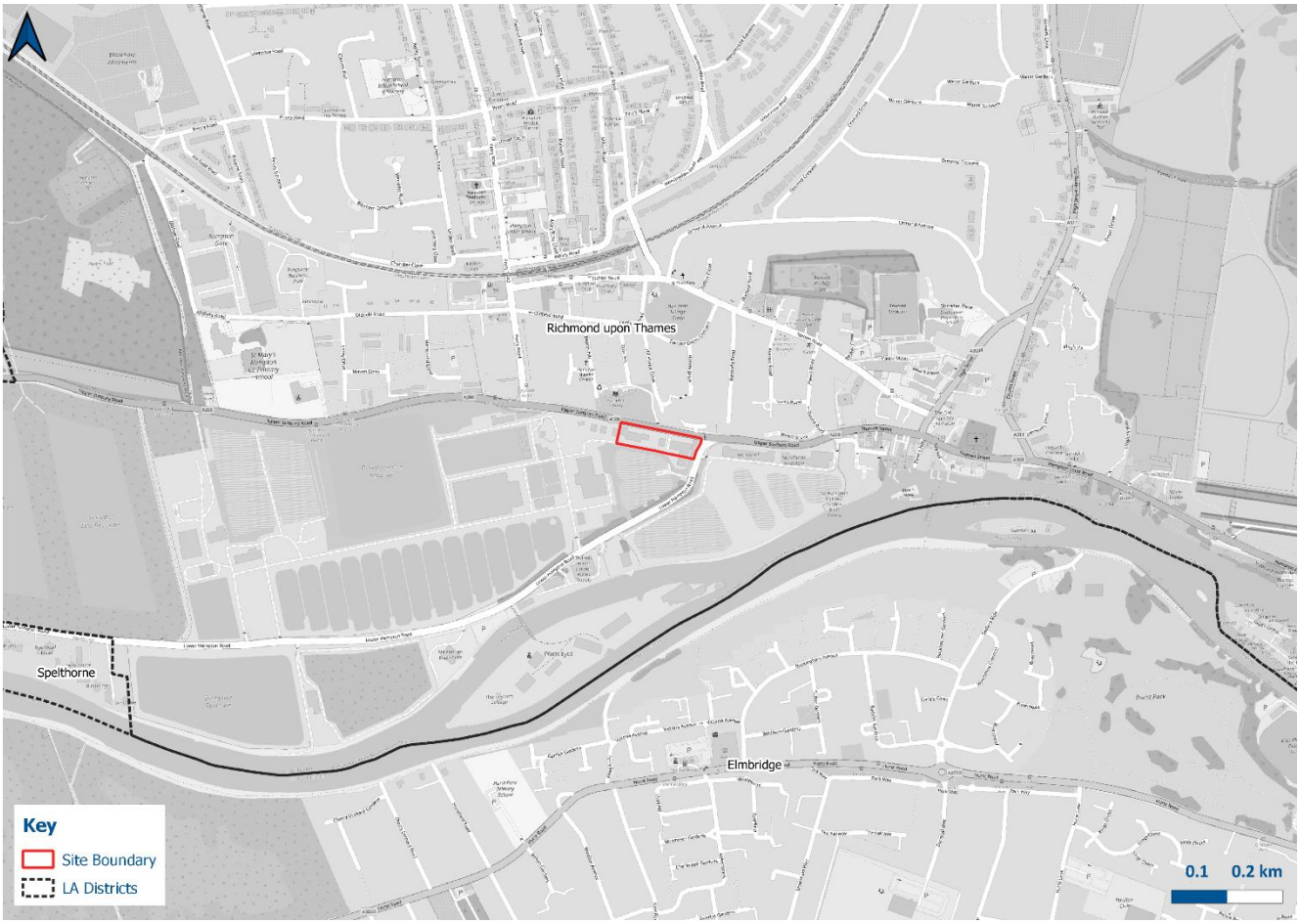

Figure 1 - Site Location

1.1 Proposed Development

The proposals seek approval for the redevelopment and extension of the existing Hampton Waterworks buildings to provide a total of 36 residential units and 306m^2 commercial space. The units will comprise a combination of 1,2, 3 and 4-bedrooms. Vehicular access will be obtained from the existing Site access locations on Upper Sunbury Road and 39 car parking spaces are included within the proposals.

1.2 Purpose of Air Quality Assessment

The assessment describes the scope, relevant legislation, assessment methodology and the baseline conditions currently existing in the area. It then presents the potential impacts resulting during the construction and operational phases of the Proposed Development and an evaluation of the significance of effects.

2. RELEVANT LEGISLATION

2.1 Air Quality Regulations and Objectives

There are two sets of air quality legislation which include ambient air quality thresholds for the protection of public health that apply in England, these include legally binding limit values originally set by the European Union (EU) Directive 2008/50/EC[1] on ambient air quality and cleaner air for Europe; and regulations implementing national air quality objectives as set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)[2] which local authorities are required to work towards achieving.

The EU (Withdrawal Agreement) Act 2020 sets out arrangement for implementing air quality limit values that are included in the EU Directive on ambient air quality and cleaner air for Europe (2008/50/EC) included in the following:

- Air Quality Regulations (SI 2010 No.1001)[3] and amended (SI 2016 No.1184)[4] ;
- The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (SI 2019 74)[5] ;
- The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (SI 2020 1313)[6] amend the Air Quality Regulations (SI 2010 No.1001) to account for EU withdrawal; and
- The AQS objectives are implemented in the Air Quality (England) Regulations 2000 (SI 2000/928)[7] and Air Quality (England) (Amendment) Regulations 2002 (SI 2002/3043)[8].

The Air Quality Strategy 2007 Volume 1[2] sets out the government's policies and framework for improving air quality in the UK with the aim of meeting the requirements of above legislation The Air Quality Strategy also outlines the Limit Values, Target Values, Standards, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report). Those relevant to this assessment is provided below, in Table 1:

[1] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe Available at: https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050

[2] Defra. "The Air Quality Strategy for England, Scotland, Wales and Northern Ireland". Available at: https://www.gov.uk/government/publications/2010-to-2015-government-policy-environmental-quality/2010-to-2015-government-policy-environmental-quality#appendix-5-international-european-and-national-standards-for-air-quality

[3] The National Archives. "The Air Quality Standards Regulations 2010". Available at: http://www.legislation.gov.uk/uksi/2010/1001/contents/made

[4] The National Archives (2016). "The Air Quality Standards (Amendment) Regulations 2016". Available at: https://www.legislation.gov.uk/uksi/2016/1184/contents/made

[5] The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (legislation.gov.uk). Available at: https://www.legislation.gov.uk/uksi/2019/74/contents/made

[6] The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (legislation.gov.uk). Available at: https://www.legislation.gov.uk/uksi/2020/1313/contents/made

[7] The National Archives. "The Air Quality (England) Regulations 2000". Available at: http://www.legislation.gov.uk/uksi/2000/928/contents/made

[8] The National Archives. "The Air Quality (England) (Amended) Regulations 2002". Available at: http://www.legislation.gov.uk/uksi/2002/3043/contents

Table 1 - National Air Quality Assessment Levels

Pollutant	Averaging Period	AQALs	
NO_2	1 Hour Mean	200 µg/m^3	Not to be exceeded more than 18 times in a year.
	Annual Mean	40 µg/m^3	
PM_{10}	24 Hour Mean	50 µg/m^3	Not to be exceeded more than 35 times in a year.
	Annual Mean	40 µg/m^3	
$PM_{2.5}$	Annual Mean	20 µg/m^3	

Defra's Local Air Quality Management Technical Guidance 2016 (LAQM.TG(22))[9] provides guidance on where the above AQALs should apply. This is summarised below, in Table 2:

Table 2 - Summary of where AQALs should apply:

Averaging Period	Objectives should apply at:	Objectives should generally NOT apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual Mean and: 24 and 8-hour mean objectives apply. Kerbside site (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railways stations etc. which are not fully enclosed, where members of the public might be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expect to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where member of the public might reasonably be exposed for a period of 15 minutes.	

[9] Defra, "LAQM Technical Guidance LAQM.TG22" (Department for Food, Environment and Rural Affairs (Defra), August 2022), https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf

2.2 Local Air Quality Management

Obligations under the Environment Act 2021[10] (which provides an amendment to the Environment Act 1995[11]) requires local authorities to review and assess air quality in their administrative boundaries. Where AQALs are predicted to be exceeded, the local authority must declare an Air Quality Management Area (AQMA) at sensitive receptor locations and formulate an Air Quality Action Plan (AQAP) to reduce pollution concentrations to values below AQALs.

The London Local Air Quality Management (LLAQM) framework[12] is the statutory process used by London authorities to review and improve air quality within their administrative boundaries. This framework was designed to specifically meet London's needs. The LLAQM framework provides London-specific policy and technical guidance (LLAQM.PG(19)[13] and LLAQM.TG(19)[14] for London boroughs. Although both are largely based on the updated national LAQM guidance (2016)[15], they incorporate London-specific elements of the LAQM system.

2.3 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[16] sets out the Government's planning policy for England. It requires planning decisions for any new development to prevent new and existing development from contributing to, or being put at risk from, unacceptable levels of air pollution (paragraph 174). It also states that planning decisions should sustain and contribute towards compliance with relevant limit values or national objectives for air pollutants, taking into account the presence of AQMAs and Clean Air Zones (CAZ)s (paragraph 186), and the cumulative impacts from other sites (paragraph 185).

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. Furthermore, planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan.

Also, to help reduce congestion and emissions, to improve air quality and public health, significant development should be focused on locations which are / can be made sustainable through limiting the need to travel (paragraph 105).

2.4 Planning Practice Guidance

Reference ID 32 (Air Quality) of the National Planning Practice Guidance (NPPG)[17], which was updated in November 2019, provides guiding principles on how planning can take account of the impact of new development on air quality. The NPPG summarises the importance of air quality in planning and the key legislation relating to it.

In particular, it provides some examples of mitigation measures to reduce air quality impacts, including:

- maintaining adequate separation distances between sources of air pollution and receptors;

[10] https://bills.parliament.uk/bills/2593/publications

[11] Environment Agency, "Environment Act 1995" (The Environment Agency, 2002), http://www.legislation.gov.uk/ukpga/1995/25/contents.

[12] London Local Air Quality Management (LLAQM) Framework. www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/working-london-Boroughs

[13] London Local Air Quality Management (LLAQM) Policy Guidance 2019. https://www.london.gov.uk/sites/default/files/llaqm_policy_guidance_2019.pdf

[14] London Local Air Quality Management (LLAQM) Technical Guidance 2019. https://www.london.gov.uk/sites/default/files/consultation-document-2-draft-revised-llaqm-techical-guidance.pdf

[15] Defra, "LAQM Technical Guidance 2016, April 2021, https://laqm.defra.gov.uk/documents/LAQM-TG16-April-21-v1.pdf

[16] Ministry of Housing, Communities and Local Government, "National Planning Policy Framework," July 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf.

[17] Ministry of Housing, Communities & Local Government, "Reference ID (32) Air Quality" (Ministry of Housing, Communities & Local Government, 2019), https://www.gov.uk/guidance/air-quality--3.

- using green infrastructure, in particular trees, where this can create a barrier or maintain separation between sources of pollution and receptors;
- appropriate means of filtration and ventilation;
- including infrastructure to promote modes of transport with a low impact on air quality (such as electric vehicle charging points);
- controlling dust and emissions from construction, operation and demolition; and
- contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development.

2.5 Regional Planning Policy

2.5.1 London Environment Strategy

The London Environment Strategy[18] released in May 2018 replaces the 2010 Mayor's air quality strategy and sets out policies and strategies across all environmental sectors to reduce pollution and protect people and the environment from its harmful effects. The strategy sets out objectives and policies to reduce emissions and air pollution, some of these include:

> *"Produce and maintain the London Atmospheric Emissions Inventory (LAEI) to better understand pollution sources in London"*
>
> *"Prioritising the phasing out of Diesel vehicles",*
>
> *"Through TfL, will clean up the bus fleet by phasing out fossil fuels, prioritising action on diesel, and switching to zero emission technologies".*
>
> *"Reduce emissions from non-road transport sources, including by phasing out fossil fuels"*
>
> *[…] "promote and prioritise more sustainable travel in London, including walking, cycling and public transport, as part of the Healthy Streets Approach"*
>
> *"Work with industry and other partners to seek reductions in emissions from construction and demolition sites"*

2.5.2 The London Plan

The GLA London Plan 2021[19] also addresses air quality. This is mainly dealt with within Policy SI 1 Improving Air Quality, which states:

> ***"A** Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.*
>
> ***B** To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:*
>
> *1) Development proposals should not:*
>
> *a) lead to further deterioration of existing poor air quality*

[18] Greater London Authority, "London Environment Strategy," May 2018, https://www.london.gov.uk/sites/default/files/london_environment_strategy_0.pdf.
[19] Greater London Authority, "THE LONDON PLAN 2021: THE SPATIAL DEVELOPMENT STRATEGY FOR GREATER LONDON," March 2021, https://www.london.gov.uk/sites/default/files/the_london_plan_2021.pdf.

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

***C** Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:*

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

***D** In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.*

***E** Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development."*

The following policy is also included in the London Plan 2021 and is aimed as a Good Growth objective to improve London as it grows:

"Policy GG3 Creating a healthy city

To improve Londoners' health and reduce health inequalities, those involved in planning and development must:

[…]

F seek to improve London's air quality, reduce public exposure to poor air quality and minimise inequalities in levels of exposure to air pollution.

2.6 Local Planning Policy

LBRT adopted the Local Plan[20] in July 2018. The document sets out the Council's policies and guidance for the development of the borough over the next 15 years. The following policies relate to air quality and state:

> *"Policy LP 8 – Amenity and Living Conditions*
>
> *All development will be required to protect the amenity and living conditions for occupants of new, existing, adjoining and neighbouring properties. The Council will:*
>
> *[…]*
>
> *4. ensure there is no harm to the reasonable enjoyment of the use of buildings, gardens and other spaces due to increases in traffic, servicing, parking, noise, light, disturbance, air pollution, odours or vibration or local micro-climatic effects.*
>
> *Applicants are expected to have regard to the guidance set out within the Council's SPDs relating to design, including Village Planning Guidance, SPDs on extensions, infill and backland developments, housing mix and standards as well as residential development standards.*
>
> *Policy LP 10 – Local Environmental Impacts, Pollution and Land Contamination*
>
> *A. The Council will seek to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land. These potential impacts can include, but are not limited to, air pollution, noise and vibration, light pollution, odours and fumes, solar glare and solar dazzle as well as land contamination.*
>
> *Developers should follow any guidance provided by the Council on local environmental impacts and pollution as well as on noise generating and noise sensitive development. Where necessary, the Council will set planning conditions to reduce local environmental impacts on adjacent land uses to acceptable levels.*
>
> *Air Quality*
>
> *B. The Council promotes good air quality design and new technologies. Developers should secure at least 'Emissions Neutral' development. To consider the impact of introducing new developments in areas already subject to poor air quality, the following will be required:*
>
> *1. an air quality impact assessment, including where necessary, modelled data;*
>
> *2. mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology;*
>
> *3. measures to protect the occupiers of new developments from existing sources;*
>
> *4. strict mitigation for developments to be used by sensitive receptors such as schools, hospitals and care homes in areas of existing poor air quality; this also applies to proposals close to developments used by sensitive receptors"*

[20] London Borough of Richmond upon Thames, Local Plan, July 2018

3. METHODOLOGY

3.1 Guidance

The following guidance has been used to undertake this AQA:

- Defra's LAQM.TG (22) [21];
- London Local Air Quality Management Technical Guidance 2019 (LLAQM.TG(19))[22];
- Sustainable Design and Construction Supplementary Planning Guidance 2014[23];
- Environmental Protection UK (EPUK) and Institute for Air Quality Management (IAQM) Land-use Planning & Development Control: Planning for Air Quality[24];
- London Council's Air Quality and Planning Guidance, Revised version January 2007[25];
- IAQM's guidance on the assessment of Dust from Demolition and Construction[26];
- GLA's The Control of Dust and Emissions During Construction and Demolition[27];
- Air Quality Neutral London Plan Guidance[28]; and
- LBRT Air Quality Supplementary Planning Document (SPD)[29].

3.2 Baseline Air Quality

The baseline air quality conditions in the vicinity of the Site have been established through the compilation and review of the following sources. The baseline assessment can be found in Section 4.

- Data from the National Atmospheric Emissions Inventory (NAEI) [30], Environment Agency (EA)[31] and Defra's Pollutant Release and Transfer Register (PRTR) data[32];
- Defra's modelled background concentrations of AQS pollutants (UK-AIR)[33]. These estimates are produced using detailed modelling tools and are available as concentrations at central 1km^2 National Grid square locations across the UK. Mapped background concentrations have been obtained based upon the 2018 base year Defra update (August 2020 publication);
- Defra's predicted roadside concentrations of NO_2 produced from their pollution climate model (PCM)[34];

[21] Defra, "LAQM Technical Guidance LAQM.TG22" (Department for Food, Environment and Rural Affairs (Defra), August 2022), https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf
[22] Mayor of London, "London Local Air Quality Management Technical Guidance 2019 (LLAQM.TG(19)), https://www.london.gov.uk/sites/default/files/llaqm_technical_guidance_2019.pdf
[23] Greater London Authority, "Sustainable Design and Construction - Supplementary Planning Guidance," April 2014, https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf.
[24] EPUK & IAQM, "Land-Use Planning & Development Control: Planning for Air Quality" (Institute for Air Quality Management (IAQM), January 2017), http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf.
[25] London Councils, "Air Quality and Planning Guidance: Revised Version- January 2007," January 2007, https://www.londoncouncils.gov.uk/node/25533.
[26] IAQM, "Guidance on the Assessment of Dust from Demolition and Construction" (Institute of Air Quality Management (IAQM)), February 2014), http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf.
[27] Greater London Authority (GLA), "The Control of Dust and Emissions During Construction and Demolition.," 2014, https://www.london.gov.uk/file/18750/download?token=zV3ZKTpP.
[28] Greater London Authority, Air Quality Neutral London Plan Guidance, Mayor of London, February 2023.
[29] London Borough of Richmond upon Thames, Air Quality Supplementary Planning Document, June 2020
[30] National Atmospheric Emissions Inventory, UK Emissions Interactive Map (beis.gov.uk).
[31] https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory
[32] UK Pollutant Release and Transfer Register (PRTR) https://prtr.defra.gov.uk/map-search
[33] UK-AIR, "Background Mapping Data for Local Authorities - 2018," n.d., https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018.
[34] https://uk-air.defra.gov.uk/data/gis-mapping/

- London Atmospheric Emissions Inventory (LAEI) 2019[35], which is available from the London Datastore and provides estimates of key pollutants using the latest data sources such as emission factors and activity data.
- Multi Agency Geographic Information for the Countryside (MAGIC)[36] and;
- LBRT's latest available air quality monitoring data, derived from the latest available air quality annual status report published in 2021[37].

3.3 Construction Phase Assessment

3.3.1 Dust Risk Assessment

The construction dust risk assessment is provided in Section 5 and has been undertaken in line with IAQM guidance. This considers the risk of impacts during the construction phase in terms of nuisance dust, human health (PM_{10} exposure) and ecological impacts.

With regard to ecological receptors, risk assessment should be taken where high-sensitivity receptors are located within 50m of a Site boundary. The Multi Agency Geographic Information for the Countryside (MAGIC) website, which incorporates Natural England's interactive maps[38], has been reviewed to identify whether any statutory ecological sensitive receptors are situated within 50m of the Site boundary or within 50m of any routes used by construction vehicles on the public highway, up to 500m from the Site entrance. The local area was screened for ecological receptors and no receptors were identified within 50m of the Site boundary or Trackout route and therefore no further consideration of ecological receptors is required.

Sensitive receptors were identified within 350m of the site boundary. Based on the IAQM guidance residential dwellings, museums, car parks and car show room are indicative examples of high sensitivity receptors in relation to both dust soiling and health effects of PM_{10}. Indicative examples of medium sensitivity receptors include places of work, such as offices.

The IAQM guidance states that the potential dust emission magnitude from Demolition, Earthworks, Construction and Trackout should all be assessed individually. In addition, the sensitivity of the area to adverse dust impacts should also be defined.

The overall significance of the risk of adverse impacts during the construction phase can then be defined using the 'risk of impacts matrix' for each stage of the construction phase described above.

3.3.2 Construction Traffic Emissions

The potential impact of construction vehicle emissions on local air quality has been evaluated using criteria given in guidance published by EPUK/IAQM guidance[24]. Impacts of Non-Road Mobile Machinery (NRMM) has also been addressed in accordance with the GLA guidance[23]

[35] https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019

[36] https://magic.defra.gov.uk/MagicMap.aspx

[37] London Borough of Richmond upon Thames, "Air Quality Annual Status Report for 2020," May 2021, na.

[38] Natural England and MAGIC partnership organisations., "Multi Agency Geographic Information for the Countryside.," 2020, https://magic.defra.gov.uk/MagicMap.aspx.,

3.4 Operational Phase Assessment

3.4.1 Scope of Impact Assessment

The scope of assessment has been determined against the EPUK and IAQM's two stage checklist criteria[24]. The Stage 1 criteria identifies whether a development requires an air quality assessment. As the proposals include more than 10 residential dwellings and more than 10 parking spaces, consideration of Stage 2 is required.

Stage 2 includes some criteria which are not directly relevant to the Proposed Development, such as those related to the realignment of roads within an AQMA, introduction of a new bus station, new road junctions and underground car parks. These have been excluded from this assessment and only relevant screening criteria have been included. The relevant checklist criteria shown in Table 3 identifies whether a detailed assessment of potential air quality impacts is required.

Table 3 – EPUK & IAQM Detailed Assessment Criteria

Criteria	The development will:	Indicative criteria to proceed to a detailed AQA:
1	Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV - cars and small vans <3.5t gross vehicle weight)	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA -more than 500 AADT elsewhere.
2	Cause a significant change in Heavy Duty (HDV) flows on local roads with relevant receptors (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3	Have one of more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. This includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO_x emission rate is less than 5mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situation where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emissions rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

As the Site is located within the boroughwide AQMA the more stringent criteria apply. The Proposed Development is anticipated to generate 100 Annual Average Daily Traffic (AADT); therefore, a detailed AQA has been undertaken in accordance with EPUK & IAQM guidance to assess air quality impacts from development-generated traffic.

Other than road traffic, there are no substantial combustions sources planned for the development, as such impacts from these sources are not discussed further.

Based on the above, a detailed assessment of air quality impacts from scheme-generated traffic has been undertaken, in accordance with EPUK & IAQM guidance, as outlined below.

3.4.2 ADMS-Urban Dispersion Model

A detailed assessment has been undertaken using the air dispersion model ADMS-Urban v5.1. The software is commercially available, has been validated for this type of assessment by Defra, and is able to provide an estimate of pollutant concentrations, considering important input data such as background pollutant concentrations, variable emissions, meteorological data, and traffic flows.

3.4.3 Assessment Scenarios

The following scenarios have been assessed:

- 2019 Base Year for model verification;
- Do Minimum (DM) – Proposed development earliest opening year traffic flows (2024), including committed developments; and
- Do Something (DS) – DM (2024) scenario flows in addition to proposed development traffic.

3.4.4 Model Inputs

3.4.4.1 Traffic Data

Traffic and speed data used in the model was provided by the Transport Consultants (Markides Associates), with data supplemented from LAEI for verification purposes. The data provided by Markides Associates is based on surveys undertaken in 2019. For future years (2024) a TEMPro (v7.2c) growth factor was applied to the 2019 data. The modelled road links are shown in Figure 2 below, with full details of traffic model inputs are provided in Appendix A.

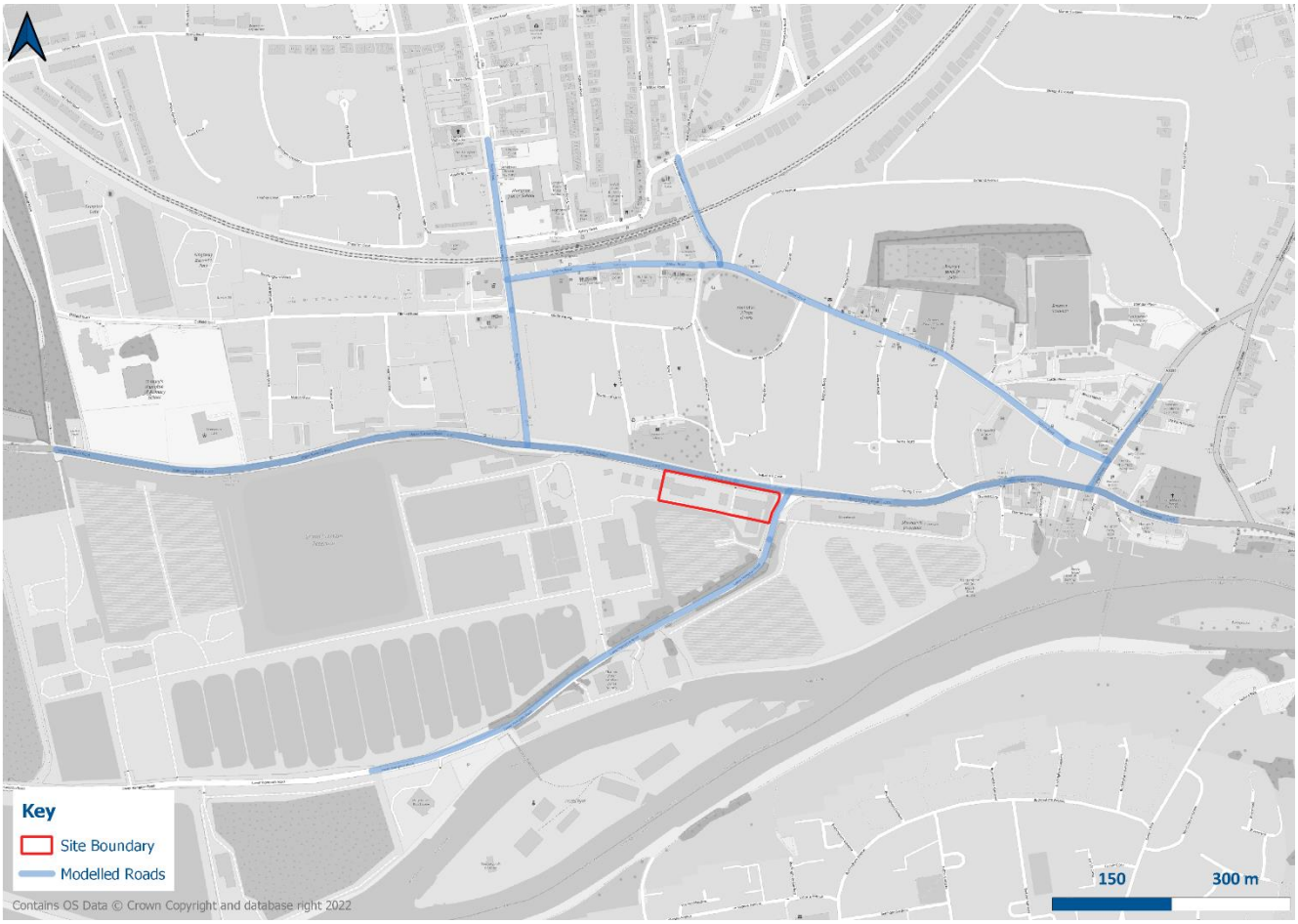

Figure 2 – Road Links Included in Dispersion Model

For each road link, vehicle speeds were obtained from the speed limit for each road derived from the OpenStreet Browser v4.10[39], which has been used as a proxy for average speeds on the network. Vehicle speeds were reduced within 50m of junctions relative to the speed limit to account for queuing and congestion in the average speed profile, in accordance with LAQM.TG (22). Google typical traffic was used to assist with determining appropriate slow down speeds across the study area.

3.4.4.2 Emission Factors

Emission rates for NO_x, PM_{10} and $PM_{2.5}$ used for the dispersion modelling assessment were calculated from Defra's latest Emissions Factor Toolkit (EFT)(v.11) which was released in November 2021.

Most modern vehicles on the road in the UK meet a particular Euro emissions standard from 1 – 6, with 6 being the newest. Different parts of the country have newer or older vehicles than others. This is defined as the "fleet". For this assessment the vehicle fleet setting applied was "London (outer)".

When predicting future year emissions, the toolkit includes forecasts such as anticipated advances in vehicle technology and changes in vehicle fleet composition, which assumes that vehicle emissions will reduce over time. It should be noted, there is a degree of uncertainty with the accuracy of the future predictions.

[39] https://www.openstreetbrowser.org/#map=15/53.7033/-1.2698&categories=car_maxspeed, accessed June 2022

3.4.4.3 Meteorological Parameters

To calculate pollutant concentrations at identified sensitive receptor locations the dispersion model uses hourly sequential meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

The dispersion modelling has been undertaken using 2019 data from Heathrow Airport meteorological station, with missing cloud cover infilled from Northolt. This station is located approximately 10km north west of the Site. It is also the closest and most relevant meteorological station that records all of the parameters necessary for dispersion modelling. A wind rose is presented in Appendix B.

3.4.4.4 Surface Characteristics

The following surface roughness parameters have been applied in the model:

- Dispersion site surface roughness = 0.5m (ADMS pre-set 'Parkland / Open Suburbia');
- Met site surface roughness = 0.02m (ADMS pre-set 'open grassland');

The following Minimum Monin-Obukhov (MO) lengths were applied:

- Dispersion site = 100m;
- Met site = 30m.

3.4.5 Receptors Included in Dispersion Model

3.4.5.1 Human Receptors

Sensitive receptor locations included in the dispersion model are shown below in Figure 3 and Table 4. These are worst-case locations within the development locale based upon their proximity to the affected road network.

Table 4 – Receptor Locations

Receptor ID	Location	NGR		Z (m)
		X	Y	
PR01	Proposed Receptor 1	513426	169516	1.5
PR02	Proposed Receptor 2	513479	169508	1.5
PR03	Proposed Receptor 3	513543	169487	1.5
R01	1 Isabel Hill Close	513576	169511	1.5
R02	2 Upper Sunbury Road	513662	169498	1.5
R03	34 Thames Street	513888	169520	1.5
R04	23 Thames Street	513869	169510	1.5
R05	Thames View, Upper Sunbury Road	513250	169568	1.5
R06	5 Upper Sunbury Road	513371	169521	1.5
R07	8 Manson Close	512945	169546	1.5

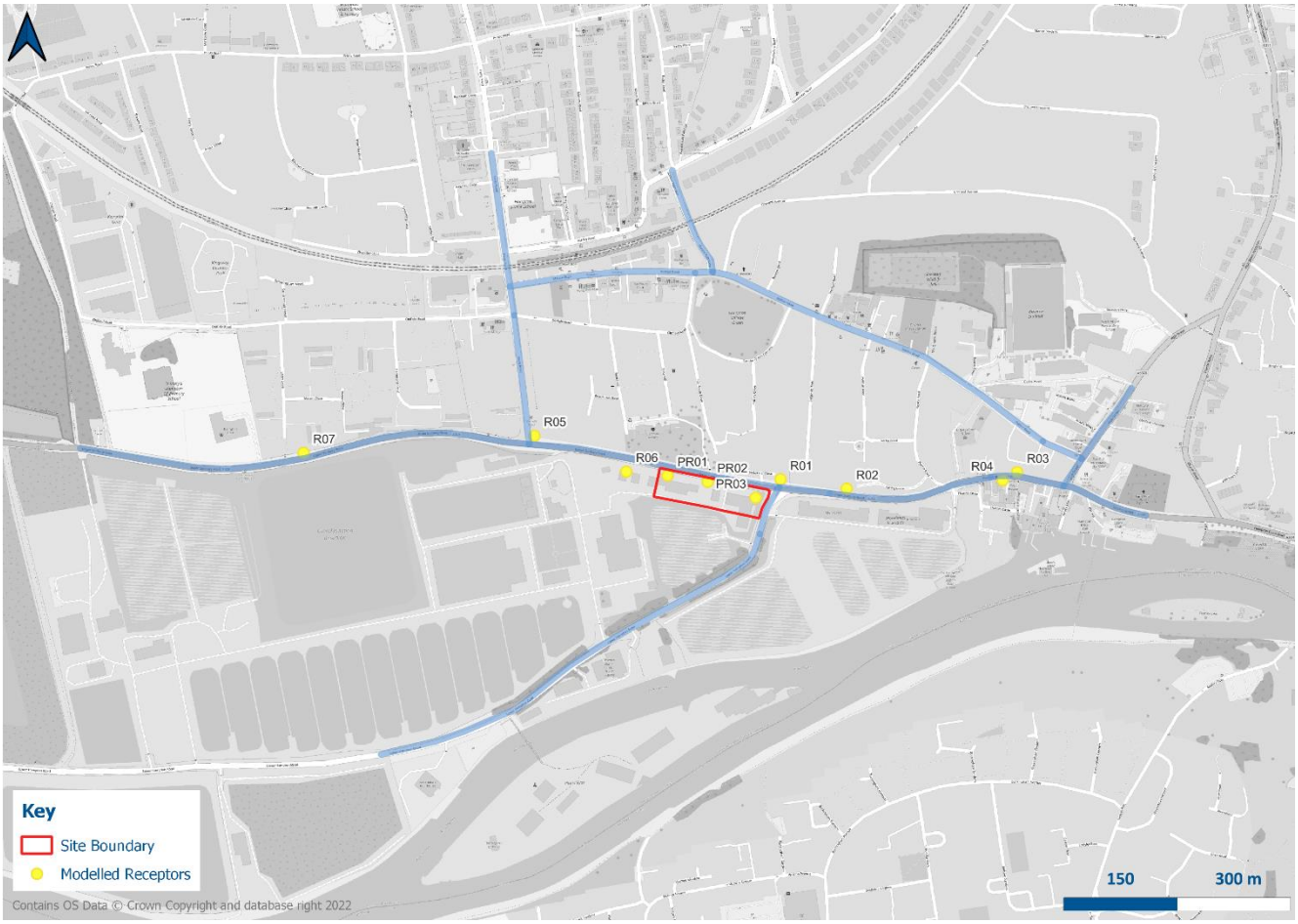

Figure 3 – Receptor locations Included in Dispersion Model

3.4.5.2 Ecological receptors

The area surrounding the Site was assessed for the designations listed below using the MAGIC website, which incorporates Natural England's interactive maps[36]:

- Special Protection Areas (SPAs);
- Special Areas of Conservation (SACs);
- Ramsar sites (protected wetlands);
- Sites of Special Scientific Interest (SSSIs); and
- Local nature sites (ancient woodlands, local wildlife sites and national and local nature reserves)

There are no ecological sites that are expected to be affected by vehicle trips from the Site.

3.4.6 Model Verification

A verification study has been undertaken in accordance with LAQM.TG(22) using LA monitoring data from 2019. An adjustment factor of **1.996** was applied to modelled road NO_x concentrations.

Due to insufficient PM monitoring in the study area, the modelled road-PM_{10} and road-$PM_{2.5}$ components have been adjusted by the NO_x verification factor obtained before adding to the appropriate background concentration, in accordance with LAQM.TG(22). This approach is considered likely to provide a conservative estimate of the contribution of modelled roads to ambient PM_{10} and $PM_{2.5}$ concentrations.

Details of the model verification procedure are included in Appendix C.

3.4.7 NO_x to NO_2 conversion

Ambient NO_x concentrations have been predicted through dispersion modelling. Annual NO_x concentrations have been converted using Defra's NO_x to NO_2 conversion tool[40] version 8.1.

3.5 Comparison with Air Quality Criteria

3.5.1 Nitrogen Dioxide

Dispersion model annual mean road NO_x was converted to annual mean NO_2 using the Defra calculator. To determine short term (1 hour mean) concentrations, reference was made to LAQM.TG(22)[9], which states if annual mean concentrations of NO_2 do not exceed 60µg/m³, it is unlikely hourly mean concentrations would exceed the relevant objective, which allows for 18 exceedances of the hourly standard (200µg/m^3) in a calendar year.

3.5.2 Particulate Matter

To determine total annual mean concentrations of PM_{10} and $PM_{2.5}$ at receptors, the modelled road contribution is added to the background concentration to give the total concentration for comparison with the annual mean criterion.

Annual mean PM_{10} concentrations are then used to derive the number of exceedances of the 24-hour mean PM_{10} criterion, of which 35 are allowed per year. The method described in Defra's Technical Guidance LAQM.TG(22) was applied, which is based on the relationship between the number of 24-hour exceedances of 50µg/m^3 and the annual mean concentration. This relationship is described in Equation 1 below:

Equation 1 - Calculation of PM_{10} 24-hour Mean Exceedances

Number of exceedances of 24-hour mean of 50µg/m^3 = -18.5 + 0.00145 * a^3 + (206/a)

where 'a' = total annual mean PM_{10} concentration.

3.6 Assessment of Significance

The long-term annual average for NO_2, PM_{10} and $PM_{2.5}$ have been compared against the applicable AQALs and the significance of impacts has been determined against the following threshold criteria, from the EPUK & IAQM guidance (Table 5).

[40] Defra, "NOx to NO2 Calculator" (Defra, 2019), https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc.

Table 5 - Impact Significance Criteria

Long term average concentration at receptor in assessment year	% Change in concentration relative to AQAL			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 - 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 - 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Notes:
In accordance with EPUK & IAQM planning guidance any change less than 0.5% will be considered as Negligible. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.

3.6.1 Impacts on Future Occupants

The results of the dispersion modelling assessment were compared against the Air Pollution Exposure Criteria (APEC) contained within the London Councils Air Quality and Planning Guidance[25]. As a large area of London experience high pollutant concentrations, the criteria allow for appropriate mitigation to protect future users to be applied (Table 6).

Table 6 - Air Pollution Exposure Criteria

APEC Band	Applicable Range NO_2 Annual Mean	Applicable Range PM_{10}	Recommendation
APEC – A	> 5% below national objective	Annual Mean: > 5% below national objective 24 hr:> 1-day less than national objective	No air quality grounds for refusal; however, mitigation of any emissions should be considered.
APEC – B	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.	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., Maximise distance from pollutant source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised.
APEC – C	> 5% above national objective	Annual Mean: > 5% above national objective 24hr: > 1-day more than national objective.	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further.

3.7 Model Limitations

There are inherent uncertainties associated with the model (ADMS Urban) used in this assessment, including the uncertainties associated with the input data such as predicted traffic flows. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS model will not take into account.

To account for uncertainty in future emission factors and pollutant concentrations, a precautionary principle has been undertaken in the assessment, whereby:

- Emission Factors held at 2019 (no future improvements assumed);
- Background pollutant concentrations held at 2019 (no future improvements assumed)

The above assumptions ensure a conservative approach has been considered in the assessment.

4. BASELINE AIR QUALITY CONDITIONS

Baseline air quality conditions in the study area are established through compilation and review of appropriately sourced monitoring and modelling data.

4.1 Local Air Quality Management

LBRT declared a borough wide AQMA in 2000 due to NO_2 and PM_{10} annual mean and 24-hour mean PM_{10} concentrations not meeting the national air quality objectives in many parts of the borough.

Through the LAQM process in London, the GLA has declared 187 Air Quality Focus Areas (AQFA). These are areas that not only exceed AQALs but are also locations with high human exposure. The closest AQFA to the Proposed Development is located approximately 4km east.

4.2 Local Emissions Sources

The main source of air pollution in the surrounding Site locale are vehicles using the local road network, predominantly Upper Sunbury Road (A308) to the north.

A review of the NAEI[30], EA[31] and Defra's PRTR[32] data indicates that there are no major industrial pollution sources in the immediate vicinity of the Site that will influence local air quality.

4.3 Defra Mapped Concentrations

4.3.1 Background Concentrations

Mapped background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were downloaded for the grid square containing the Site.

Background pollutant concentrations for 2019 (the base year), 2024 (the earliest opening year of the Proposed Development) are displayed in Table 7.

Table 7 – Defra Mapped Background Concentrations

Grid Square (x,y)	Pollutant	AQAL (µg/m³)	Annual Mean Concentration (µg/m³)	
			2019	2024
513500, 169500	NO_2	40	18.1	15.1
	PM_{10}	40	15.9	14.9
	$PM_{2.5}$	20	11.1	10.3

The data show that annual mean background concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the grid square within which the Site is located are below the AQALs in both years.

Concentrations of all pollutants are predicted to decline incrementally each year. These reductions are principally due to the forecast effect of the roll out of cleaner vehicles and strategies to reduce emissions across all sectors.

Defra UK-AIR modelled background concentrations from 2019 for relevant grid squares were considered an appropriate source of background concentrations in the dispersion model for the assessment of human health

receptors for NO_2, PM_{10} and $PM_{2.5}$ due to the absence of monitoring data in the vicinity. Full details of the background concentrations used in the modelling are presented in Appendix D.

4.3.2 Pollution Climate Mapping (PCM)

Defra's PCM model provides estimates of roadside concentrations of annual mean NO_2, which are used in reporting compliance with limit values. The model provides projected roadside concentrations of pollutants, for the years 2018-2030 inclusive, based on a 2018 base year.

The A308 Upper Sunbury Road has been included as PCM model links as illustrated in Figure 4. Roadside annual mean NO_2 concentrations are projected to be 29µg/m^3 and therefore below the annual mean AQAL.

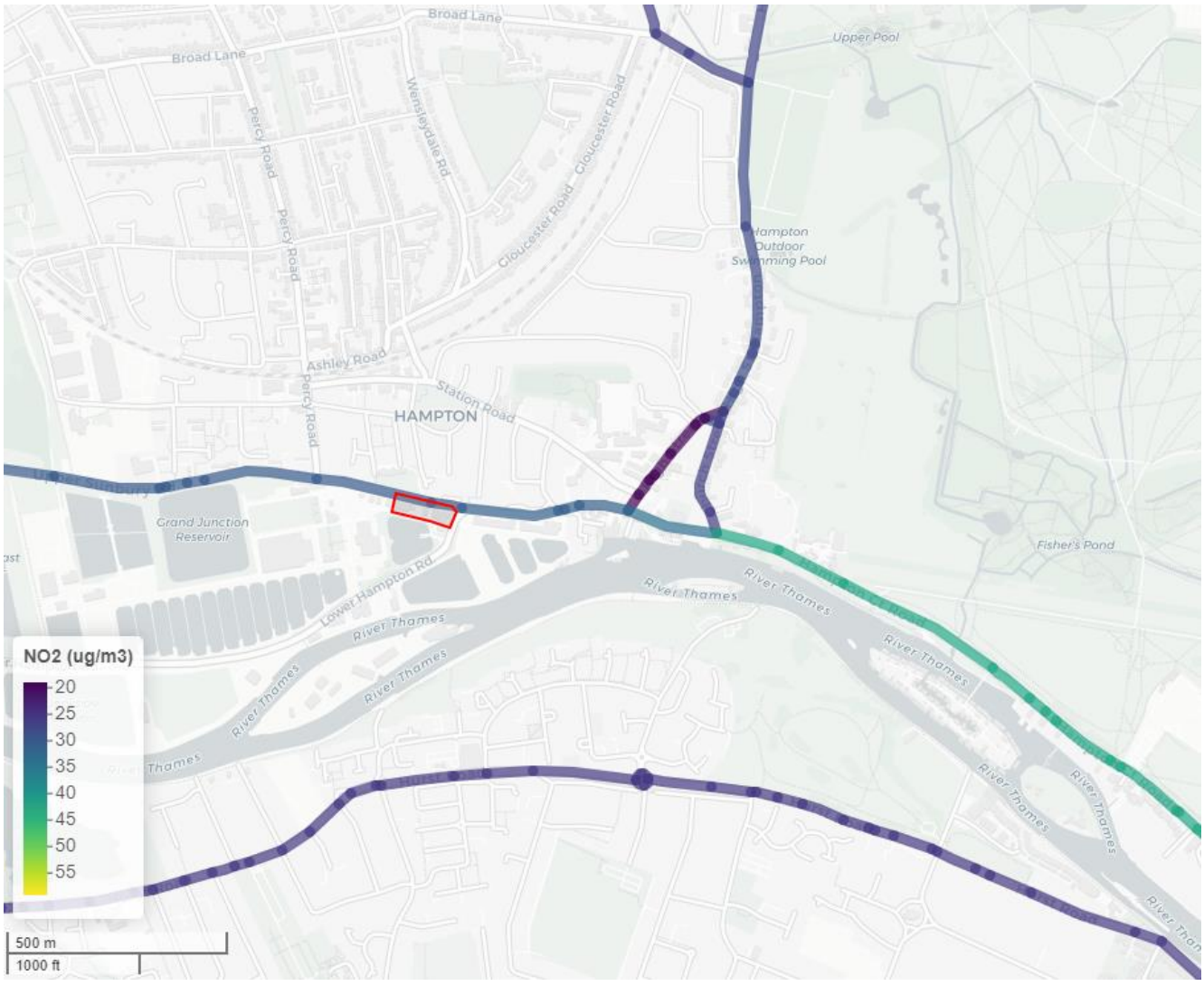

Figure 4 - Defra Modelled PCM Roadside NO_2 Concentrations (Site Boundary in Red)

4.4 London Atmospheric Emissions Inventory (LAEI)

The GLA have calculated estimated ground level concentration of key pollutants (NO_2, NO_x, PM_{10} and $PM_{2.5}$) across Greater London (the 32 London boroughs and the City of London). The data provides concentrations at 20m grid resolution.

The highest predicted 2019 annual mean NO_2 concentration within the Application Site boundary is 39µg/m^3 (see Figure 5). The highest predicted concentrations of PM_{10} and $PM_{2.5}$ are 23µg/m^3 and 13µg/m^3 respectively. As such, all pollutants indicate compliance with the relevant AQALs, however, as the predicted NO_2 concentration is within 10% of the objective, there is a risk of exceedance in accordance with LLAQM.TG(19).

Figure 5 – LAEI 2019 Modelled NO_2 Concentrations

4.5 Air Quality Monitoring Data

4.5.1 Automatic Air Quality Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of the Defra. Monitoring data for AURN sites is available from the UK Air website[41].

The closest AURN monitor to the Site is the London Teddington Bushy Park AURN (NGR: x515120, y170884) located approximately 2km north east from the Site. Based on the distance, measurements at this monitor are unlikely to be representative of conditions at the Site and therefore concentrations have not been presented.

LBRT also undertakes continuous air quality monitoring at two locations within the Council's area. The closest to the Site is the Wetlands Centre, Barnes (R12) monitor located approximately 12km to the north east. Based on the distance, the monitor is unlikely to be representative of conditions at the Site and therefore results have not been presented.

[41] Automatic Urban and Rural Network (AURN) - Defra, UK.

4.5.2 *Passive Diffusion Tube Monitoring*

Passive diffusion tube monitoring is currently undertaken by LBRT at numerous locations throughout the Council's area as part of their commitment to LAQM. The closest tubes to the Site within 1km are shown in Figure 6 and the data presented in Table 8.

Figure 6 – Local Authority Monitoring

Table 8 – Passive Diffusion Tube Monitoring Concentrations

Site ID	Site Name	Site Type	X(m)	Y(m)	Distance from Site (m)	Annual Mean NO_2 Concentrations (µg/m³)				
						2016	2017	2018	2019	2020
78 (34)	Upper Sunbury Rd, Hampton, TW12	R	513527	169513	<10m - N	36	35	32	30	25
2	Percy Rd, Hampton (nr. Side of Waitrose)	R	513217	169746	300 – NW	31	29	32	29	21
Notes: R = Roadside Site 34 moved > 20m from 6/1/20 so for clarity has been renamed site 78.										

The data in Table 8 shows there have been no exceedances of the NO_2 annual mean AQAL at monitoring sites within 1km of the Site during 2016 - 2020. The diffusion tube closest to the Site 78(34) and considered most representative of Site conditions, shows that annual mean NO_2 concentrations are below the AQAL in recent

years. The 2020 measured concentrations should be treated with caution due to the potential effects associated with the COVID-19 pandemic.

5. CONSTRUCTION PHASE ASSESSMENT

5.1 Overview

The construction phase of the Proposed Development will involve a number of activities that will release polluting emissions to air. Predominantly, these will be emissions of dust. As such, a qualitative construction dust risk assessment has been carried out in accordance with IAQM and GLA guidance. Where detailed information was unknown, the dust emission magnitude has been calculated based on educated assumptions.

Construction activities will include:

- material export and import;
- temporary stockpiling of materials;
- groundwork for foundations and services;
- construction of buildings;
- landscaping works; and
- vehicle movements (with the potential to track-out material from site).

The risks of impact and the significance of each stage of the construction phase is classified as Negligible, Low, Medium or High, determined against a matrix which considers the distance from source, receptor sensitivity, background pollution concentrations and the potential dust emission magnitude of the works.

5.2 Construction Traffic Emissions

The IAQM's guidance states that, from experience of assessing exhaust emissions from site traffic, it is unlikely that any significant adverse impacts on local air quality would be caused and in the vast majority of cases, quantitative assessment is not needed. As such, short term effects of construction traffic emissions have not been assessed, as they are also likely to be well below the IAQM traffic criteria outlined in Table 3.

5.3 Dust Emission Magnitude

5.3.1 Demolition

The existing buildings on Site will be retained and therefore minimal demolition works are proposed. As such, demolition activities have not been considered further.

5.3.2 Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. The total area of the Site is within the IAQM's 'Medium' criteria (2,500m^2 – 10,000m^2) however due to the nature of the proposals, the area for earthworks is likely to fall within the IAQM's 'small' criteria. The underlying soil texture is loamy[42] which have a medium potential for dust release when due to the small particle size.

Based on the above, the potential dust emission magnitude for earthworks is considered to be '**Small**'.

5.3.3 Construction

The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build.

[42] Cranfield University, "Cranfield Soil and Agrifood Institute," n.d., http://www.landis.org.uk/soilscapes/.

An estimation of the total volume of buildings to be constructed (i.e., extensions) has been estimated based on the elevation drawings of the Proposed Development.

The total volume was estimated to be within the IAQM's Small category (<25,000m^3), with construction materials comprising masonry and glass.

Based on the above, the potential dust emission magnitude for construction is considered to be **'Small'**.

5.3.4 Trackout

The risk of impacts occurring during Trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size, speed and the duration of activities are also factors which are used to determine the risk of impacts.

It is expected that there would be no more than 50 HDVs outwards movements from the Site each day. No unpaved surfaces over 50m would be utilised as site traffic would be routed along the existing road network.

Based on the above, the potential dust emission magnitude during Trackout is considered to be '**Small**'.

5.3.5 Summary

Table 9 below shows a summary of the potential dust emission magnitudes from each activity:

Table 9 - Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	N/A
Earthworks	Small
Construction	Small
Trackout	Small

5.4 Sensitivity of Area

The prevailing wind direction for the closest regionally representative meteorological measurement station to the Site, at Heathrow Airport, is shown for 2019 in Appendix B. The wind rose shows that the prevailing winds are from the south west. As such, receptors downwind (i.e. north west) of the Site are more at risk of dust impacts than those located upwind.

Figure 7 shows the construction phase distance buffers (20m, 50m, 100m and 350m) plotted around the Site boundary, as well as identified high sensitivity receptor locations within these buffers.

Figure 7 – Construction Phase Receptors

5.4.1 Dust Soiling Impacts

As shown in Figure 7, there are <10 high sensitivity human receptors within 20m of the Site boundary. As such, the overall sensitivity of the surrounding area to nuisance dust soiling effects during Demolition, Earthworks and Construction, according to IAQM guidance, is defined as '**Medium'.**

With regard to Trackout, the sensitivity for Medium size sites is assessed where receptors are located within 50m from Trackout routes up to 200m from the Site. As there are <10 high-sensitivity receptors within 50m of potential Trackout routes from the Site, the sensitivity to dust soiling impacts from Trackout is defined as **'Medium'**.

5.4.2 Human Health Impacts

Defra mapped background predictions (Table 7) show that annual mean concentrations of PM_{10} are not likely to exceed 24µg/m^3 in the vicinity of the Site[43], based on 2019 estimates. According to IAQM guidance, where PM_{10} concentrations are <24µg/m^3 and there are less than 100 high sensitivity receptors within 20m of construction works, the overall sensitivity of the surrounding area to human health impacts is defined as 'Low' for Earthworks, Construction and Trackout.

[43] the concentration at which exceedance of the 24-hour AQAL is likely

5.4.3 Ecological Impacts

There are no sensitive ecological receptors within 50m of the Site boundary or Trackout routes and therefore ecological impacts have not been considered further.

5.4.4 Summary

The sensitivity of the surrounding area for the potential impacts discussed above are shown in Table 10 below.

Table 10 - Sensitivity of Local Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Medium	Medium	Medium
Human Health	N/A	Low	Low	Low

5.5 Risk of Impacts

Using the methodology prescribed in the IAQM guidance, the overall risk of impacts can be defined by combining the sensitivity of the area with the potential dust emission magnitude of each stage of the construction phase as described above.

Table 11 provides a summary of the construction dust risk assessment. The Proposed Development is considered to be **Low Risk** for nuisance dust soiling effects and a **Negligible** for PM_{10} health effects. Overall, the Proposed Development is considered **'Low Risk'** in the absence of mitigation, in accordance with the IAQM guidance.

Table 11 - Risk of Adverse Impacts During Construction Phase

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Low Risk	Low Risk	Negligible
Human Health	N/A	Negligible	Negligible	Negligible

Section 8.1 provides site specific mitigation measures to be adopted in line with 'Low Risk' developments. The IAQM guidance states that implementing these measures should effectively reduce the risk of impacts to *Negligible* during this phase.

6. OPERATIONAL PHASE ASSESSMENT

6.1 Annual Mean NO_2

Predicted annual mean NO_2 concentrations were assessed against the AQAL of 40µg/m^3 as presented in Table 12.

Table 12 – Modelled Annual Mean NO_2 Concentrations

Receptor	DM 2024 (µg/m^3)	DS 2024 (µg/m^3)	Concentration Change (µg/m^3)	DS % of AQAL	% Change relative to AQAL	EPUK & IAQM Impact Descriptor
R01	35.4	35.4	<0.1	88%	0	Negligible
R02	34.9	34.9	<0.1	87%	0	Negligible
R03	**61.6**	**61.6**	<0.1	154%	0	Negligible
R04	33.5	33.5	<0.1	84%	0	Negligible
R05	35.4	35.4	<0.1	89%	0	Negligible
R07	24.3	24.3	<0.1	61%	0	Negligible
R07	34.3	34.3	<0.1	86%	0	Negligible

% Change rounded to nearest whole number as per EPUK & IAQM guidance
Bold denotes an exceedance of the annual mean AQAL

Table 12 shows no predicted exceedances of the annual mean NO_2 AQAL at any receptor in either the DM or DS scenarios associated with the 2024 opening year (using 2019 backgrounds and emission factors), with the exception of R03. R03 is located within a street canyon on Thames Street (A308) and therefore higher concentrations are anticipated. This receptor exceeded the annual mean AQAL in both the DM and DS scenarios.

The maximum increase in annual mean NO_2 concentrations is <0.1µg/m^3 at all residential properties modelled. Contours across the site for annual mean NO_2 are shown in Figure 8.

The predicted changes in annual mean NO_2 at all existing receptors are <0.5% of the relevant AQAL. As such, in accordance with the EPUK & IAQM guidance, the impact associated with the Proposed Development on annual mean NO_2 concentrations is considered to be Negligible at all receptor locations.

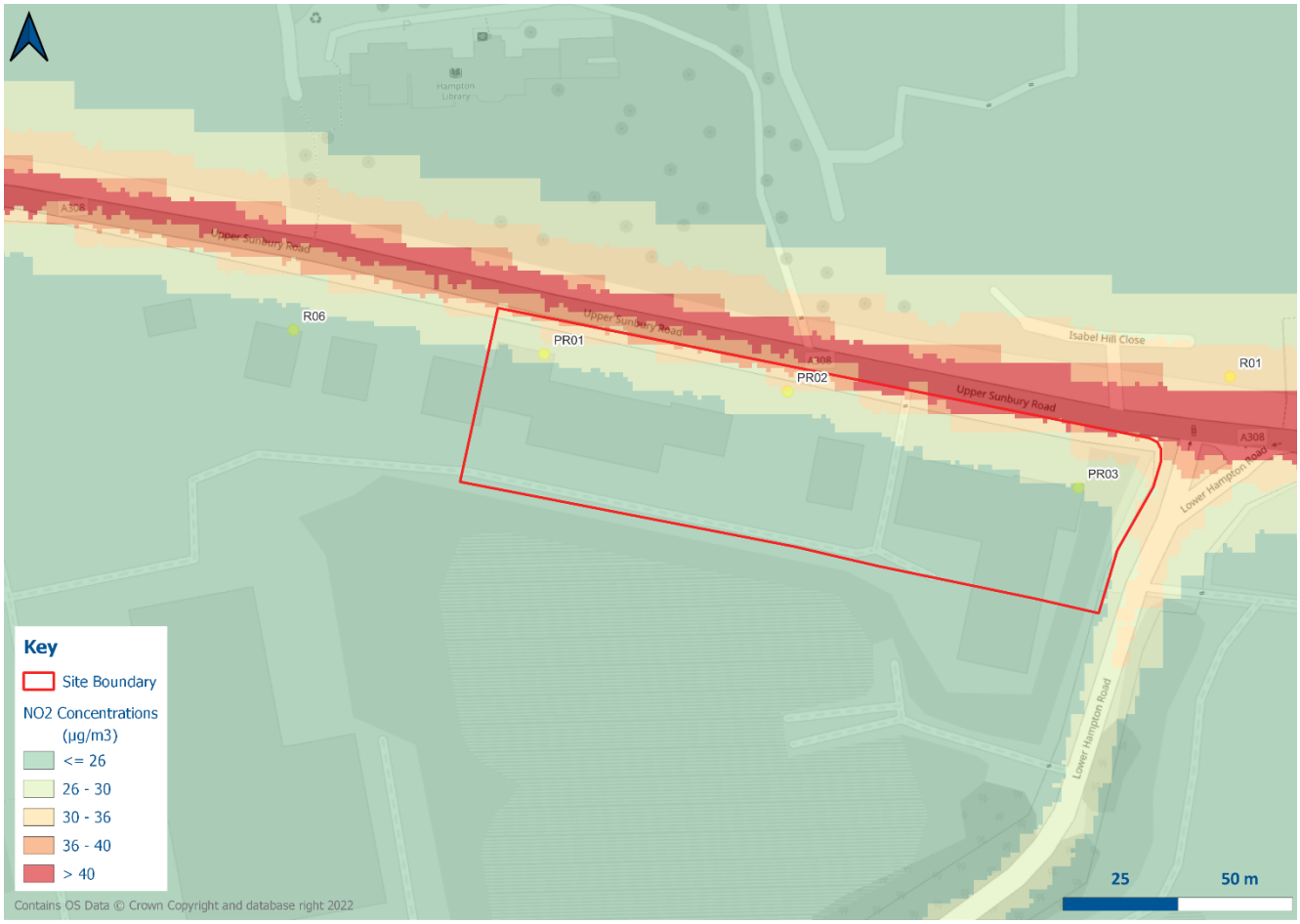

Figure 8 - Annual Mean NO_2 Concentrations

6.2 1-hour Mean NO_2

With regard to the 1-hour NO_2 objective, Defra's LAQM.TG(22) states where the annual means are below 60µg/m^3, it is unlikely that exceedances of the 1-hour mean will occur. All modelled results are below this threshold, and therefore it is considered unlikely that the 1-hour NO_2 AQAL will be exceeded at any of the receptor locations modelled. The impact of the Proposed Development on short term NO_2 concentrations is considered to be negligible.

6.3 Annual Mean PM_{10}

Predicted annual mean PM_{10} concentrations were assessed against the AQAL of 40µg/m^3 as presented in Table 13.

Table 13 – Modelled PM_{10} Concentrations

Receptor	DM 2024 (µg/m³)	DS 2024 (µg/m³)	Concentration Change (µg/m³)	DS % of AQAL	% Change relative to AQAL	Days Exceeding 50µg/m³	EPUK & IAQM Impact Descriptor
R01	18.7	18.7	<0.1	47%	0	2	Negligible
R02	19.0	19.0	<0.1	47%	0	2	Negligible
R03	25.7	25.7	<0.1	64%	0	14	Negligible
R04	18.8	18.8	<0.1	47%	0	2	Negligible
R05	19.1	19.1	<0.1	48%	0	2	Negligible
R07	16.9	17.0	<0.1	42%	0	<1	Negligible
R07	19.4	19.4	<0.1	49%	0	3	Negligible
% Change rounded to nearest whole number as per EPUK & IAQM guidance							

Table 13 shows that there are no predicted exceedances of the annual mean PM_{10} AQAL at any receptor in either the DM or DM scenarios associated with the 2024 opening year (using 2019 backgrounds and emission factors). The maximum increase in annual mean PM_{10} concentrations is <0.1µg/m³.

The predicted changes in annual mean PM_{10} concentrations are all <0.5% of the relevant AQAL. Based on the EPUK & IAQM criteria, the impact of the Proposed Development on annual mean PM_{10} concentrations is considered to be negligible.

6.4 24-hour Mean PM_{10}

The AQAL for 24-hour mean PM_{10} concentrations is 50µg/m³ not be exceeded more than 35 times a year. There were no predicted exceedances of the 24-hour mean AQAL at any of the receptors included in the dispersion model; therefore, in accordance with the guidance there is no predicted risk of exceedances of the 24-hour mean PM_{10} AQAL as a result of increased traffic generation associated with Proposed Development.

6.5 Annual Mean $PM_{2.5}$

Predicted annual mean $PM_{2.5}$ concentrations were assessed against the AQAL of 20µg/m³ as presented in Table 14.

Table 14 – Modelled Annual Mean $PM_{2.5}$ Concentrations

Receptor	2024 DM (µg/m³)	2024 DS (µg/m³)	Concentration Change (µg/m³)	DS % of AQAL	% Change relative to AQAL	EPUK & IAQM Impact Descriptor
R01	12.8	12.8	<0.1	64%	0	Negligible
R02	12.9	12.9	<0.1	65%	0	Negligible
R03	17.0	17.0	<0.1	85%	0	Negligible
R04	12.8	12.8	<0.1	64%	0	Negligible
R05	13.0	13.0	<0.1	65%	0	Negligible
R07	11.7	11.7	<0.1	59%	0	Negligible
R07	13.1	13.1	<0.1	66%	0	Negligible
% Change rounded to nearest whole number as per EPUK & IAQM guidance						

Table 14 shows that there are no predicted exceedances of the annual mean $PM_{2.5}$ AQAL at any receptor in either the 2024 DM or DS scenarios associated with the opening year.

Predicted annual mean concentrations of $PM_{2.5}$ are all below the AQAL of 20µg/m^3 in all modelled scenarios.

The predicted changes in annual mean $PM_{2.5}$ concentrations are all <0.5% of the relevant AQAL, with total concentrations below 75% of the objective. Based on the EPUK & IAQM criteria, the impact of the Proposed Development on annual mean $PM_{2.5}$ concentrations is considered to be negligible.

6.6 Occupant Exposure

Modelled annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at locations of relevant exposure within the Site boundary are shown in Table 15.

Table 15 - Model Predicted Annual Mean Concentrations for 2024

Receptor	NO_2 Concentration (µg/m^3)	% of AQAL	APEC	PM_{10} Concentration (µg/m^3)	% of AQAL	APEC	$PM_{2.5}$ Concentration (µg/m^3)	% of AQAL
R01	26.5	66.3	APEC A	17.3	43.3	APEC A	11.9	59.6
R02	28.5	71.3	APEC A	17.7	44.1	APEC A	12.1	60.7
R03	26.3	65.8	APEC A	17.2	43.0	APEC A	11.9	59.3

Table 15 indicates modelled concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the relevant AQALs across the Site. Furthermore, the predicted concentrations fall well within APEC band A and therefore no mitigation is required.

6.7 Significance of Air Quality Impacts

The EPUK & IAQM guidance considers a number of factors for the determination of significance of predicted air quality impacts. Such factors include:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the development has adopted best practice to eliminate and minimise emissions.

The unmitigated impact associated with the scheme has been predicted in accordance with the stated assessment methodology. The following factors have been taken into account:

- there are no predicted exceedances of the annual mean NO_2, PM_{10} or $PM_{2.5}$ AQALs as a result of the Proposed Development;
- a negligible impact on annual mean NO_2, PM_{10} or $PM_{2.5}$ concentrations has been predicted at all considered sensitive receptor locations;
- the Proposed Development will not introduce any new receptors into an area of exceedance of any relevant AQAL, including at new receptor locations of relevant exposure introduced within the Site;
- exceedances of the 1-hour mean NO_2 and 24-hour mean PM_{10} AQALs are considered unlikely, based upon the marginal change in concentrations and absolute concentrations predicted through the dispersion modelling study; and
- all modelled concentrations have been verified against LBRT monitoring data.

On the basis of the above, the overall effect on air quality as a result of the additional development trips on sensitive receptors is considered to be 'not significant'.

7. AIR QUALITY NEUTRAL

The London Plan 2021 requires all developments at a minimum be 'air quality neutral' to ensure proposals do not lead to further deterioration of existing poor air quality. To support this policy, guidance[28] has been produced on behalf of the GLA to provide methodology for determining potential emissions from a development and benchmark values for comparison purposes. Where the benchmark is exceeded then action is required, either locally or by way of off-setting. The updated guidance for the updated AQN is still under consultation, as such the existing guidance has been followed.

7.1 Transport Related Emissions

The Total Transport Emissions (TTE) and Transport Emissions Benchmark (TEB) have been calculated. In accordance with the Air Quality Neutral guidance[28.]

7.1.1 TEB

Anticipated trip generation from the scheme was provided by the traffic engineers for the project. The expected traffic generation (24-hour AADT) is 67 for residential use and 32 AADT for commercial use, resulting in a total traffic generation of 99 AADT from the proposals. Average trip distance, and NO_x and PM_{10} emission factors were sourced from the Air Quality Neutral Planning Support document. The average trip distance has utilised Residential and Office / Light Industrial values within the document as it is the most appropriate for residential and commercial use. NO_x and PM_{10} emission factors have been based upon an 'Outer' London location.

Table 16 presents the air quality neutral TTEs for the Proposed Development.

Table 16 – Total Transport Emissions

Land Use	Trip Rate (AADT)	Total trip rate (trips/year)	Average distance per trip (km)	NO_x Emissions (g/veh-km)	$PM_{2.5}$ Emissions (g/veh-km)	Total NO_x Emissions (kg)	Total $PM_{2.5}$ Emissions (kg)
Residential	67	24455	11.4	0.35	0.028	97.6	7.8
Commercial	32	11680	10.8	0.35	0.028	44.2	3.5
TOTAL		**36135**				**141.7**	**11.3**

7.1.2 Transport Emission Benchmarks

The total emissions of the site (TTE) were compared against the TEB of the proposed use of the site. Reference should be made to Table 17 for the air quality neutral TEBs.

Table 17 – Transport Emission Benchmarks

Land Use	Annual Trips Per	Trip rate Benchmark	Total trip rate (trips/year)	Average distance per trip (km)	NO_x Emissions (g/veh-km)	$PM_{2.5}$ Emissions (g/veh-km)	Total NO_x Emissions (kg)	Total $PM_{2.5}$ Emissions (kg)
Residential	36	447	16092	11.4	0.35	0.028	64.2	5.1
Commercial	306	16	4896	10.8	0.35	0.028	18.5	1.5
TOTAL			**20988**				**82.7**	**6.6**

7.1.3 Summary

As shown in Table 18, the Proposed Development emissions are above the TEBs and therefore calculation of an offsetting payment is required. Table 18 presents the offsetting payment calculation, whereby the relevant damage costs have been based on the most recent values released by Defra for Outer London Central[44]. In line with the Air Quality Neutral London Plan Guidance[28], the damage costs have been multiplied over 30 years, with a 2 per cent annual uplift, to give the total offsetting payment of **£126,449.50.**

Table 18 – Air Quality Neutral Offsetting Payment

	Benchmark (tonnes/annum)	Total predicted emissions (tonnes/annum)	Excess emissions (tonnes/annum)	Damage Cost (£/tonne)	Annual Offsetting Amount (£)
Transport NOx Emissions	0.083	0.142	0.059	£33,064	£1,951.17
Transport $PM_{2.5}$ Emissions	0.007	0.011	0.005	£246,942	£1,165.80
TOTAL					**£3,116.97**
TOTAL OFFSETTING AMOUNT					**£126,449.50**

7.2 Building Related Emissions

The proposed energy strategy will comprise either Air Source Heat Pumps (ASHPs) or will be entirely electric and as such, will not have associated emissions of NO_x or PM_{10}. As such, building emissions can be considered air quality neutral.

[44] https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance#annex-a

8. MITIGATION MEASURES

8.1 Construction Phase

8.1.1 Construction Dust

The qualitative construction dust risk assessment shows that the site is Low Risk for adverse impacts during construction, in the absence of mitigation.

To effectively reduce the risk of impacts to negligible, appropriate mitigation measures should be adopted. The Greater London Authority provides guidance[45] for mitigation measures which is considered to be best-practice for the UK. Appropriate measures that could be included in the construction of the proposed redevelopment include:

- ideally cutting, grinding and sawing should not be conducted on-site and pre-fabricated material and modules should be brought in where possible;
  - » where such work must take place, water suppression should be used to reduce the amount of dust generated;
- skips, chutes and conveyors should be completely covered and, if necessary, enclosed to ensure that dust does not escape;
- any excess material should be reused or recycled on-site;
- developers should produce a waste or recycling plan;
- following earthworks, exposed areas and soil stockpiles should be re-vegetated to stabilise surfaces, or otherwise covered with hessian or mulches;
- stockpiles should be stored in enclosed or bunded containers or silos and kept damp where necessary;
- hard surfaces should be used for haul routes where possible;
- haul routes should be swept/washed regularly;
- vehicle wheels should be washed on leaving the site;
- all vehicles carrying dusty materials should be securely covered; and
- delivery areas, stockpiles and particularly dusty items of construction plant should be kept as far away from neighbouring properties as possible.

In addition to the above, the IAQM's highly recommended mitigation measures for Low-Risk sites is provided at Appendix E of this report. Implementing these measures should effectively reduce the risk of impacts to Negligible during the construction phase.

8.1.2 Construction Phase – Vehicular Pollutants

Potential air quality impacts associated with construction phase road traffic emissions (principally HDV movements) have been screened out for further assessment with associated impacts on air quality predicted to result in an 'insignificant' effect. Therefore, mitigation measures are not considered to be required.

[45] Greater London Authority (GLA), "The Control of Dust and Emissions During Construction and Demolition.," 2014, https://www.london.gov.uk/file/18750/download?token=zV3ZKTpP.

8.1.3 *Construction Phase – NRMM Emissions*

London has implemented a 'Low Emission Zone' (LEZ) for NRMM[46], which encompasses a number of Boroughs within London including the borough of Richmond upon Thames. As such, the Proposed Development is required to meet at least stage IIIB.

In addition to the above standards, the following controls should apply to NRMM:

- Ensure all equipment complies with the appropriate NRMM standards by reorganising the fleet and replacing equipment where necessary;
- Where feasible, ensure further retrofit abatement technology is installed on existing NRMM equipment, e.g., Diesel Particulate Filters (DPFs);
- Ensure all vehicles switch off engines when stationary – no idling vehicles;
- Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where possible; and
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- An inventory of all NRMM should be kept on-site stating the emission limits for all equipment. All machinery should be regularly serviced and service logs kept on-site for inspection. This documentation should be made available to local authority officers as required; and
- Sign up to the Considerate Constructors Scheme to assist with monitoring compliance

Successful implementation of the above mitigation measures would ensure that emissions from the construction phase and NRMM used during construction are negligible.

8.2 Operational Phase

8.2.1 *Road Traffic Emissions*

8.2.1.1 *Electric Vehicle Charging Infrastructure*

From the 15th June onwards, Approved Document S 2021 comes into force, which states;

> *"The erection of new residential buildings (S1)*
>
> *A new residential building with associated parking must have access to electric vehicle charge points as provided for in paragraph (2).*
>
> *The number of associated parking spaces which have access to electric vehicle charge points must be—*
>
> *(a) the total number of associated parking spaces, where there are fewer associated parking spaces than there are dwellings contained in the residential building; or*
>
> *(b) the number of associated parking spaces that is equal to the total number of dwellings contained in the residential building, where there are the same number of associated parking spaces as, or more associated parking spaces than, there are dwellings.*

[46] https://www.london.gov.uk/what-we-do/environment/pollution-and-air-quality/nrmm#Stub-300466

Cable routes for electric vehicle charge points must be installed in any associated parking spaces which do not, in accordance with paragraph (2), have an electric vehicle charge point where—

(a) a new residential building has more than 10 associated parking spaces; and

(b) there are more associated parking spaces than there are dwellings contained in the residential building."

It is recommended that Electric Vehicle (EV) Charging Infrastructure is provided across the Site at a rate of provision compliant with applicable policy.

8.2.1.2 Travel Plan Measures

The trip generation associated with the Proposed Development is predicted to have a negligible impact and operational phase air quality impacts are unlikely to be significant. However, the Air Quality Neutral calculation illustrates transport emissions exceed the benchmark and therefore further mitigation is required.

A Travel Plan has been prepared by Markides Associates Ltd, which outlines the following measures beneficial to air quality:

- Promoting lift / car sharing;
- EV charging infrastructure (ducting and cabling);
- Welcome pack providing details on the timetables and routes of bus, rail and tube services within easy walking / cycling distance of the site. Additional details include routes to a variety of key Points of Interest, such as healthcare facilities, community facilities (places of worship, leisure centres, etc), and supermarkets;
- Provision of a noticeboard within the communal area providing regularly updated timetable and events information; and
- Secure cycle parking, including 69 long stay spaces and 16 short stay cycle spaces.

8.2.2 Building Emissions

As the Proposed Development is Fossil Fuel free, this follows the 1st hierarchy principle of the IAQM guidance to '*prevent and avoid*' by eliminating any point source emissions[47]. Therefore, no embedded mitigation into the Proposed Development design is required.

8.2.3 Occupant Exposure

The Proposed Development is not expected to introduce new receptors into an area of poor air quality. As such, air quality does not present a constraint on the ventilation strategy for this Proposed Development.

It is recommended that future residents will be provided with Air Quality information and appropriate advice to protect against exposure to higher concentrations of air pollutants during peak pollution periods / episodes with a welcome pack.

There are a number of free air quality information services in London that could be included within the welcome pack, as set out below in Table 19:

[47] IAQM Mitigation of Development Air Quality Impacts, Version 1.1 (June 2018).

Table 19 - London Air Quality Information Services

Provider	Website	Service Provided
Defra	https://uk-air.defra.gov.uk/forecasting/ www.twitter.com/defraukair	Official feed for UK wide air pollution forecast from Defra. Provides forecast, Health Advice, Air Pollution Index and Air Pollution alerts, enabling residents to plan accordingly.
airText	www.airtext.info	Free text message service providing air quality alerts for Greater London.[48]
London Air	www.londonair.org.uk	Free downloadable air quality app providing real time air quality index forecast across London, in addition to LAQM data for London Boroughs.
CityAir app	https://www.cityoflondon.gov.uk/services/environmental-health/air-quality/cityair-app	The City of London Corporation has developed a free smartphone app which helps Londoners lower their impact on, and exposure to, air pollution. The CityAir app version 2.0 is available for iOS and Android and is compatible with iPhone, iPad and Android devices.

The above alerts are based on the Daily Air Quality Index (DAQI) scale[49], which provides recommended actions and health advice. The index is numbered 1-10 and divided into four bands, low (1) to very high (10), to provide detail about air pollution levels in a simple way.

The DAQI covers 5 pollutants. The DAQI for NO_2, which is the main pollutant of concern for the purposes of this report, is shown below in Figure 8. The scale is based on hourly mean concentrations.

Index	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Band	Low	Low	Low	Moderate	Moderate	Moderate	High	High	High	Very High
µg/m³	0-67	68-134	135-200	201-267	268-334	335-400	401-467	468-534	535-600	601 or more

Figure 9 – Daily Air Quality Index: NO_2

The following are recommended actions and health advice depending on the DAQI band:

[48] https://www.haringey.gov.uk/business/licensing-and-regulations/environment-and-waste/pollution-control/air-pollution/airtext

[49] https://uk-air.defra.gov.uk/air-pollution/daqi

Air Pollution Banding	Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, should **consider reducing** strenuous physical activity, particularly outdoors.	**Enjoy** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, should **reduce** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever inhaler more often. Older people should also **reduce** physical exertion.	Anyone experiencing discomfort such as sore eyes, cough or sore throat should **consider reducing** activity, particularly outdoors.
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, should **avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

Figure 10 – DAQI Actions and Health Advice

9. DISCUSSION AND CONCLUSION

Hydrock were commissioned by Waterfall Hampton Investment Ltd to prepare an AQA for the proposed redevelopment at Hampton Waterworks, Upper Sunbury Road.

A qualitative construction dust risk assessment has been undertaken in line with IAQM and GLA guidance. Through good practice and implementation of appropriate mitigation measures outlined, it is expected that the release of dust would be effectively controlled and mitigated, with resulting effects considered to be 'not significant'. All dust impacts are considered to be temporary and short-term in nature.

In line with EPUK & IAQM guidance detailed dispersion modelling, using ADMS-Urban, has been performed to assess the significance of potential impacts of the Proposed Development on local air quality. The modelling assessment has shown that the impact of the Proposed Development on local air quality is Negligible for NO_2, PM_{10} and $PM_{2.5}$. No exceedances of the relevant AQALs were identified, with the exception of R03 whereby the annual mean NO_2 AQAL was exceeded in both the DM and DS scenarios. Additionally, future receptors at the Proposed Development will not be introduced to an area of poor air quality, as no exceedances of the AQALs were identified at the Site. As such, the overall effect arising from operational phase trips generated by the Proposed Development is considered to be 'not significant'.

An air quality neutral assessment was undertaken in accordance with the London Plan 2021. Building emissions from the Proposed Development are considered to be air quality neutral, however total transport emissions were above the transport emission benchmarks and therefore further mitigation is required.

From the evidence presented, and by following the guidance provided herein, the Proposed Development will comply with all relevant air quality policy. As such, air quality should not pose any significant obstacles to the planning process.

Appendix A - Traffic Data

The traffic data was sourced from the Transport Consultants, Markides Associates Ltd and LAEI and is shown in below in Table 20. Data was provided for the following scenarios:

- 2019 AADT;
- 2024 DM AADT (this scenario includes committed developments); and
- 2024 DS (this scenario includes committed developments and generated traffic associated with the Proposed Development).

Table 20 - Traffic Data

Link ID	Road Link	2019 Verification		2024 DM		2024 DS	
		AADT	% HDV	AADT	%HDV	AADT	% HDV
L01	Upper Sunbury Road (East)	17147	5.5%	17916	5.5%	17955	5.5%
L02	Upper Sunbury Road (West)	14345	5.2%	14988	5.2%	15038	5.2%
L03	Percy Road	4829	5.5%	5046	5.5%	5056	5.4%
L04	Lower Sunbury Road	4257	4.8%	4447	4.8%	4457	4.8%
L05	Thames St	22330	5.6%	23330	5.6%	23330	5.6%
L06	High Street	6106	6.9%	6380	6.9%	6380	6.9%
L07	High Street	3038	1.7%	3174	1.7%	3174	1.7%
L08	Station Road	3427	10.8%	3581	10.8%	3581	10.8%
L09	Station Road	4593	7.8%	4799	7.8%	4799	7.8%
L10	Tudor Road	4065	0.1%	4247	0.1%	4247	0.1%
L11	Station Road	2315	14.9%	2419	14.9%	2419	14.9%
L12	Station Road	2312	14.8%	2416	14.8%	2416	14.8%
L13	Percy Road N	5685	5.3%	5940	5.3%	5940	5.3%
L14	Upper Sunbury WO Percy	22677	4.5%	23693	4.5%	23733	4.5%

Appendix B – Meteorological data

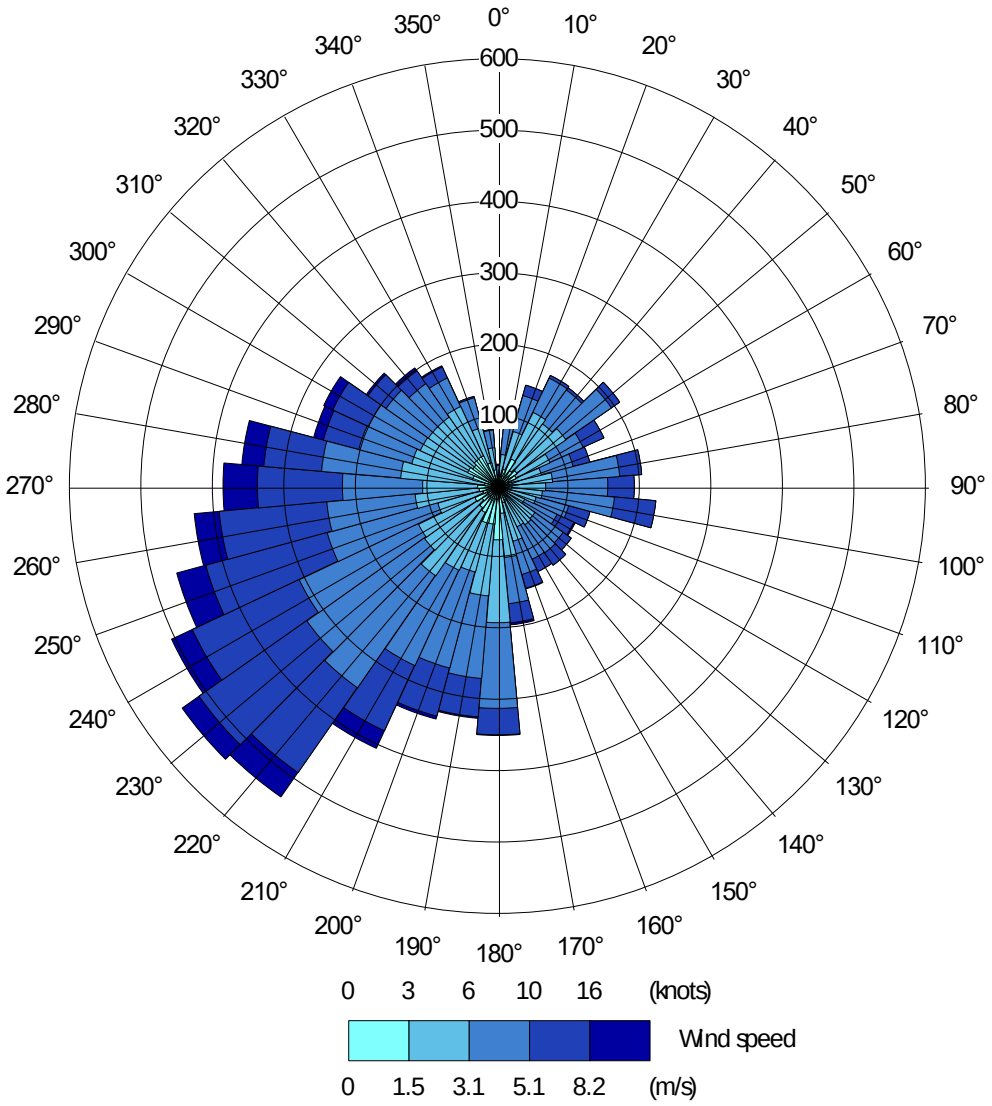

Figure 11 – Wind rose London Heathrow Airport (2019)

Appendix C – Model Verification

An important stage in the modelling process is model verification, which involves comparing the model output with measured concentrations in order to increase confidence in modelled predictions.

According to LAQM.TG (22), the difference between modelled results and monitored concentrations is acceptable where it is within 25%.

Monitoring Locations used for Verification

The following monitoring locations were selected for model verification due to being representative of the study area and having more than 75% data collection for 2019:

- 34 (now 78) - Upper Sunbury Rd; and
- 2 – Percy Road

There were no other suitable tubes in the vicinity of the Site.

Model Verification

It is most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2). The model output of road-NO_x (i.e., the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x. Measured road-NO_x has been calculated from the measured NO_2 concentrations using the NOx from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website[40].

A comparison of modelled and monitored concentrations prior to adjustment are given in Table 21.

Table 21 - 2019 Modelled and Monitored Concentrations Before Adjustment

Monitoring ID	Modelled Road NOx (µg/m³)	Monitored Road NOx (µg/m³)	Ratio Monitored/ Modelled	Modelled Total NO_2 (µg/m³)	Monitored Total NO_2 (µg/m³)	Difference (%)
34	14.6	25.0	1.7	25.2	30.0	-15.9
2	7.3	22.8	3.1	21.7	29.0	-25.1

As shown, the model was underpredicting at all diffusion tubes. As such, an adjustment factor of 1.9964 has been determined, as the equation of the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution of NO_x, as shown below:

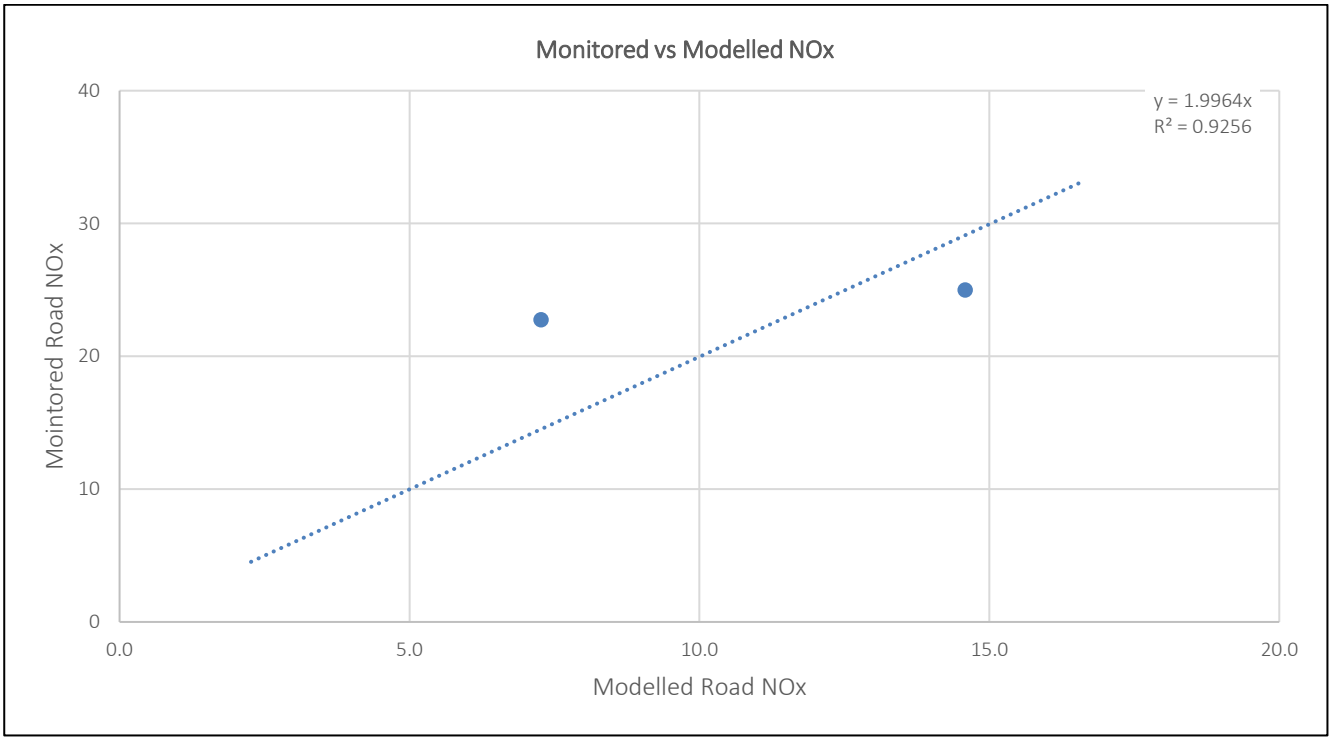

Figure 12 – Model Adjustment Factor

Table 22 shows total monitored versus modelled NO_2 following the adjustment of the road contribution of NO_x by this factor. The total NO_2 concentration was determined by adding the calculated background NO_2 concentration to the modelled road contribution.

Table 22 – Post-adjusted 2019 Modelled and monitored results

Monitoring ID	Adjusted Modelled NO_2 ($\mu g/m^3$)	Monitored NO_2 ($\mu g/m^3$)	Difference (%)
34	31.8	30.0	6.0%
2	25.2	29.0	-13.1%

Following adjustment of NO_x by a factor of 1.996, modelled concentrations of NO_2 were within the accepted +/- 25% range of monitored concentrations:

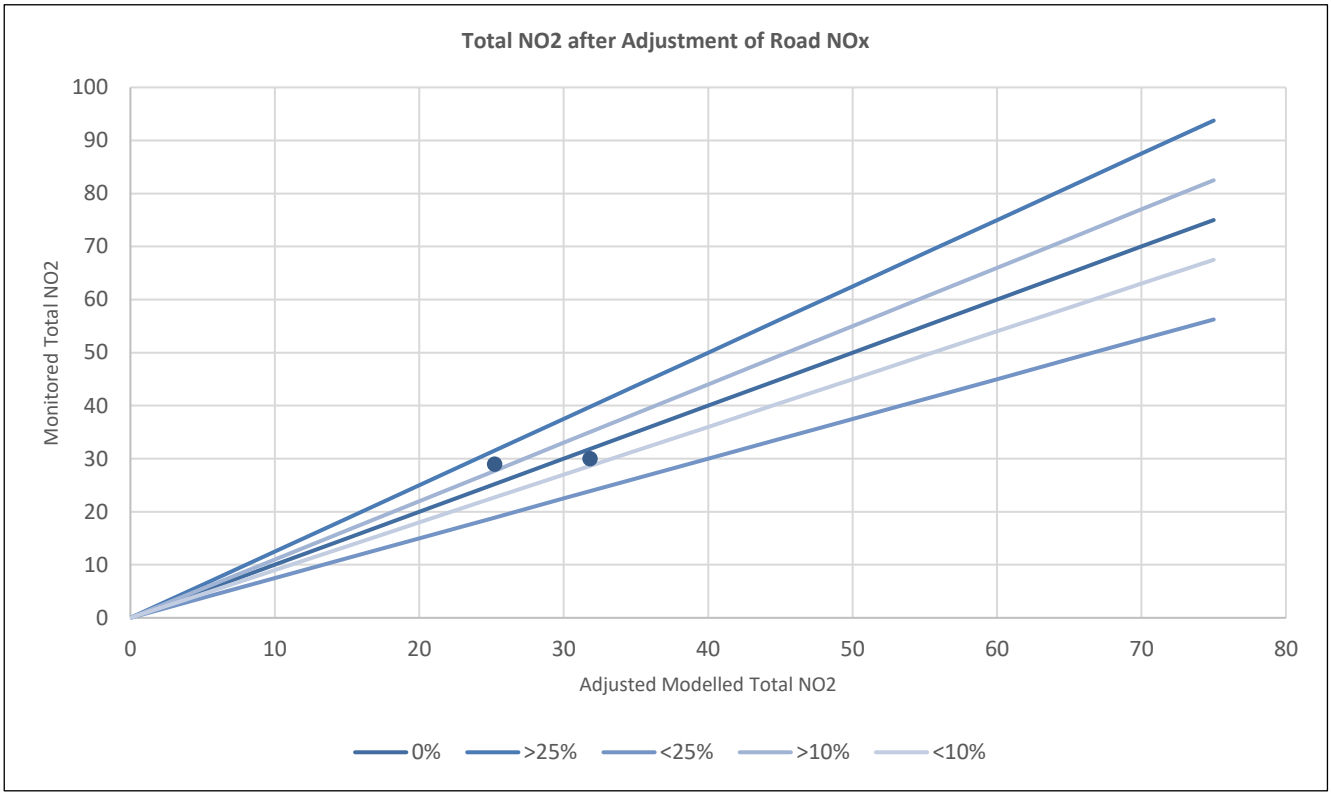

Figure 13 – Post-adjusted Monitored vs Modelled NO_2

In addition, the overall post-adjusted uncertainty (RMSE) for annual mean NO_2 was 7.4%, which is well within ideal 10% range of uncertainty. As such, the factor was considered to be acceptable.

As there is insufficient PM_{10} or $PM_{2.5}$ monitoring data in the study area, it was not possible to perform model verification for these pollutants. As such, the NO_2 adjustment factor has also been applied to PM_{10} and $PM_{2.5}$ model results, in accordance with LAQM.TG(22).

Appendix D – Background Concentrations

The background concentrations used in the modelling assessment are shown below. For future years as a conservative assumption 2019 concentrations were applied.

Table 23 - Background Concentrations

Backgrounds						
Receptor	Year	X	Y	NO_2	PM_{10}	$PM_{2.5}$
PR01	2019	513500	169500	18.1	15.9	11.1
PR02	2019	513500	169500	18.1	15.9	11.1
PR03	2019	513500	169500	18.1	15.9	11.1
R01	2019	513500	169500	18.1	15.9	11.1
R02	2019	513500	169500	18.1	15.9	11.1
R03	2019	513500	169500	18.1	15.9	11.1
R04	2019	513500	169500	18.1	15.9	11.1
R05	2019	513500	169500	18.1	15.9	11.1
R06	2019	513500	169500	18.1	15.9	11.1
R07	2019	512500	169500	17.3	15.8	10.9
34	2019	513500	169500	18.1	15.9	11.1
2	2019	513500	169500	18.1	15.9	11.1

Appendix E - Construction Dust Mitigation for Low Risk sites

In order to mitigate the worst-case dust impacts the following general mitigation measures are highly recommended by the IAQM for Low Risk construction sites.

Highly Recommended

Communications:

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information

Site Management:

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

Monitoring:

- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and maintaining the site:

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Avoid site runoff of water or mud.

Operating vehicle/machinery and sustainable travel:

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable
- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable

Operations:

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.

- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

Waste Management:

- No bonfires and burning of waste materials.