Aether

Air Quality Assessment for the proposed development at Elleray Hall

Report to Richmond and Wandsworth Councils’ Programme Management Office

April 2021

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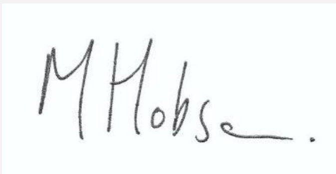
Signature	
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1 Introduction

Aether has been commissioned by Richmond and Wandsworth Councils' Programme Management Office to undertake an air quality assessment for the proposed development of a new community centre (Elleray Hall) and a 16-unit residential development (Elleray Housing) near North Lane in Richmond. Car parking spaces will be provided with the development.

The Elleray Hall and housing developments are part of one planning application. This report, although based on air quality modelling that combines the two development aspects, is provided with a focus on the impacts and mitigation at Elleray Hall community centre. A separate report is provided with a focus on the Elleray Housing part of the scheme.

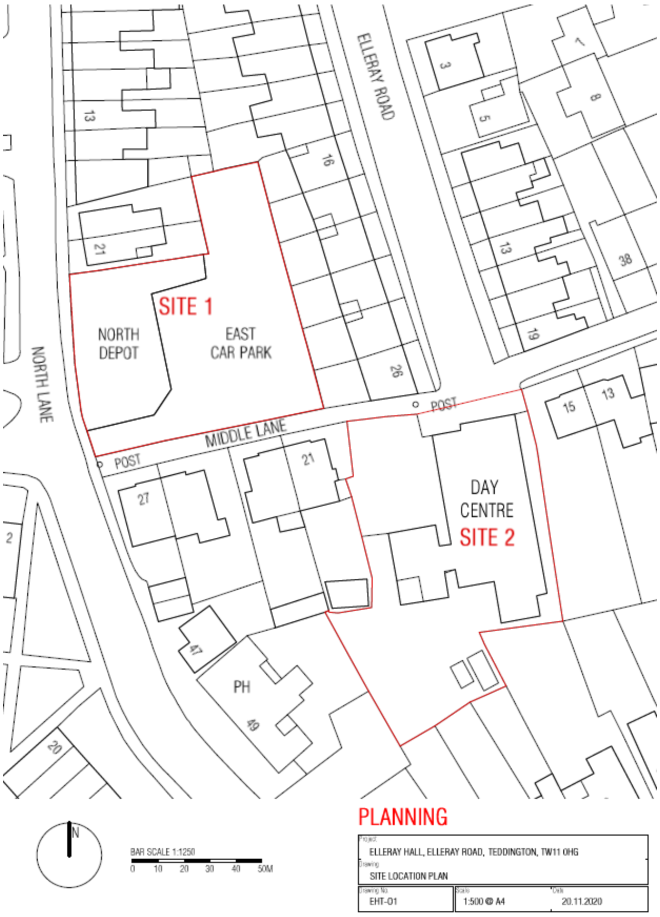
The development falls within the London Borough of Richmond Upon Thames, which suffers from elevated levels of air pollution, primarily due to high levels of. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM_{10}) or nitrogen dioxide (NO_2) at the proposed site and then advise whether any action is required to reduce the users' exposure to air pollution. The assessment utilises ADMS-Roads, a comprehensive dispersion modelling tool for investigating air pollution problems due to small networks of roads and industrial sources. In addition, an air quality neutral assessment has been undertaken.

The expected completion date of the proposed development is 2023. The assessment has therefore been completed for 2024, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located just south of the A313 in Teddington, within the London Borough of Richmond upon Thames. Site 1 is the location of the proposed Elleray Hall. Site 2 is the location for Elleray Housing (**Figure 1**).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Elleray Hall development, as set out in the UK Air Quality Strategy[1], is presented in **Table 1** below.

Table 1: UK Air Quality Objectives for NO_2 and PM_{10}

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO_2)	40 µg/m^3	Annual mean
	200 µg/m^3	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM_{10})	40 µg/m^3	Annual mean
	50 µg/m^3	24 hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_X) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO_2). NO_2 is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO_2 can also form in the atmosphere due to a chemical reaction between NO and ozone (O_3). Health based

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. https://uk-air.defra.gov.uk/assets/documents/Air_Quality_Objectives_Update.pdf

standards for NO_X generally relate to NO_2, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM_{10}.

A growing body of research has also pointed towards the smaller particles as a metric more closely associated with adverse health impacts. In particular, particulate matter with an aerodynamic diameter of less than 2.5 micrometres, known as $PM_{2.5}$. Local Authorities in England have a flexible role[2] in working towards reducing emissions and concentrations of $PM_{2.5}$ as there is no specific objective for them. However, there is a UK (excluding Scotland) annual mean objective of 25 $\mu g/m^3$.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants[3].

As defined by the regulations, the air quality objectives for the protection of human health are applicable:

- Outside of buildings or other natural or man-made structures above or below ground
- Where members of the public are regularly present.

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members of the public do not have regular access. The 24 hour objective will apply at all locations where the annual mean objective would apply together with hotels. Therefore, in this assessment the annual mean and 24 hour mean objectives will typically only apply at the ground floor of the Elleray Hall development. The hourly objective will apply at all locations where members of the public could reasonably be expected to spend that amount of time. Therefore, in this assessment the hourly objective will also apply at all levels of the development.

1.3 Local Air Quality Management

Local authorities are required to periodically review and assess the current and future quality of air in their areas. Where it is determined that an air quality objective is not likely to be met, the authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan (AQAP).

The London Borough of Richmond Upon Thames has declared one AQMA[4] covering the whole borough. This AQMA was declared in 2000 due to exceedances of the annual

[2] LAQM TG16 – paragraph 1.09
[3] https://www.gov.uk/government/collections/comeap-reports
[4] https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=352

mean NO_2, and both annual and daily mean PM_{10} objectives. An updated AQAP[5] was published in 2019 covering the period 2020 to 2025.

1.4 The ADMS-Roads Method

Local air quality has been assessed using ADMS-Roads, a comprehensive dispersion model that can be used to predict concentrations of pollutants in the vicinity of roads and small industrial sources. The model has been used for many years in support of planning applications for new residential/commercial developments.

ADMS-Roads is able to provide an estimate of air quality both before and after development, taking into account important input data such as background pollutant concentrations, meteorological data, traffic flows and on-site energy generation (if applicable). The model output can be verified against local monitoring data to increase the accuracy of the predicted pollutant concentrations and this approach has been followed in this assessment.

The use of dispersion modelling enables estimates of concentrations to be made at varying heights. As a result, suggestions for appropriate mitigation measures can be made where necessary, taking into consideration the identification of worst-case locations.

The most recent version of ADMS-Roads (v5) was issued in April 2020 and requires the following information to assess the impact at sensitive receptor locations:

- **Setup:** General site details and modelling options to be used
- **Source:** Source dimensions and locations, release conditions, emissions
- **Meteorology:** hourly meteorological data
- **Background:** Background concentration data
- **Grids:** Type and size of grid for output
- **Output:** Output required and sources/groups to include in the calculations.

2 Methodology

2.1 Local Pollutant Concentrations

It is good practice to include up-to-date local background pollutant concentrations in the assessment model, and also to verify modelled outputs against local monitoring data where available. This section provides an overview of the local data available for use in the assessment.

2.1.1 Local monitoring data

The London Borough of Richmond Upon Thames has three automatic monitoring sites which measure nitrogen dioxide (NO_2) and particulate matter (PM_{10}). Unfortunately, none of these automatic monitoring sites lie within 1 km of the development and they are therefore unlikely to be representative of the development site. NO_2 concentrations are also measured passively at diffusion tube sites across the Borough. Three of these

[5] https://www.richmond.gov.uk/services/environment/pollution/air_pollution/air_quality_action_plan

diffusion tube sites lies within 1 km of the development site. Details of these monitoring sites are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)[6].

Table 2: Monitoring sites within 1 km of the development

Site Name	Site Type	Pollutant	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
Hampton Rd, Teddington (nr. Bushy Pk Gardens)	K	NO_2	514882, 171155	1.3	870
Broad St, Teddington (Boots)	K	NO_2	515624, 170975	0.8	130
154 High St, Teddington	K	NO_2	516383, 171154	0.5	740

Note: K = kerbside

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme[7]. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. London Borough of Richmond Upon Thames has applied a local bias adjustment factor (0.90) to their 2019 diffusion tube results.

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO_2 objective was exceeded 2 times between 2017 and 2018 at the nearby Broad St monitoring site. The site remains extremely close to the objective level in 2019. Diffusion tubes do not provide information on hourly exceedances, but research[8] identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m^3. Therefore, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites.

[6] https://www.richmond.gov.uk/services/environment/pollution/air_pollution/air_quality_reports/progress_reports_and_air_quality_action_plans
[7] This is a national QA/QC scheme.
[8] As described in Box 5.2 of LAQM Technical Guidance (TG16).

Table 3: Monitoring results for sites close to the proposed development site, 2017-2019

Objective	Site Name	2017	2018	2019
Annual mean NO_2 (µg/m^3)	Hampton Rd, Teddington (nr. Bushy Pk Gardens)	36	35	31
	Broad St, Teddington (Boots)	**43**	**45**	39
	154 High St, Teddington	35	33	32

Values exceeding the 40 µg/m^3 annual mean objective are shown in bold

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website[9] and data has been extracted for Richmond for this assessment. These 2018 baseline, 1 kilometre grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites. The projections in the 2018 LAQM background maps are based on assumptions which were current before the Covid-19 outbreak in the UK. In consequence these maps do not reflect short or longer term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

The estimated mapped background NO_X, NO_2 and PM_{10} concentrations around the development site are 26 µg/m³, 18.3 µg/m³ and 15.5 µg/m³ respectively in 2019. For 2024 (the estimated first full year of occupation), the concentrations obtained for the same pollutants are 22 µg/m³, 15.8 µg/m³ and 14.6 µg/m³ respectively.

Due to the lack of a nearby urban background monitoring site, the 2019 mapped background concentrations have been used in this assessment. To provide a conservative estimate, the projected improvements in background air quality by 2024 have not been used in the dispersion modelling. This is in line with best practice to apply worst-case assumptions.

2.2 Model input data

Hourly meteorological data from Heathrow for 2019 has been used in the model. The wind-rose diagram (**Figure 2**) presents this below.

[9] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2019

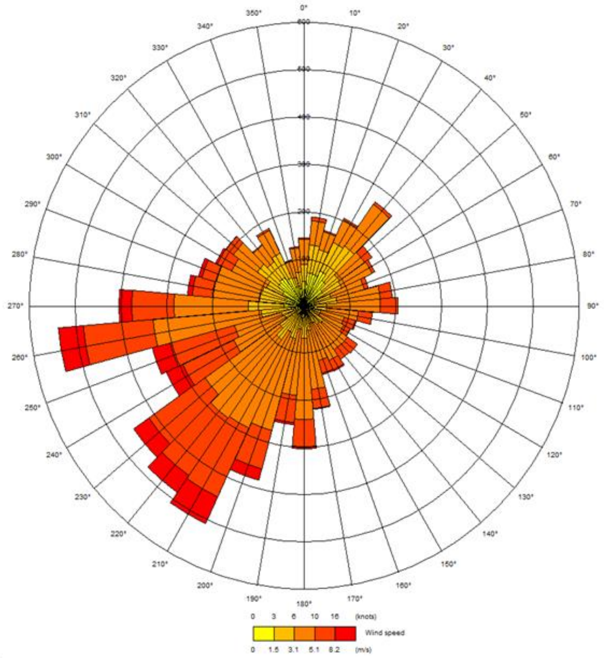


Figure 3: Road sources and receptors

ArcMap software has been used to model the road source locations (dark blue lines) that are within 200 metres of the receptor locations (light blue circles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in terms of the length of roads and distances between sources and receptors. This is shown in **Figure 3** above. It is assumed that the contribution of other sources to NO_2 and PM_{10} is included in the background concentrations.

Six sensitive receptor locations have been selected for the assessment, three of which represent Elleray Hall:

- H1 SW corner of the development, located closest to the North Lane / Middle Lane junction
- H2 NW corner of the development, located closest to North Lane and the A313 (approx. 100m away to the north).

- H3 representing the drop off in pollutant concentrations with distance from the surrounding local roads.

The receptors R1-R3 show the relevant (residential) model receptors for the Elleray Housing scheme.

These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architect's plans (**Figure 4**) show the development site in more detail with receptor locations highlighted (blue circles). An assessment is made for the receptors at varying heights to assess likely concentrations across floor levels. It has been assumed that background concentrations remain constant at all heights of the development based on the 2017 City Air Quality at Height report[10]. Exposure has been assumed to be represented at the mid-point of each floor.

Figure 4: The location of the receptors used in the modelling

2.3 Traffic data

Average annual daily traffic (AADT) count data for 2019 (the selected baseline year) has been obtained for two sections of the A313 (both west and east of the A309/A313 intersection), Stanley Rd / Queen's Rd (B358) A309 and A311 from Department for Transport (DfT) Traffic Counts[11], which provides data for major and some minor roads. In the absence of any other data being available for the minor roads, estimates are based upon average values for an 'urban minor road, London' from the DfT National Road Traffic Survey, 2020[12].Therefore there will be uncertainty in the model input. A time variant factor was applied to all data based on the distribution on all roads by time of

[10] http://www.wsp-pb.com/PageFilesn/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf
[11] http://www.dft.gov.uk/traffic-counts
[12] http://www.dft.gov.uk/statistics/series/traffic/

day and day of the week in Great Britain[13]. All roads within 200 metres of the modelled receptors have been included in the assessment. The values are shown in Appendix B.

For the purpose of this assessment, the RTF[14] model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 5.3 % between 2019 and 2024.

The proposed development will rely upon car parking via Elleray Hall and the North Lane East car park. The Transport Assessment[15] concludes that overall, there will be a minor increase in daily traffic through both the proposed Elleray Hall (+2 daily vehicle trips) and Elleray Housing (+11 daily vehicle trips) developments compared to previous site use. The resulting estimated increase in daily car trips has been taken into account in the assessment for roads with direct access to the site with development in 2024; however this has no accountable impact on modelled concentrations. Results (**Section 3** of this report) therefore refer to concentrations modelled in 2024 regardless of whether the development takes place or not. As a result, the assessment and its conclusions are focused on the exposure of site users to currently elevated levels of pollutant concentrations, rather than assessing the impacts of the development per se. Instead, the Air Quality Neutral assessment (section 3.5) gives specific consideration of the development transport impact under each land use class.

Average speed data has been obtained for all A roads from DfT Road Congestion Statistics[16]. Average speeds on minor roads have been set at a similar average speed (20.9kph), which is considered to be conservative given the comparatively low speed data obtained for the study area (which correlates to higher emission rates).

2.3.1 Queuing Traffic

Special consideration has been given to notable junctions modelled in this assessment. CERC note 60[17] has been used for estimating emissions from queuing traffic. This defines a representative AADT for queuing traffic to be 30,000 at 5 kph, assuming an average vehicle length of 4 m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)[18] to calculate emission rates. The emission rates were then used within the dispersion model as separate road sources of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods. The traffic light junction nearest to the Broad St diffusion tube and the junction where the A313 meets the B358 have been modelled for queuing traffic in this assessment.

2.4 Conversion of NO_X to NO_2

Evidence shows that the proportion of primary NO_2 in vehicle exhaust has increased[19]. This means that the relationship between NO_X and NO_2 at the roadside has changed from that currently used in the ADMS model. A NO_X to NO_2 calculator (Published in

[13] https://www.gov.uk/government/statistical-data-sets/road-traffic-statistics-tra
[14] http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls
[15] By email (Paul Mew Associates, April 2021)
[16] https://www.gov.uk/government/collections/road-congestion-and-reliability-statistics
[17] Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004
[18] Latest version 10.0, http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html
[19] http://uk-air.defra.gov.uk/assets/documents/reports/aqeg/primary-no-trends.pdf

August 2020)[20] has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO_2 concentrations.

2.5 Model Verification

Model verification refers to checks that are carried out on model performance at a local level. This involves the comparison of predicted versus measured concentrations. Where there is a disparity, the first step is to check the input data and the model parameters in order to minimise the errors. If required, the second step will be to determine an appropriate adjustment factor that can be applied.

In the case of NO_2, the model should be verified for NO_X as the initial step and should be carried out separately for the background contribution and the source (i.e. road traffic). Once the NO_X has been verified and adjusted as necessary, a final check should be made against the measured NO_2 concentration.

For this project, modelled annual mean road-NO_X estimates have been verified against the concentrations measured at the Hampton Rd, Broad St and 154 High St diffusion tube sites (see **Appendix A**). These sites were selected because they represent the monitoring sites closest to the proposed development.

The adjustment factor determined for annual mean NO_X concentrations was also applied to the modelled annual mean PM_{10} concentrations. This was done as no PM_{10} monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment[21].

3 Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the base year (2019) and the development year (2024)[22]. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2019 levels in the development year scenarios to provide a conservative estimate. Traffic growth has been predicted using the RTF calculator.

[20] https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc
[21] Paragraph 7.529 of LAQM TG(16)
[22] 'The development is not expected to impact local air quality (see Section 2). The difference in results reflects future traffic growth in line with the RTF calculator.

Table 4: Estimated pollutant concentrations in 2019 and 2024 ($\mu g/m^3$)

Floor level	Receptor	Annual mean NO_2 concentration ($\mu g/m^3$)		Annual mean PM_{10} concentration ($\mu g/m^3$)		NO_2 Change	PM_{10} change
		2019	2024	2019	2024		
Ground	H1	21.8	21.9	15.9	16.0	0.1	<0.1
	H2	22.4	22.5	16.0	16.0	0.1	<0.1
	H3	21.5	21.6	15.9	15.9	0.1	<0.1
	R1	*21.2*	*21.3*	*15.9*	*15.9*	*0.1*	*<0.1*
	R2	*21.5*	*21.6*	*15.9*	*15.9*	*0.1*	*<0.1*
	R3	*20.9*	*21.0*	*15.8*	*15.8*	*<0.1*	*<0.1*
first	H1	21.6	21.7	15.9	15.9	0.1	<0.1
	H2	22.1	22.2	16.0	16.0	0.1	<0.1
	H3	21.4	21.5	15.9	15.9	0.1	<0.1
	R1	*21.1*	*21.2*	*15.8*	*15.9*	*0.1*	*<0.1*
	R2	*21.3*	*21.4*	*15.9*	*15.9*	*0.1*	*<0.1*
	R3	*20.8*	*20.9*	*15.8*	*15.8*	*<0.1*	*<0.1*

Note: The changes in NO_2 and PM_{10} presented may not exactly equal the difference in the constituent parts shown due to rounding.

Nitrogen dioxide

In the base year scenario, the model predicts annual mean NO_2 concentrations to be below (by 44 %) the annual mean objective at all locations. The worst-case location is identified as receptor H2, which lies closest to North Lane and the A313 (albeit at approx. 100m distance).

The estimated annual mean NO_2 concentrations at the development site are reasonable when compared to the data collected at the Broad St monitoring site. The diffusion tube lies next to a busy A road, whereas the development site lies well away from the major road network.

The Guidance states that authorities may assume exceedances of the hourly mean objective are only likely to occur where annual mean concentrations are 60 $\mu g/m^3$ or above. Therefore, it is considered highly unlikely that this objective will be exceeded at any of the receptors.

The model has also been run for a future year scenario taking into account predicted increases to general traffic levels on local roads. The results indicate that annual mean NO_2 concentrations would change by 0.1 $\mu g/m^3$ at worst-case locations.

Particulate matter

The model estimates no exceedance against the annual mean PM_{10} objective. Potential exceedances of the daily mean PM_{10} objective can be estimated based on the annual mean[23], such that:

$$No.24 - hour\ mean\ exceedances = -18.5 + 0.00145 \times Annual\ Mean^3 + \left(\frac{206}{Annual\ Mean}\right)$$

On this basis, it is estimated that in 2024 there will be no exceedances of the daily mean PM_{10} limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM_{10} objective would be met as 35 exceedances of limit value are allowed per year.

For estimating $PM_{2.5}$ concentrations, where no appropriate sites measuring both PM_{10} and $PM_{2.5}$ are available, then a nationally derived correction ratio of 0.7 can be used[24]. If this factor is used, then all locations in the modelling meet the EU Directive annual mean $PM_{2.5}$ limit value of 25 $\mu g/m^3$.

3.2 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation, as concentrations are estimated to meet all of the objective levels.

However, it is widely acknowledged that there is no safe level of exposure to air pollution[25], and as such, the developer is encouraged to consider mitigation measures to

[23] Paragraph 7.92 of LAQM TG(16)
[24] LAQM: TG16, paragraph 7.109
[25] https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution

reduce emissions arising from the site. The National Planning Policy Framework[26], requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments "should ensure that appropriate opportunities to promote sustainable transport can be – or have been taken up". It states that developments should be located and designed where practical to:

- Give priority to pedestrian and cycle movements, and have access to high quality public transport facilities
- Incorporate facilities for charging plug-in and other ultra-low emission vehicles
- A key tool to facilitate the above will be a Travel Plan. All developments which generate a significant amount of movement should be required to provide a Travel Plan.

Building on the NPPF, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice[27] which should be applied to all major development[28]. Examples of good practice include:

- The provision of at least 1 Electric Vehicle (EV) "rapid charge" point per 10 residential dwellings and/or 1000 m^2 of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made.
- Where the development generates significant additional traffic, a detailed travel plan should be implemented.
- Not relevant: All gas-fired boilers to meet a minimum standard of < 40 mg NO_X/kWh
- Not relevant: All gas-fired CHP plant to meet a minimum emissions standard of:
  - Spark ignition engine: 250 mg NO_X/Nm^3
  - Compression ignition engine: 400 mg NO_X/Nm^3
  - Gas turbine: 50 mg NO_X/Nm^3
- Not relevant: A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:
  - Solid biomass boiler: 275 mg NO_X/Nm^3 and 25 mg PM/Nm^3

Energy provision for the scheme is planned through air source heat pumps, and therefore mitigation measures related to fuel use are not relevant to this development.

3.3 Mitigating the Impacts of the Construction Phase

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. IAQM has produced a document titled 'Guidance on the assessment of dust from demolition and construction'[29] published in May 2015. This

[26] https://www.gov.uk/government/publications/national-planning-policy-framework--2 Published in July 2018
[27] http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf
[28] Major developments can be defined as developments where:
(1) The number of dwellings is 10 or above, (2) The residential development is carried out on a site of more than 0.5ha where the number of dwellings is unknown, (3) The provision of more than 1000 m^2 commercial floor space, (4) Development carried out on land of 1ha or more, (5) Developments which introduce new exposure into an area of existing poor air quality (e.g. an AQMA) should also be considered in this context.
[29] http://iaqm.co.uk/guidance/

guidance contains a methodology for determining the significance of construction developments on local air quality using a simple four step process:

- STEP 1: Screen the requirement for a more detailed assessment
- STEP 2: Assess the risk of dust impacts
- STEP 3: Determine any required site-specific mitigation
- STEP 4: Define post mitigation effects and their significance.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience adverse effects for airborne dust or dust soiling, or exposure to PM_{10}, over a time period relevant to the air quality objectives (see **Table 1**). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Following assessment of the impacts of dust as a result of the development, a qualitative risk impact level can be assigned, ranging from 'negligible' to 'high risk'. Based on the designated risk impact level, the mitigation measures which are appropriate for all sites and are applicable specifically to demolition, earthworks, construction and trackout can be determined. Examples of the general measures include:

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- 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
- Ensure all loads entering and leaving the site are covered
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation

The use of the outlined IAQM methodology for assessing the impacts of dust from demolition/construction is considered to be current best practice. Therefore, it is recommended that the developer refers to the relevant IAQM documentation, to help reduce the impact of dust and vehicle exhaust emissions, and liaises with the Local Authority to come up with an acceptable dust management strategy.

In addition to the IAQM guidance referred to above, the Mayor of London has introduced standards to reduce emissions of pollutants from construction and demolition activity and associated equipment. In July 2014 the Mayor adopted the Control of Dust and Emissions from Construction and Demolition Supplementary Planning Guidance following extensive consultation. The SPG includes the world's first non-Road Mobile Machinery Low Emission Zone (NRMM LEZ) combining standards to address both nitrogen oxide (NO_X) and particulate matter (PM) emissions[30].

From 1st September 2015, construction equipment used on the site of any major development within Greater London has been required to meet the EU Stage IIIA as a minimum; and construction equipment used on any site within the Central Activity Zone

[30] https://nrmm.london/

or Canary Wharf has been required to meet the EU Stage IIIB standard as a minimum. Some exemptions are provided where pieces of equipment are not available at the emission standard stipulated or in the volumes required to meet demand in a construction environment as dynamic as London. From September 2020, the requirements became more stringent. Construction equipment used on major development sites within the Central Activity Zone, Canary Warf and Opportunity Areas must meet EU Stage IV standards and EU Stage IIIB across the rest of London. As Stages IIB and IV have not been defined for machines with constant speed engines, e.g. generators, these machines will need to meet stage V from September 2020 by default. However, in recognition of the disruption COVID-19 has caused, a time limited exemption from the new standards was introduced between 1st September 2020 and 28th February 2021.

3.4 Air Quality Neutral Assessment

London Plan Policy 7.14 requires development proposals within Greater London to be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality (such as areas designated as AQMAs). A method for assessing this is outlined in the Sustainable Design and Construction Supplementary Planning Guidance (SPG) April 2014[31]. The SPG outlines building emission benchmarks for NO_X and PM_{10} for all land use classes and these are presented in **Table 5** below.

This development comes under land use class F2(b)[32] under the amended Town and Country Planning Order. However, the SPG benchmarks were defined before this designation was made, and assessment has therefore been developed against the previous land use class D2 (a-d) (cinemas / concert halls).

Table 5: Building Emission Benchmarks by Land Use Category

Land use class	NO_X (g/m^2)	PM_{10} (g/m^2)
A1 (Retail)	22.60	1.29
A3-A5 (Restaurants, drinking establishments, hot food takeaway)	75.20	4.32
A2, B1 (Financial/professional services/business)	30.80	1.77
B2-B7 (General industrial)	36.60	2.95
B8 (Storage and distribution)	23.60	1.90
C1 (Hotels)	70.90	4.07
C2 (Residential institutions)	68.50	5.97
C3 (Residential dwellings)	26.20	2.28
D1 (a) (Medical and health services)	43.00	2.74
D1 (b) (Crèche, day centres etc.)	75.00	4.30
D1 (c-h) (Schools, libraries, places of worship etc.)	31.00	1.78
D2 (a-d) (Cinemas, concert halls etc.)	90.30	5.18
D2 (e) (Swimming pools, gymnasium etc.)	284.00	16.30

[31] https://www.london.gov.uk/sites/default/files/gla_migrate_files_destination/Sustainable%20Design%20%26%20Construction%20SPG.pdf
[32] https://www.planningportal.co.uk/info/200130/common_projects/9/change_of_use

The SPG outlines transport emission benchmarks for NO_X and PM_{10} for a limited number of land use classes and these are presented in **Table 6** below.

Table 6: Transport Emission Benchmarks by Land Use Category and London Zone

Pollutant and benchmark unit	Land use class	London Zone		
		CAZ*	Inner	Outer
NO_X (g/m²/annum)	Retail (A1)	169	219	249
	Office (B1)	1.27	11.4	68.5
NO_X (g/dwelling/annum)	Residential (C3)	234	558	1553
PM_{10} (g/m²/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

**Central Activity Zone: Central area of Greater London containing a unique cluster of vital economic activities*

New major developments[33] in London must meet these benchmarks, or implement mitigation measures to reduce emissions either on-site or off-site. Where this is not practical or desirable, some form of pollutant offsetting could be applied. One route would be to enforce the necessary "air quality neutral" measures via a Section 106 agreement.

The guidance on application of Air Quality Neutral[34] has been followed in this assessment. The energy scheme for this development will be through the provision of air source heat pumps. On this basis, the proposed Elleray Hall development **meets the air quality neutral requirements for buildings**. No quantified assessment against the benchmarks is necessary.

The data below (**Table 7**) has been used in order to derive estimated transport emissions for the Elleray Hall development for comparison against the Transport NO_X and PM_{10} emissions benchmarks for Outer London. Although the Elleray Hall development is only expected to contribute an additional two vehicle trips per day (section 2.3), the assessment has been undertaken on the basis of an overall trip generation of 49 vehicle trips per day. The previous community centre at Elleray Hall has been estimated to be responsible for 47 trips per day. For the purposes of the air quality neutral calculations, the total trip generation has been attributed across the 519m² community centre site. As no TEB is currently available for the land class considered, the most comparable land class category has been used.

Table 7: Transport Emissions Input Data

Selected land use class	Trip rate (trips/m²/yr)	Av. Trip (km)*	NO_X EF (g/km)**	PM_{10} EF (g/km)**
Retail (A1)	34	5.4	0.353	0.0606

**From London Travel Demand Survey*

[33] As outlined in the London Plan (10 or more residential dwellings (or where the number is not given, an area of more than 0.5 ha; or for all other uses, where the floor space is 1,000 m2 or more, or the site area is 1 ha or more).
[34] http://www.london.gov.uk/sites/default/files/GLA%20AQ%20Neutral%20Policy%20Final%20Report%20April%202014%20J1605.pdf

***London Atmospheric Emissions Inventory*

Transport emissions resulting from the development have been compared to the Transport Emissions Benchmarks for Outer London and the results are shown in **Table 8** below. **The proposed development meets the air quality neutral requirements for transport and no further action is required.**

Table 8: Comparison of development transport emissions to NO_X and PM_{10} Transport Emissions Benchmark (TEB)

Pollutant	Selected land use class	TEB (g/yr)	Development (g/yr)	+/- (kg/yr)
NO_X	Retail (A1)	249.0	65.7	-95.1
PM_{10}	Retail (A1)	42.9	11.3	-16.4

4 Summary and Conclusions

An air quality assessment has been undertaken for a proposed community centre development at Elleray Hall. The London Borough of Richmond Upon Thames has declared one Air Quality Management Area (AQMA) due to the exceedance of the annual mean nitrogen dioxide (NO_2) objective and both the annual and daily mean PM_{10} objectives. The proposed development falls within the AQMA.

A conservative approach with regards to expected improvements to air quality has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2019) and the first year of occupation (2024). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise. This is in line with best practice to apply worst-case assumptions.

The ADMS-Roads dispersion model has been used to determine the impact of emissions from road traffic on sensitive receptors. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean NO_2 concentrations are below the objective in the base year scenario. Concentrations of PM_{10} are also predicted to be below the annual mean objective in the base year scenario. Based on the evidence it is estimated that there will be no exceedances of either short term objective for NO_2 or PM_{10}. The future year scenario predicts that NO_2 and PM_{10} concentrations to change by 0.1 and < 0.1 $\mu g/m^3$, respectively. The transport impact of the development is expected to have a negligible impact on local air quality, and as such this change is a result of predicted local traffic growth using the RTF calculator.

Therefore, no mitigation is required as the air quality objectives are predicted to be met. Instead, other measures such as providing secure and covered cycle storage and installing electric charging point(s), should be considered to reduce the emissions arising from the development. In addition, the developer is encouraged to refer to the IAQM's 'Guidance on the assessment of dust from demolition and construction' in order to minimise the impact of the construction/demolition phase on local air quality.

The proposed development has been assessed, and found to be compliant with London's 'air quality neutral' guidance for buildings and transport. The assessment has been completed on the assumption that air source heat pumps are utilised. If the development plans regarding energy generation do not meet this requirement, re-assessment may be required.

Appendix A – Model Verification

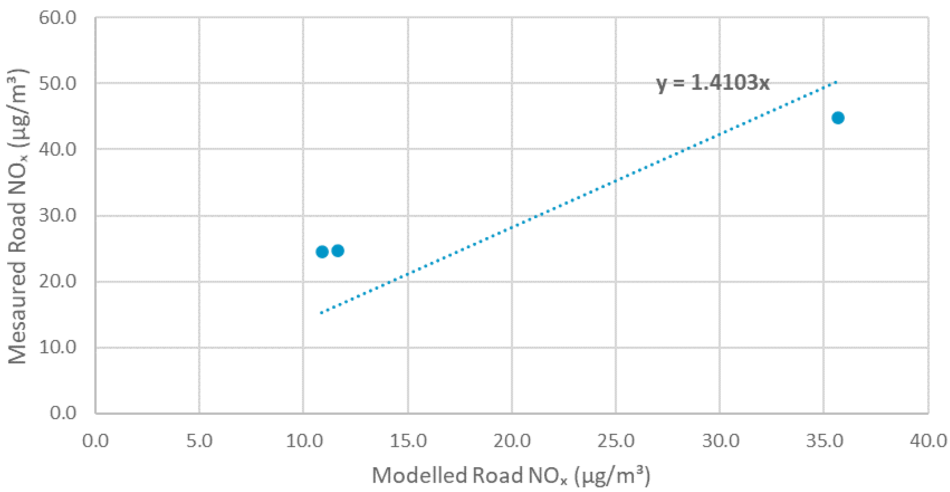
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_X concentration during 2019 at the diffusion tube sites described in **Table 2**.

The model output of road-NO_X has been compared with the 'measured' road-NO_X. Measured NO_X for the monitoring sites was calculated using the NO_X to NO_2 calculator.

A primary adjustment factor was determined to convert between the 'measured' road contribution and the model derived road contribution (**Figure A.1**). This factor was then applied to the modelled road-NO_X concentration for each receptor to provide adjusted modelled road-NO_X concentrations. Total NO_2 concentrations were then determined by combining the adjusted modelled road-NO_X concentrations with the 2019 background NO_2 concentration.

The results imply that the model was under-predicting the road-NO_X contribution. This is a common experience with ADMS and most other models.

Figure A.1: Comparison of Measured road-NO_X to unadjusted modelled road-NO_X concentrations



RMSE

The root mean square error (RMSE) is used to define the average error or uncertainty of the model. The following RMSE value has been calculated:

NO_2: 5.4

If the RMSE values are higher than ±25 % of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. In this case the model is being assessed against the annual mean objective, which is 40 µg/m^3 for NO_2. An RMSE value of less than 10 µg/m^3 is obtained and therefore the model behaviour is acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2019 (and prediction for 2024 without development)

Development/ verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	A313	14,795 (15,581)	3.7	21
	Stanley Rd / Queen's Rd B358	7,611 (8,016)	7.4	21
	A309	8,509 (8,961)	3.7	31
	Minor roads	3,500 (3,686)	1.9	21
Verification sites	A313 (east of devt)	10,654 (11,220)	6.3	21
	A311	13,425 (14,139)	4.5	22
Traffic queues	A313 queues	30,000 (30,000)	3.7	5
	B358 queues	30,000 (30,000)	7.4	5
	A309 queues	30,000 (30,000)	3.7	5
	A313 (east) queues	30,000 (30,000)	6.3	5
	A311 queues	30,000 (30,000)	4.5	5

Note: The Elleray Hall development is expected to result in two additional vehicle trips per day compared to previous site use.

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