AIR POLLUTION SERVICES

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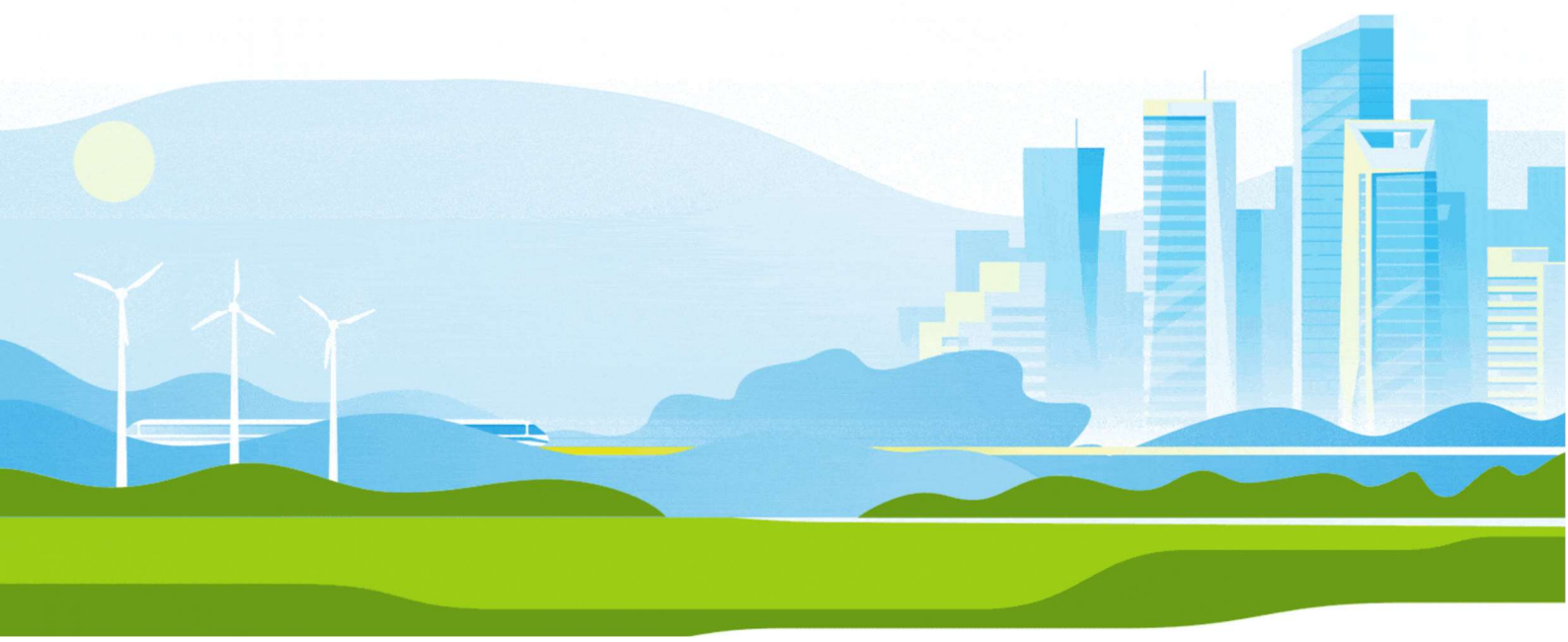
Air Quality Assessment: Former Beales Hotel, Hatfield

Date: 24 May 2022



Quality Assurance

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AIR POLLUTION SERVICES

Experts in Air Quality, Odour and Climate Change

Executive Summary

The air quality impacts associated with the proposed development at the site of the Former Beales Hotel, Comet Way, Hatfield have been considered.

The proposed development will be provided with heating and hot water electrically. It will generate net traffic below the relevant screening threshold for considering impacts on the local area. The impacts of the proposed development have been found to be negligible and it will not lead to any exceedances of the air quality objectives, not significantly worsen existing exceedances, delay compliance with the limit values, or result in any significant worsening of air quality in relation to the World Health Organization guidelines.

Consideration has been given to air quality for future users of the proposed development. Pollutant concentrations have been predicted at relevant locations of sensitive exposure at the proposed development. All concentrations are below the air quality objectives and limit values, and no new exposure to exceedances will occur.

Overall, the air quality impacts of the proposed development will be 'not significant'.

Contents

1. Introduction

1.1. Air Pollution Services (APS) has been commissioned by Hatfield Park Homes Ltd to assess the ambient air quality impacts associated with the proposed development at the site of the Former Beales Hotel, Comet Way, Hatfield (herein the 'Proposed Development'). The Proposed Development will involve the demolition of the existing hotel and construction of mid-rise residential buildings with associated amenity space and ground floor car park. The location of the application site is shown Figure 1.

Figure 1: Application Site Location

Figure notes: Imagery © 2022 Google, Map data © 2022.

Scope of assessment

Scoped In

1.2. The application site is in a modestly built-up urban area adjacent to a dual carriageway. It is not located within an Air Quality Management Area (AQMA).

1.3. The main concern relating to air quality is the potential conditions for future users of the Proposed Development.

1.4. The assessment describes the existing and future air quality at the Proposed Development. Consideration has been given to nitrogen dioxide (NO_2) and particulate matter (both PM_{10} and $PM_{2.5}$) as these are the pollutants of most concern related to road traffic.

Scoped/Screened Out

1.5. Due to the size, nature and location of the Proposed Development, impacts due to the following have been considered and screened out based on the relevant screening criteria/thresholds:

- impacts on sensitive human health receptors in the local area from changes in road traffic on local roads due to the Proposed Development;
- impacts on sensitive ecological sites from changes in road traffic on local roads due to the Proposed Development; and
- impacts on the local area from on-site combustion;

1.6. Details are set out in Appendix A1.

1.7. The report does not consider the impacts of air quality on human health implications associated with Covid-19, as there remains too much uncertainty at this stage to consider explicitly.

2. Legislation, Policy and Guidance Documents

2.1. This section sets out the planning policy which is a material consideration in determining planning applications, legislation, guidance documents and other sources of useful information.

Planning Policy

National Planning Policy Framework

2.2. The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities & Local Government, 2021) sets out planning policy for England. It includes advice on when air quality should be a material consideration in development control decisions. The following paragraphs have been considered:

Paragraph 104: *"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that…the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains…"*

Paragraph 105: *"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health".*

Paragraph 174: *"Planning policies and decisions should contribute to and enhance the natural and local environment by: preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality".*

Paragraph 185: *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".*

Paragraph 186: *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

Paragraph 188: *"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that*

these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."

Paragraph 55: *"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."*

Local Planning Policy

Local Plan

2.3. Welwyn Hatfield Borough Council's (WHBC's) current Local Plan comprises three key documents; Welwyn Hatfield District Plan, Hertfordshire Waste Local Plan and Hertfordshire Minerals Local Plan. The District Plan (2005) sets out the local planning framework, policies and proposals that guide the development and land use in the district over the next 10 years. It includes a policy on Air Quality (R18), which states:

"The Council will have regard to the potential effects of a development on local air quality when determining planning applications. Consideration will be given to both the operational characteristics of the development and to the traffic generated by it. Any development within areas designated as Air Quality Management Areas must have regard to guidelines for ensuring air quality is maintained at acceptable levels as set out in the Air Quality Strategy".

Draft Local Plan

2.4. WHBC also has a draft Local Plan (2016) which has been under consultation since August 2016. Until this plan is adopted, the current Local Plan remains the key document for informing determination of applications. The draft Local Plan includes several policies which relate to air quality, these are described below:

Policy SP 1 – Delivering Sustainable Development

"The Local Plan seeks to bring about sustainable development in the borough by applying the following principles:

- *The need to plan positively for growth in a way which supports economic growth, increases the supply of housing and helps to reduce social and health inequalities in the borough - whilst recognising environmental and infrastructure constraints.*
- *That new development should contribute to the creation of mixed and sustainable communities which are well planned, promote healthy and active lifestyles, are inclusive and safe, environmentally sensitive, accessible, culturally rich, vibrant and vital, well served, and built to high design standards reflecting local character.*
- *That the location of new development should deliver a sustainable pattern of development which prioritises previously developed land; minimises the need to travel by directing growth to those areas with good transport networks and which are well served by jobs,*

services and facilities; protects areas of highest environmental value; and avoids areas of high flood risk…".

Policy SP 11 – Protection and Enhancement of Critical Environmental Assets

"The protection, enhancement and management of the environmental, ecological and historic assets within the borough, will be sought commensurate with their status, significance and international, national and/or local importance…".

Policy SADM 11 – Amenity and Layout

"All proposals will be required to create and protect a good standard of amenity for buildings and external open space in line with the Council's Supplementary Design Guidance, and in particular should ensure:…

b. Dwellings are dual aspect to enable passive ventilation and avoid the need for mechanical ventilation, subject to any noise and air pollution mitigation measures that are required to make the proposal acceptable".

Policy SADM 18 – Environmental Pollution

"Prevailing air quality and potential impacts upon air quality arising from airborne emissions, dust and odour associated with the construction and operation of a proposal (including vehicular traffic) will be considered when determining planning applications. Proposals that would result in or be subject to unacceptable risk to human health and the natural environment from air pollution, or would prejudice compliance with national air quality objectives, will be refused.

An Air Quality Assessment that demonstrates how prevailing air quality and potential impacts upon air quality have been considered and how air quality will be kept to an acceptable standard through avoidance and mitigation will be required for major and minor development proposals that are:

i. Likely, due to the nature of the proposal, to give rise to significant air pollution;
ii. Within an Air Quality Management Area;
iii. Within 50 metres of a major road or heavily trafficked route;
iv. Within proximity to a source of air pollution which could present a significant risk to human health; and/or
v. Particularly sensitive to air pollution due to their nature, such as schools, health care establishments or housing for older people".

Air Quality Standards, Critical Levels/Loads, Limit Values and Air Quality Objectives

2.5. The Environment Act 1995 (HMSO, 1995) sets out the requirements of the Local Air Quality Management (LAQM) regime and the requirement for the Government to produce an Air Quality Strategy including standards and objectives.

2.6. The latest Air Quality Strategy was published in 2007 (Defra, 2007) and sets out the Air Quality Standards (AQSs), which consider the effects on human health and ecosystems, and the Air Quality Objectives (AQOs) for ambient pollution. The AQOs for use by local authorities when considering human health were incorporated into UK legislation within the Air Quality (England) Regulations,

2000, Statutory Instrument 928 (2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043 (2002). In addition to the AQO for protection of human health set out in the Air Quality Regulations, both critical levels and critical loads are defined for protection of ecosystems. These critical levels and critical loads also form part of the AQOs in the strategy.

2.7. The Strategy explains that the AQSs for the protection of human health are defined as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant at the time the Strategy was developed. An exceedence is a breach of the threshold for the concentration for the specific averaging period. In terms of ecosystems the AQS are based on the critical levels and critical loads, which are derived for habitats and exceedence of these values are used as an indication of the potential for harmful effects to systems at steady state thus giving an indication of risk to the system. Critical loads are values of pollutants deposited below which significant effects do not occur. Critical levels the concentrations of pollutants above which direct adverse effects on vegetation or ecosystems may occur.

2.8. The AQOs set out the extent to which the Government expects the AQS to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility, and possible timescales. AQO are policy targets often expressed as a maximum ambient concentration, for a specific averaging period, not to be exceeded, either without exception or with a permitted number of exceedences, within a specified timescale. The LAQM regime, introduced by the Environment Act 1995, requires local authorities to review air quality within their boundary and work towards achieving and maintaining the AQOs.

2.9. The Strategy describes the LAQM regime that has been established by Part IV of the Environment Act 1995, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an AQMA and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives. The strategy also provides the policy framework for air quality management and assessment in the United Kingdom (UK).

2.10. In additional to the AQOs set within the Air Quality Strategy, the European Union (EU) has also set limit values for the protection of human health. These were transposed into the Air Quality Standards Regulations (HMSO, 2010) and amended in The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (HMSO, 2020), which sets out the UK limit values, target values and critical levels for specific pollutants. Like the AQOs, the limit values, target values and critical levels are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedences allowed per year (if any) and a date by which it must be achieved. Some pollutants have more than one value covering different dates or averaging times. While the AQOs are policy targets, the government has the duty to ensure compliance with the legally binding limit values which is a national obligation rather than a local one.

2.11. The 2019 Clean Air Strategy (Defra, 2019a) includes a commitment to set a *"new, ambitious, long-term target to reduce people's exposure to $PM_{2.5}$"* which the Environment Act 2021 commits the Secretary of State to setting. The World Health Organization (WHO) acknowledges that current evidence suggests no safe level for $PM_{2.5}$. The WHO set a previous guideline, which was 10 µg/m^3 as an annual mean and more stringent than the current AQOs, to reflect the level at which increased mortality from exposure to $PM_{2.5}$ is likely. However, the WHO guidelines were updated in September 2021 and now include more stringent levels to reflect updated evidence of health effects (5 µg/m^3 for $PM_{2.5}$), since the previous guidelines were published in 2005. Following the UK leaving the EU the Government have published the Environment Act 2021, which puts a duty on the Secretary of State to lay before Parliament an annual mean target for $PM_{2.5}$ in ambient air before November 2022.

2.12. In addition, the recent coroners court case investigating a young girl's death in 2013 concluded that air pollution was a significant contributing factor to both the induction of her asthma and the exacerbation of her symptoms, due to exposure in exceedance of WHO guidelines for pollutants.

Useful Sources of Information

2.13. Summaries of relevant documents and useful information have been presented in Appendix A2. The documents cover the following:

- Planning Practice Guidance;
- Clean Air Strategy;
- The Industrial Strategy;
- The Clean Growth Strategy;
- The 25 Year Environment Plan;
- Road to Zero;
- Air Quality Action Plan;

Guidance Documents

Guidance on Land-Use Planning & Development Control: Planning For Air Quality

2.14. Environmental Protection UK (EPUK) in partnership with The Institute of Air Quality Management (IAQM) have produced guidance on *Land-Use Planning & Development Control: Planning For Air Quality*. EPUK and IAQM have produced this guidance to ensure that air quality is adequately considered in the land-use planning and development control processes. It provides a means of reaching sound decisions, having regard to the air quality implications of development proposals and provides guidance on how air quality considerations of individual schemes may be considered within the development control process, by suggesting a framework for the assessment of the impacts of developments on local air quality.

LAQM Technical Guidance

2.15. Defra and the devolved administrations have published a guidance document on LAQM - *Local Air Quality Management Technical Guidance (TG16)* (Defra, 2021). This document is designed to support local authorities in carrying out their duties under the Environment Act 1995, the Environment (England) Order 2002, and subsequent regulations. LAQM is the statutory process by which local authorities monitor, assess, and take action to improve local air quality. The Technical Guidance provides tools, approaches and technical information related to air quality.

3. Assessment of Significance

Criteria for this Assessment

3.1. The assessment criteria include three separate types, covered by different legislation, policy, and guidance. These include AQOs, limit values, and WHO guidelines.

3.2. No ecological assessment criteria are presented as impacts are screened at the stage prior to the need to define the criteria, the details are set out later in this report.

Air Quality Objectives and Limit Values

3.3. The human-health related to AQOs and limit values for England for the pollutants relevant to this project are detailed in Table 1.

Table 1: AQOs and Limit Values

Pollutant	Time Period	Criteria Type	Concentration, and the number of exceedences allowed per year (if any)	Date AQO / Limit Value to be Achieved From and Maintained After
Nitrogen Dioxide (NO_2)	1-hour Mean	AQO / Limit Value	200 µg/m^3 not to be exceeded more than 18 times a year	31st December 2005 / 1st January 2010
	Annual Mean	AQO / Limit Value	40 µg/m^3	31st December 2005 / 1st January 2010
Fine Particles (PM_{10})	24-hour Mean	AQO / Limit Value	50 µg/m^3 not to be exceeded more than 35 times a year	31st December 2004
	Annual Mean	AQO / Limit Value	40 µg/m^3	31st December 2004
Fine Particles ($PM_{2.5}$)	Annual Mean	AQO / Limit Value	25 µg/m^3 [a] / 20 µg/m^3	2020 / 2020

Table notes:

a. The $PM_{2.5}$ AQO is not in Regulations, but Local Authorities have a duty to work towards reducing $PM_{2.5}$ in their areas.

WHO Guidelines

3.4. The World Health Organization (WHO) has recently revised its air quality guidelines (AQGs) (2021) for six pollutants including PM_{10}, $PM_{2.5}$ and NO_2. The air quality guideline for these pollutants have become more stringent. Table 2 presents the WHO AQGs and Interim Targets for the pollutants of concern. For PM, the guidelines are lower, although it is noted that there is no safe level of PM.

3.5. In recognition of the difficultly of meeting the AQGs, a series of Interim Targets have been proposed by the WHO and these should be considered steps towards ultimately achieving the AQGs, rather than as end targets. The WHO document aims to provide quantitative health-based recommendations for air quality management.

3.6. The guidelines are not legally binding standards; however, they should be used to inform legislation and policy. Ultimately, the goal of the guidelines is to help reduce the health burden resulting from exposure to air pollution. Air pollution increases morbidity and mortality from cardiovascular and respiratory disease and from lung cancer and there is increasing evidence of effects on all other organ systems.

3.7. The WHO AQGs are based solely on the latest epidemiological evidence, whereas the AQOs and limit values were based on health evidence from the 1990s. They also take account of other factors such as the technical and economic feasibility of meeting the standard by a defined date.

3.8. It is more than 15 years since WHO published its last AQGs (2006). Over that period there has been a large increase in the evidence of health effects of air pollution. New epidemiological studies have shown adverse effects at much lower levels than had previously been studied.

3.9. The WHO guidelines are not currently in Regulations and there is no legal requirement for local authorities to meet them. The Environment Act 2021 puts a duty on the Secretary of State to lay before Parliament an annual mean target for $PM_{2.5}$ in ambient air before November 2022. It is unknown at this stage whether it would align with the WHO guidelines.

Table 2: WHO Guidelines

Pollutant	Time Period	Interim Target				AQG Level
		1	2	3	4	
Nitrogen Dioxide (NO_2)	1-hour Mean	-	-	-	-	200 µg/m³
	24-hour Mean	120	50	-	-	25 µg/m³
	Annual Mean	40	30	20	-	10 µg/m³
Fine Particles (PM_{10})	24-hour Mean	150	100	75	50	45 µg/m³
	Annual Mean	70	50	30	20	15 µg/m³
Fine Particles ($PM_{2.5}$)	24-hour Mean	75	50	37.5	25	15 µg/m³
	Annual Mean	35	25	15	10	5 µg/m³
Table notes:						

Health Effects

3.10. Air pollution has a significant effect on public health. Long-term exposure (over years) reduces life expectancy, mainly due to cardiovascular and respiratory diseases and lung cancer. Recent evidence suggests that it can also adversely affect cognitive ability, and is associated with dementia, diabetes, obesity, and low birth weight (Royal College of Physicians, 2016).

3.11. Short-term exposure (over hours or days) to elevated levels of air pollution can also cause a range of health effects, including on lung function and exacerbation of asthma, resulting in respiratory and cardiovascular hospital admissions and mortality.

3.12. It has been estimated that exposure to man-made air pollution in the UK gives rise to 28,000 to 36,000 deaths a year (Public Health England, 2018).

3.13. There is no evidence of a safe level of exposure to PM below which there is no risk of adverse health effects. UK Health Security Agency (UKHSA) formerly Public Health England (PHE) believe that reductions of both PM and NO2 concentrations below the current standards is likely to bring health benefits.

Relevant exposure

AQO Receptors

3.14. The annual mean AQO applies at locations where members of the public might be regularly exposed, such as building façades of residential properties, schools, hospitals, and care homes.

3.15. The 24-hour mean AQO applies at the annual mean locations of exposure as well as at hotels and residential gardens.

3.16. The 1-hour mean AQO applies at the annual mean locations of exposure and at hotels, residential gardens, and any outdoor location where members of the public might reasonably be expected to spend one hour or longer, such as busy pavements, outdoor bus stations and locations with outdoor seating.

3.17. Places of work like factories or offices are not considered places where members of the public might be regularly exposed and therefore the AQOs do not apply at these locations.

Limit Value Receptors

3.18. In accordance with Article 2(1), Annex III, Part A, paragraph 2 of Directive 2008/50/EC details locations where compliance with the limit values does not need to be assessed:

"Compliance with the limit values directed at the protection of human health shall not be assessed at the following locations:

a) Any locations situated within areas where members of the public do not have access and there is no fixed habitation;

b) In accordance with Article 2(1), on factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and

c) On the carriageway of roads; and on the central reservation of roads except where there is normally pedestrian access to the central reservation."

3.19. The government models compliance with the Directive at locations 4 m from the kerbside, 2 m high, more than 25 m from major road junctions and adjacent to at least 100 m of road length where the limit value applies.

WHO Receptors

3.20. The WHO criteria apply whenever there is relevant exposure in relation to each time period, for each pollutant. These are considered the same as those set out above for AQO receptors.

Assessment Approach

3.21. Standard practice is to assess the impacts of a proposed development on local air quality using the EPUK and IAQM guidance on Land-Use Planning & Development Control: Planning For Air Quality (EPUK/IAQM, 2017).

3.22. The EPUK and IAQM guidance provides a staged approach to considering air quality assessments:

- Stage1) Initial screening
- Stage2) Detailed screening
- Stage3) Simple or Detailed assessment

3.23. The approach includes elements of professional judgement, and the experience of the consultants preparing this report is set out in Appendix A3.

3.24. Further details of this approach is set out in Appendix A4.

Significance

3.25. The approach developed by EPUK and IAQM (2017) has been used. The guidance is that the assessment of significance should be of professional judgement, with overall air quality impact of the development described as either 'significant' or 'not significant'.

3.26. If none of the criteria in Stage 1 and 2 are met, then there should be no requirement to carry out an air quality assessment for the impact of the development on the local area, and the impacts can be considered as having a not significant effect.

3.27. Where a Simple or Detailed assessment is carried out, in drawing the determination of significance, the following factors should be taken into account:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts. In such circumstances, several impacts that are described as "slight" individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a "moderate" or "substantial" impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; i.e. will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

3.28. The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the users of any new development where the air quality is such that an air quality objective is not met will be judged as significant.

4. The Proposed Development

4.1. The Proposed Development will involve the demolition of the Former Beales Hotel and the construction of mid-rise blocks providing residential dwellings with associated amenity space and ground floor car parking. The ground floor plan of the Proposed Development is shown in Figure 2.

Figure 2: The Proposed Development

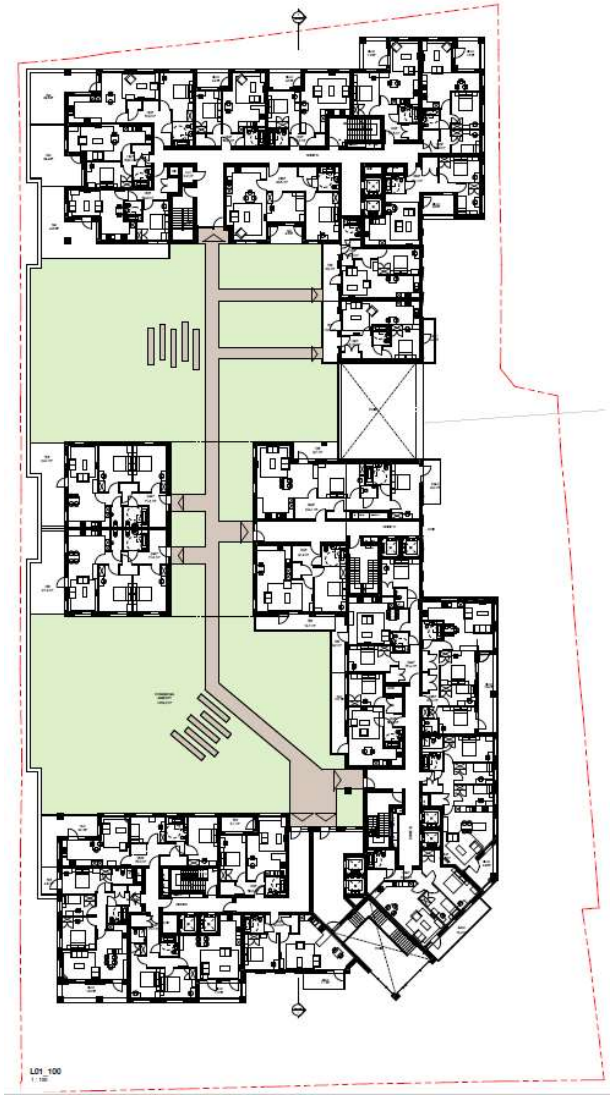

Figure notes: First Floor drawing provided by Alan Camp Architects.

Traffic Generation

4.2. The project Transport Consultants, RPS Group, have provided details of traffic generated by the operation of the Proposed Development. The trip generation associated with The Proposed Development is expected to be 325 Annual Average Daily Traffic (AADT) movements. However, the previous use of the site generated 222 AADT movements. The net change in trip generation for the Proposed Development is thus expected to be 103 AADT movements.

Car Park

4.3. The car parking for the Proposed Development will be situated at the ground floor and will include 125 parking spaces. The ventilation strategy to remove pollutants generated by vehicles using the car park will utilise natural ventilation. The facades will be open at sections of the eastern, northern and western boundaries of the floor. The car park layout is shown in Figure 3.

Figure 3: Proposed Car Parking within the Proposed Development

Figure notes: Drawing provided by Alan Camp Architects.

Mitigation Included by Design

4.4. The EPUK and IAQM guidance (2017) is clear that it is important that proposed developments should incorporate good design and best practice measures to ensure any impacts are minimalised as far as practicable, even where the pollutant are predicted below the AQOs/limit values. The Proposed Development includes the following good design and best practice measures by design:

- the Proposed Development includes bicycle storage, to help promote sustainable modes of transport and to minimise pollutant emissions in the local area;
- the Proposed Development is located near to several bus stops, the closest being within 250 m, enabling users to easily access the Proposed Development via public transport; and
- the Proposed Development will not include a centralised energy plant for provision of power, hot water or heating. These services will be provided electrically, helping to minimise local emissions.

5. Methodology

5.1. The following section details the methodology of the assessment. The process consists of:

1. Defining baseline conditions.
2. Considering the impact of the emissions related to and on the development.
3. Evaluating the significance of any impacts in relation of both AQO receptors, using EPUK & IAQM and Environment Agency (EA) guidance, and the compliance receptors.

Existing Conditions

5.2. Consideration of the baseline conditions within the area of the Proposed Development have made based on the following:

- Industrial and waste management sources that may affect the area have been identified using the European Pollutant Release and Transfer Register (European Environment Agency, 2019). Local sources have also been identified through examination of maps and the Council's Air Quality Review and Assessment reports.
- Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority and where available other monitoring networks. This covers both the proposed site and the surrounding area, the latter being used to provide context to the assessment.
- Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been defined using the national pollution maps published by Defra (2022b). These cover the whole of the country on a 1x1 km grid of average concentrations.
- Predicted roadside concentrations of NO_2 in the study area have been identified using the maps of roadside concentrations published by Defra (2022c) as part of its 2017 Air Quality Plan for the baseline year 2015 and for the future years 2017 to 2030. These maps are used by the UK Government, to report exceedances of the limit value to the EU. The national maps of roadside PM_{10} and $PM_{2.5}$ concentrations (Defra, 2022a), which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

Impacts of emissions sources upon the Proposed Development

5.3. The following section sets out the approach taken to the assessment of pollutant emissions upon air quality at the Proposed Development.

Modelling approach overview

5.4. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted for:

- the existing year of 2019 (latest year with relevant monitoring data); and
- the future year of 2024 (when the Proposed Development may be first operational).

5.5. The year 2019 is selected to represent the existing conditions because it is the latest year with monitoring data which is unaffected by the Covid-19 pandemic and therefore the model can be appropriately verified.

5.6. Concentration contributions associated with road traffic have been predicted using the ADMS-Roads atmospheric dispersion model (v5) with the latest vehicle emission factors available from Defra's Emissions Factors Toolkit (EFT) (v11.0).

5.7. As a result of the pandemic, the vehicle fleet turnover in the UK has not materialised as expected over the pandemic period and although Defra released EFT v11.0 in November 2021 it is based on pre-pandemic information. There is therefore some uncertainty in Defra's emission factors. It is currently understood that new vehicle sales were reduced, with higher rates of private vehicle owners retaining their existing vehicles; leading to predicted reductions in emissions not materialising. However, electric vehicles have increased over the pandemic, accounting for more than one in ten new car registrations in 2020 and a 90% increase of plug-in hybrid cars; causing predicted reductions in emissions to be exceeded. Thus, while there may be some uncertainty in the EFT's emission factors, overall they are considered likely to be representative.

5.8. ADMS-Roads was developed and validated by Cambridge Environmental Research Consultants (CERC). The model is used extensively throughout the UK for regulatory compliance purposes and Local Air Quality Management and is accepted as an appropriate tool by local authorities and the EA. The model requires a range of input parameters which are discussed below.

Modelled Receptors

5.9. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at sensitive locations of exposure within the Proposed Development. 27 locations have been identified as receptors within the model. These are shown in Figure 4. Receptors 1 to 3 represent ground floor long term exposure whereas receptors 4 to 27 represent first floor long term exposure. Receptors 17 to 27 represent balconies and roof terraces, which are locations relevant for consideration of short-term exposure.

Figure 4: Receptor Locations within the Proposed Development

Figure notes: First Floor Drawing provided by Alan Camp Architects. Contains OS data © Crown copyright and database right (2022).

5.10. In addition, concentrations of pollutants have been predicted at two monitoring sites located within the local area, in order to improve and verify the model (see paragraph A5.22 for details).

Modelled Roads

5.11. The road geometries, widths, street canyons and heights included in the dispersion model have been aligned with data from Google Satellite and Ordinance Survey maps, which included carefully considering relative distances from the roadsides to receptors and monitoring sites. The modelled road links, speeds and canyons are shown in Figure 5, Figure 6 and Figure 7. This includes roads near to the Proposed Development and close to the local monitoring sites used in model verification.

Figure 5: Modelled Road Geometries, Widths, Street Canyons and Speeds near the Proposed Development

Figure notes: Imagery © 2022 Google, Map data © 2022

Figure 6: Modelled Road Geometries, Widths, Street Canyons and Speeds near Verification Monitor WH24

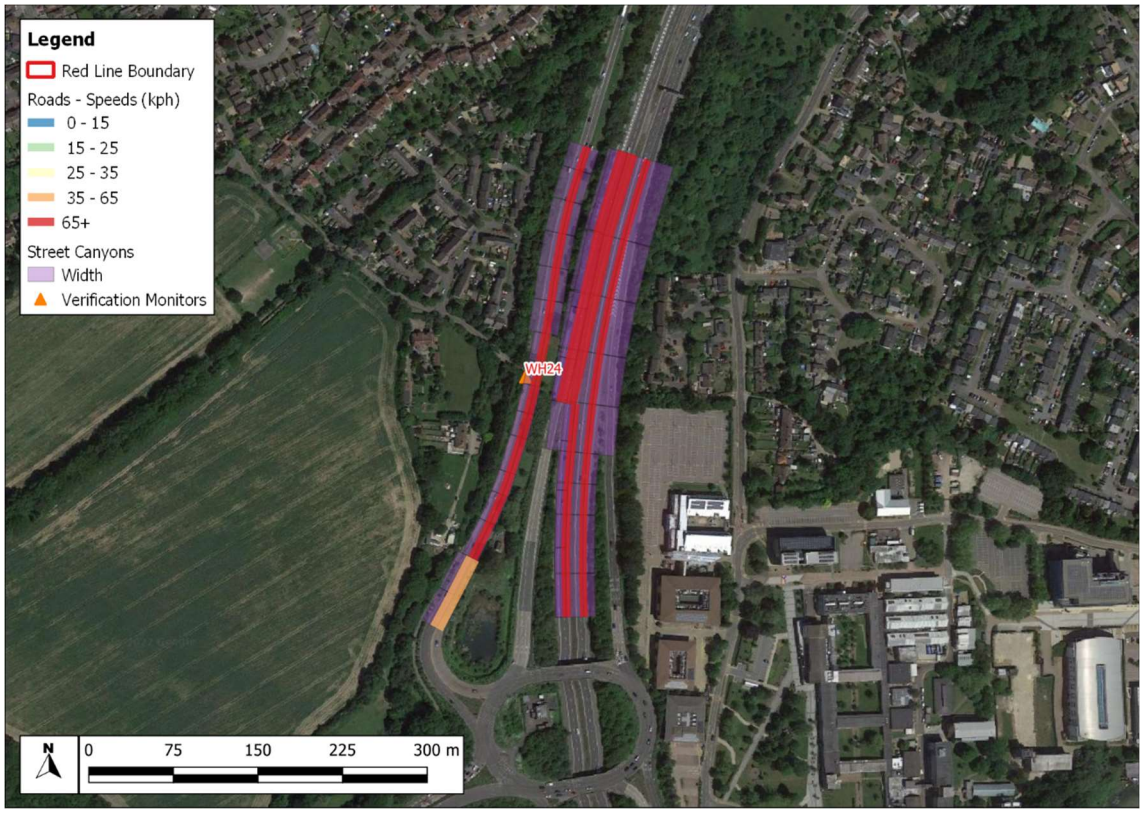

Figure notes: Imagery © 2022 Google, Map data © 2022

Figure 7: Modelled Road Geometries, Widths, Street Canyons and Speeds near Verification Monitor WH19

Figure notes: Imagery © 2022 Google, Map data © 2022

Traffic Data

5.12. Traffic data has been derived from nearby Department for Transport (DfT) traffic count points. This data includes the AADT flows, the percentage of cars and taxis, Light Goods Vehicles (LGVs), Heavy Goods Vehicles (HGVs), buses and motorcycles. Where appropriate, the vehicle speeds have been reduced to take account of slower speeds at junctions from queuing traffic. Further details are set out in Appendix A5.

Modelled Car Park

5.13. The Proposed Development includes a car park at ground floor level. The car park will be naturally ventilated via a number of open façades. Emissions from vehicles using the car park will be vented out of these open facades. Volume sources have been included in the dispersion model to represent these emissions. The modelled volume sources are shown in Figure 8. Further details are set out in Appendix A5.

Figure 8: Modelled Car Park Volume Sources

Figure notes: Drawing provided by Alan Camp Architects. Contains OS data © Crown copyright and database right (2022).

Additional Model setup Parameters and post-processing

5.14. Further details on additional setup parameters and post-processing approaches are set out in Appendix A4. These include the vehicles emission factors, meteorology, model verification and other key modelling considerations.

Uncertainty

5.15. The assessment involves a range of uncertainties, including the model inputs, assumptions, the model, model verification and post-processing of model results. A brief overview of the key uncertainties is discussed in Appendix A4.

6. Baseline Conditions

AQMAs

6.1. WHBC have investigated air quality within its administrative area as part of its responsibilities under the LAQM regime. The Council have not declared any AQMAs within the borough.

Baseline Concentrations

LAQM Monitoring

6.2. WHBC operates two automatic monitoring stations, WHBAM and WHNOX. WHBAM, which measures $PM_{2.5}$, is located approximately 1.9 km north-east of the application site whereas WHNOX, which measures 1-hour mean NO_2, is located approximately 1.1 km north of the application site.

6.3. WHBC also operate a large number of passive monitoring sites (diffusion tubes), some of which are located close to the Proposed Development. There are 11 monitoring sites within approximately 1.5 km of the application site. Relevant monitoring locations are shown in Figure 9. Data for 2016 to 2020 have been obtained from WHBC's latest Air Quality Annual Status Report (Welwyn Hatfield Borough Council, 2021).

6.4. Data from 2020 are not considered representative of typical conditions at the monitoring stations due to restrictions associated with the Covid-19 pandemic.

Figure 9: Monitoring Locations Relative to Proposed Development

Figure notes: Imagery © 2022 Google, Map data © 2022.

Annual Mean NO_2

6.5. Annual mean NO_2 concentrations for the years of 2016 to 2020 are presented in Table 3. Measured NO_2 concentrations were above the annual mean AQO level of 40 µg/m^3 at 5 of these 11 monitoring sites for at least one year between the years 2015 – 2019. Two of these monitors had exceedances in the most recent relevant year (2019). West View 1-3 are all located close to the large Gyratory approximately 1 km north of the Proposed Development where additional congestion would be expected. WH7 lies approximately 150 m north of the Proposed Development and has consistently demonstrated pollutant concentrations to be below the national air quality objectives but is set back about 20 m from Comet Way.

6.6. In 2019, measured concentrations at 2 monitors were above WHO Interim Target 1 (40 µg/m^3), 5 were below WHO Interim Target 1 (40 µg/m^3) and 3 were below WHO Interim Target 2 (30 µg/m^3) and 1 was below WHO Interim Target 3 (20 µg/m^3).

Table 3: Measured NO_2 Annual Mean Concentrations ($\mu g/m^3$) [a]

Site ID – Name (Type)	2016	2017	2018	2019	2020 [c]
WH7 – Parkhouse Court, Hatfield (Roadside)	30	30	17	17	20
WH14 – Green Lanes, Hatfield (Kerbside)	29	28	21	25	25
WH16 – Stanborough Road, near Stanborough Close (Roadside)	25	21	20	38	30
WH19 – Comet Way on A1001 & A1M (Roadside)	**55**	**49**	**44**	**42**	32
WH20 – Link Drive, Hatfield (Roadside)	31	27	23	23	22
WH22 – Garden Village, Hatfield (Kerbside)	36	**43**	35	37	28
WH24 – Ellenbrook Lane, A1001 (Urban Centre)	**44**	**40**	38	36	25
WH25 – West View 1 (Roadside)	**44**	**46**	40	36	29
WH26 – West View 2 (Roadside)	37	39	**45**	**48**	35
WH27 - West View 3 (Roadside)	37	40	34	34	26
WH30 – Woods Avenue, Hatfield (Roadside)	-	-	23	21	18
AQO / Limit Value	**40**				
WHO AQG Level (Interim Targets) [b]	**10 (40, 30, 20)**				

Table notes:

a. Exceedances of the AQO are presented in bold.

b. Not required to be achieved within UK legislation.

c. Air quality monitoring carried out in 2020 includes periods of national travel restrictions due to the Covid-19 pandemic; measured concentrations are therefore not likely to be representative of typical conditions.

6.7. There has been an overall downward trend in NO_2 concentrations over the last five years within the local area (see Figure 10). This is expected to continue into the future, as old vehicles are gradually replaced with low emission alternatives.

Figure 10: Trend in Measured Concentrations

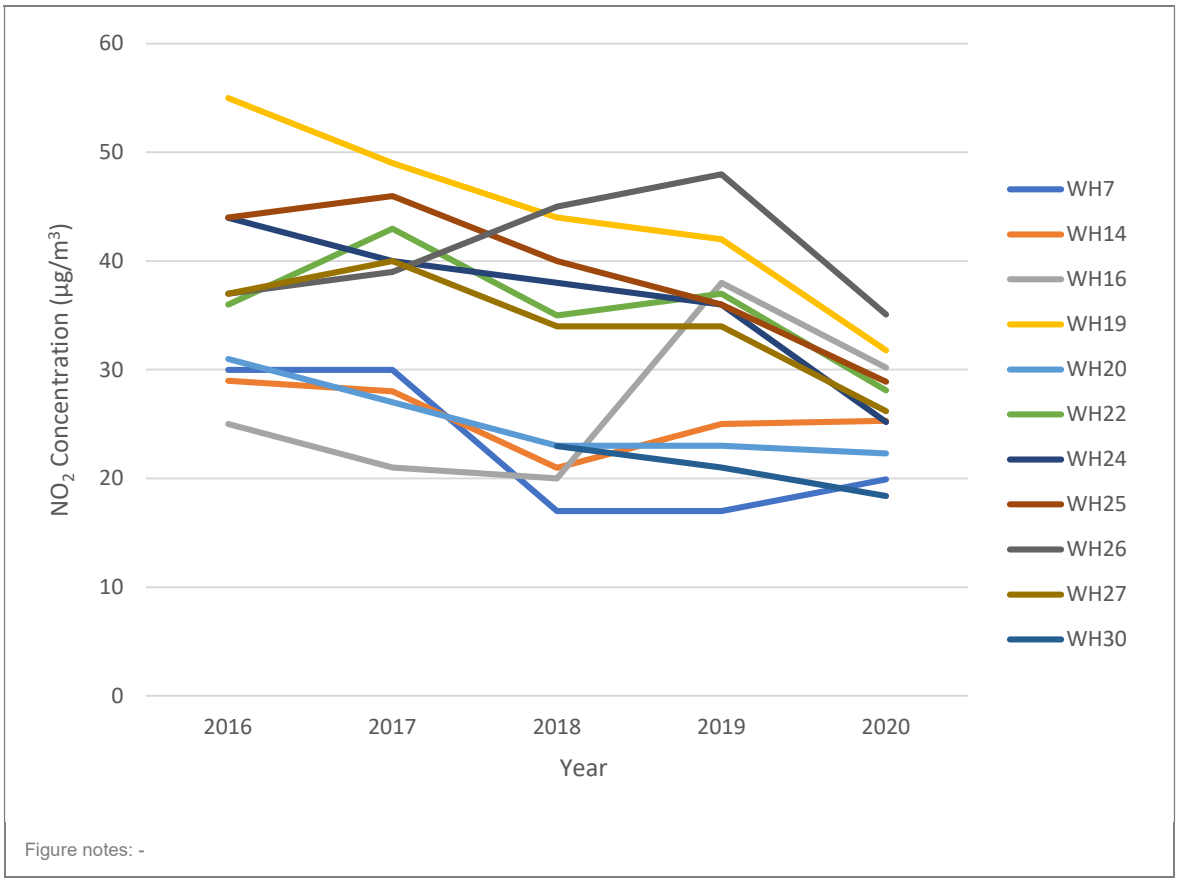

Figure notes: -

1-hour Mean NO_2

6.8. The measured number of 1-hour mean NO_2 concentrations above 200 µg/m^3 for the relevant monitoring site within WHBC are presented in Table 4. No exceedances of the 1-hour mean NO_2 AQO have been measured in 2020. The monitor was not operating prior to 2020.

Table 4: Measured Number of NO_2 1-hour Concentrations above 200 (µg/m^3) [a]

Site ID - Name	2016	2017	2018	2019	2020 [c]
WHNOX	-	-	-	-	0
AQO / Limit Value	**18**				
WHO AQG Level (Interim Targets) [b]	**0**				

Table notes:

a. Exceedances of the AQO are presented in bold.

b. Not required to be achieved within UK legislation. The guideline is 200 µg/m^3 thus no exceedance of this level is permitted.

c. Air quality monitoring carried out in 2020 includes periods of national travel restrictions due to the Covid-19 pandemic; measured concentrations are therefore not likely to be representative of typical conditions.

Annual and 24-hour Mean PM_{10}

6.9. WHBC does not operate any automatic monitors that measure PM_{10}.

Annual Mean $PM_{2.5}$

6.10. Measured annual mean $PM_{2.5}$ concentrations for the relevant automatic monitoring station are presented in Table 5. Measured $PM_{2.5}$ concentrations were below the annual mean AQO and limit value in 2019. Measured concentrations have consistently been below WHO Interim Target 3 (15 $\mu g/m^3$).

Table 5: Measured $PM_{2.5}$ Annual Mean Concentrations ($\mu g/m^3$) [a]

Site ID - Name	2016	2017	2018	2019	2020 [c]
WHBAM	9	13	11	10	9
AQO / Limit Value	**25 / 20**				
WHO AQG Level (Interim Targets) [b]	**5 (35, 25, 15, 10)**				

Table notes:

a. Exceedances of the AQO are presented in bold.

b. Not required to be achieved within UK legislation.

c. Air quality monitoring carried out in 2020 includes periods of national travel restrictions due to the Covid-19 pandemic; measured concentrations are therefore not likely to be representative of typical conditions.

AURN Monitoring

6.11. National Government measures concentrations of NO_2, PM_{10} and $PM_{2.5}$ at monitoring sites across the UK, as part of the Automatic Urban and Rural Network (AURN) regime. There are no Defra AURN monitoring sites located within the local area.

Predicted background concentrations

6.12. Ambient background concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been defined using the national pollution maps published by Defra (Defra, 2022b). These cover the whole of the country on a 1x1 km grid for each year from 2018 until 2030. These concentrations have been calibrated to match locally measured background concentrations (see Appendix A5). Concentrations for 2019 (the baseline year) and 2024 (future assessment year) have been extracted for the grid cells that surround the Proposed Development. These concentrations have been bilinearly interpolated to give specific background concentrations at the Proposed Development. The predicted background values are presented in Table 6.

6.13. All predicted background concentrations are below the AQOs and Limit Values for both 2019 and 2024. With respect to the WHO Interim Targets, the levels are below Interim Target 3 (20 $\mu g/m^3$) for NO_2, below Interim Target 4 (20 $\mu g/m^3$) for PM_{10} and below Interim Target 3 (15 $\mu g/m^3$) for $PM_{2.5}$.

Table 6: Mapped Background Concentrations (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2019	19.8	17.0	11.1
2024	15.8	16.0	10.3
AQO / Limit Value	**40**	**40**	**25 [a] / 20**
WHO AQG Level (Interim Targets) [a]	**10 (40, 30, 20)**	**15 (70, 50, 30, 20)**	**5 (35, 25, 15, 10)**

Table notes:

a. Not in Regulations and there is no legal requirement for local authorities to meet it.

Predicted roadside concentrations

6.14. Defra has predicted roadside concentrations of NO_2, PM_{10} and $PM_{2.5}$ for the main roads in the UK (Defra, 2022c) for the years 2017 to 2030 as part of Defra's commitment to report exceedances of the limit values. In 2019 the nearest roads (A1001 and A1057) with predictions from Defra are not predicted to exceed the limit values.

6.15. It should also be noted that it is widely accepted that in many locations in the UK Defra's modelling has underpredicted roadside concentrations when compared with local monitoring and these Defra roadside estimates should be treated with caution.

6.16. The earliest year that the Proposed Development might contribute to or be exposed to local air pollution is likely to be 2024. Defra predicts that there will be no exceedances of the limit value in 2024 as shown in Table 7; the local area will thus not be sensitive to small changes in concentrations and there is unlikely to be any exceedances within the Proposed Development.

Table 7: Defra Predicted Roadside Concentrations (µg/m^3)

Road (Census ID)	NO_2		PM_{10}		$PM_{2.5}$	
	2019	2024	2019	2024	2019	2024
A1001 (6078)	19.3	19.0	16.3	16.0	12.3	12.0
A1057 (78208)	19.3	18.2	16.3	15.2	12.3	12.0
Limit Value	**40**		**40**		**20**	

Table notes:

Figure 11: PCM modelled NO_2 concentrations for 2024 and Site Location

Figure notes: Contains OS data © Crown copyright and database right (2022).

Other Sources of Air Pollution

Permitted Facilities

6.17. The EA regulates sites which are at risk of contributing significantly to pollutant concentrations and maintains a database of these sites called the UK Pollutant Release and Transfer Register (PRTR). The UK PRTR data has been used to fulfil the reporting requirements of the European Pollutant Release and Transfer Register (E-PRTR) which provides details of all regulated sites in the UK (European Environment Agency, 2019). The 2019 database has not identified any regulated facilities within 1 km of the Proposed Development.

Overall Baseline Conditions

Air Quality Objectives

6.18. When considering the baseline year of 2019, most nearby monitoring sites have not measured exceedances of the NO_2 AQOs. The monitors that did exceed are located closer to the roadside than the Proposed Development and also closer to either a motorway or busy junction. These monitors are therefore not representative of conditions at the Proposed Development. Additionally, background concentrations in the vicinity of the Proposed Development of NO_2, PM_{10} and $PM_{2.5}$ are significantly below the AQOs. Concentrations are also expected to be lower in 2024, when the Proposed Development is likely to be first operational.

Limit Value Compliance

6.19. Defra have not identified any exceedances of the limit values along the A1001 and A1057 in 2019 or 2024.

World Health Organization Guidelines

6.20. Based upon the most relevant baseline information, in the local area baseline concentrations may be above Interim Target 2 for annual mean NO_2 (30 µg/m^3), may be above Interim Target 3 for PM_{10} (30 µg/m^3) and may be above Interim Target 3 for $PM_{2.5}$ (15 µg/m^3) at the Proposed Development.

Health Effects

6.21. The Public Health Outcomes Framework (Public Health England, 2021) provides information on the fraction of mortality attributable to particulate matter ($PM_{2.5}$) air pollution (indicator D01). For WHBC 5.8% of deaths were attributed to $PM_{2.5}$, which is slightly above the average for the East of England (5.5%) and significantly higher than the average for England of 5.1%. The long-term trend in proportion of deaths associated with exposure to $PM_{2.5}$ is shown in Figure 12.

Figure 12: Public Health Framework D01 Fraction of all-cause adult mortality attributable to anthropogenic particulate air pollution

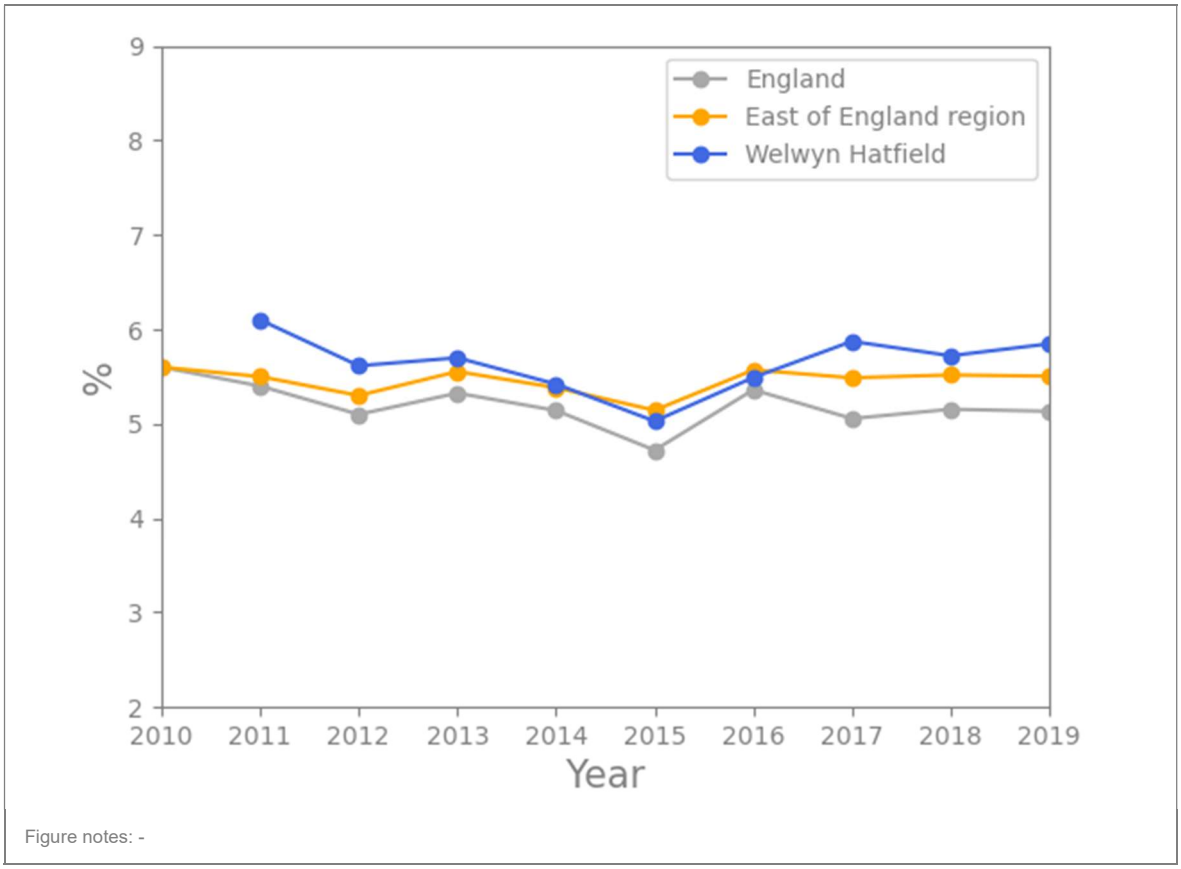

Figure notes: -

7. Operational Air Quality Impacts

Impacts on the Proposed Development

7.1. The Proposed Development is located within an urban area where ambient background pollution and pollutant emissions from vehicles using local roads may impact upon future users of the Proposed Development.

Air Quality Objectives

7.2. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted for the future year of 2024 (anticipated first year of operation) at the Proposed Development. The annual mean concentrations at each receptor are presented in Table 8. The concentrations are predicted to be well below the AQOs at all receptor locations.

7.3. Previous research carried out on behalf of Defra and the devolved administrations identified that, where road traffic emissions are the dominant pollutant source, exceedences of the 1-hour mean NO_2 AQO are unlikely to occur where the annual mean is below 60 µg/m^3 and exceedences of the 24-hour mean PM_{10} AQO are unlikely to occur where the annual mean is below 32 µg/m^3 (Defra, 2021). Since the annual mean concentrations are predicted to be well below these levels, it is considered unlikely that any short-term exceedences will occur. As such, there will be no exceedances of the AQOs at the Proposed Development.

Table 8: Predicted Annual Mean Concentrations at Locations within the Proposed Development (µg/m^3)

Receptor	Floor	NO_2	PM_{10}	$PM_{2.5}$
1	Ground	18.0	16.7	10.7
2	Ground	18.0	16.7	10.7
3	Ground	18.0	16.7	10.7
4	First	16.6	16.2	10.4
5	First	16.8	16.2	10.5
6	First	17.0	16.3	10.5
7	First	17.2	16.4	10.6
8	First	17.7	16.6	10.6
9	First	17.9	16.7	10.7
10	First	17.9	16.7	10.7
11	First	17.9	16.7	10.7
12	First	17.9	16.7	10.7
13	First	18.1	16.7	10.7
14	First	17.6	16.5	10.6
15	First	16.9	16.3	10.5
16	First	16.6	16.2	10.4
17[a]	First	16.5	16.2	10.4
18[a]	First	16.6	16.2	10.4
19[a]	First	16.8	16.2	10.5

20[a]	First	17.0	16.3	10.5
21[a]	First	17.2	16.4	10.6
22[a]	First	17.6	16.5	10.6
23[a]	First	17.9	16.7	10.7
24[a]	First	17.9	16.7	10.7
25[a]	First	17.9	16.7	10.7
26[a]	First	17.9	16.7	10.7
27[a]	First	17.9	16.6	10.7
AQO [a]		**40**	**40**	**20**

Table notes:

a. Annual mean AQOs are not relevant at these receptor locations as they are located at roof terraces and balconies. However, the 1-hour mean NO_2 AQO and the 24-hour mean PM_{10} AQO do apply.

Limit Values

7.4. Defra has not identified any exceedances of the limit values along the A1001 or the A1057. As such, limit values will not be exceeded at the Proposed Development in 2024.

WHO Guidelines

7.5. With regards to the compliance with the WHO guidelines, the following has been identified for the Proposed Development:

- NO_2 concentrations are predicted to be below WHO Interim Target 3 (20 µg/m^3);
- PM_{10} concentrations are predicted to be below WHO Interim Target 4 (20 µg/m^3); and
- $PM_{2.5}$ concentrations are predicted to be below WHO Interim Target 3 (15 µg/m^3).

Health Effects

7.6. As set out in paragraph 6.21, the number of deaths attributed to the $PM_{2.5}$ exposure in WHBC is slightly above the average for the East of England and above the average for England (Public Health England, 2021). It is therefore important to minimise exposure to $PM_{2.5}$ concentrations at the Proposed Development.

Significance of Operational Air Quality Effects

7.7. The operational air quality effects without mitigation are judged to be *'not significant'*. This professional judgement is made in accordance with the methodology and assessment criteria set out earlier in this report. The judgement that the operational air quality effects will be 'not significant' without mitigation takes account of the assessment that:

- predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the Proposed Development are likely to be below the AQOs and limit values;
- the Proposed Development is unlikely to delay compliance with the limit values in Hatfield; and
- the Proposed Development is unlikely to delay compliance with the WHO guidelines in Hatfield.

8. Mitigation

Mitigation Included by Design

8.1. Mitigation measured included by design are set out in Section 4.

Recommended Mitigation

8.2. The assessment has demonstrated that there will not be any exceedance of the AQOs or limit values at the Proposed Development and will not cause any exceedances in the local area. The overall effect of the Proposed Development will be 'not significant'. It is, therefore, not considered necessary to propose further mitigation measures.

8.3. Measures to reduce pollutant emissions from road traffic are principally being delivered in the longer term by the introduction of more stringent emissions standards, largely via European legislation (which was transposed into UK law). Furthermore, the government and the local authority are working on improving air quality under the relevant air quality Strategies and LAQM regime.

9. Summary and Conclusions

9.1. The air quality impacts of the Proposed Development at the Former Beales Hotel, Comet Way, Hatfield have been considered.

9.2. Consideration has also been given to the potential air quality impacts of the Proposed Development upon the local area. All impacts have been screened out as negligible following relevant guidance. The Proposed Development is unlikely to delay compliance with the limit values or WHO guidelines in Hatfield.

9.3. Air quality for future users of the Proposed Development have been considered. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at the Proposed Development. All predicted concentrations are below the AQOs and limit values. It is therefore not necessary to include any further mitigation measures.

9.4. Overall, the air quality impacts of the Proposed Development will be 'not significant'.

10. Glossary, References and Appendices

Glossary

APS	Air Pollution Services
AQG	Air Quality Guideline
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Standard
AURN	Automatic Urban and Rural Network
EA	Environment Agency
EFT	Emissions Factors Toolkit
EIA	Environmental Impact Assessment
E-PRTR	European Pollutant Release and Transfer Register
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle (which comprise of heavy goods vehicles, buses, and coaches)
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle (which comprise of motorcycles, cars, taxis, and light goods vehicles)
NPPF	National Planning Policy Framework
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides
µg/m^3	Microgrammes per cubic metre
PHE	Public Health England
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
$PM_{2.5}$	Small airborne particles, more specifically particulate matter less than 2.5 micrometres in aerodynamic diameter
PRTR	Pollution Release and Transfer Register
UK	United Kingdom
UKHSA	United Kingdom Health Security Agency

WHBC	Welwyn Hatfield Borough Council
WHO	World Health Organization

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A1. Screening & Scoping

Impacts on Human Health Related Air Quality Objectives

A1.1. The Proposed Development has the potential to impact upon locations of human-health exposure in the local area due to emissions from changes in local road traffic.

A1.2. The screening criteria set out in the EPUK and IAQM guidance states that the impacts will be negligible where the change in LDV AADT flow is less than 500 outside an AQMA and the change in HDV AADT flow is less than 100 outside an AQMA.

A1.3. As stated in Section 4, the Proposed Development will lead to an increase of 103 LDV AADT movements per day.

A1.4. There will thus be significantly fewer vehicle movements than the EPUK/IAQM criterion. The impacts upon local air quality will thus be negligible.

Impacts on Limit Value Compliance

A1.5. Without the Proposed Development, existing levels of air pollution are predicted by Defra to be significantly below the annual mean NO_2 limit value in 2024 for the A1001 and the A1057, both being close to the Proposed Development. The Proposed Development will not significantly increase traffic on local roads and will therefore not delay compliance with the limit values.

Impacts on WHO Guidelines

A1.6. The Proposed Development is not expected to be detrimental to air quality in the local area and is thus unlikely to have a significant effect on achieving the WHO guidelines in the local area.

Impacts on Ecological Sites

A1.7. With regards to ecological sites, the first step in considering the road traffic impacts of the Proposed Development has been to screen the Proposed Development and its traffic generation against the criteria set out in the IAQM habitats guidance (2019). The IAQM have produced this guidance to assist in the assessment of the air quality impacts of development on designated nature conservation sites. The guidance focuses on air quality assessments in support of Habitats Regulations Assessments (HRA), but also considers the approach for assessing the air quality impact on national or local designated nature conservation sites. Where impacts can be screened out there is no need to progress to a more detailed assessment.

A1.8. Following the departure from the EU, the functions performed by the EU are required to transfer to the appropriate authorities in England. As part of the updates, Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) in the UK no longer form part of the EU's Natura 2000 ecological network. The 2019 Regulations have created a national site network (i.e European sites are now referred to as national network sites). Designated Wetlands of International Importance (known as Ramsar sites) do not form part of the national site network. Many Ramsar sites overlap with SACs and SPAs and may be designated for the same or different species and habitats. All Ramsar sites remain protected in the same way as SACs and SPAs. Similarly, the Countryside and Rights of Way (CRoW) Act 2000 provides protection to Sites of Special Scientific Interest (SSSIs) to

ensure that developments are not likely to cause damage. Locally important sites (such as National Nature Reserves (NNR), Local nature Reserves (LNR), Local Wildlife Sites (LWS) or Sites of Importance for Nature Conservation (SINCs) and Ancient Woodland (AW)) are also protected by legislation to ensure developments do not cause significant pollution. Sites of nature conservation importance at a national and local level, are provided environmental protection from the development, including from emissions to air.

A1.9. The location of the Proposed Development in relation to nearby designated ecological habitats is shown in Figure A1.

A1.10. There is one national network site within 5 km of the Proposed Development (Water End Swallow Holes SSSI) and there are three locally important ecological sites within 2 km of the Proposed Development (Hazel Grove AW, Oxleys Wood LNR and Howe Dell LNR).

A1.11. According to IAQM guidance, the need for a detailed assessment of impacts on nationally designated ecological sites can be screened out if a development, in-combination with other plans and projects, will lead to an increase in traffic generation of less than 1,000 AADT.

A1.12. The expected traffic trip generation, as set out in Section 4.2, is expected to be well below the threshold. Therefore, the impact of emissions related to the Proposed Development upon the ecological sites are considered to likely be insignificant.

Figure A1: Designated Ecological Habitats and the Proposed Development Location

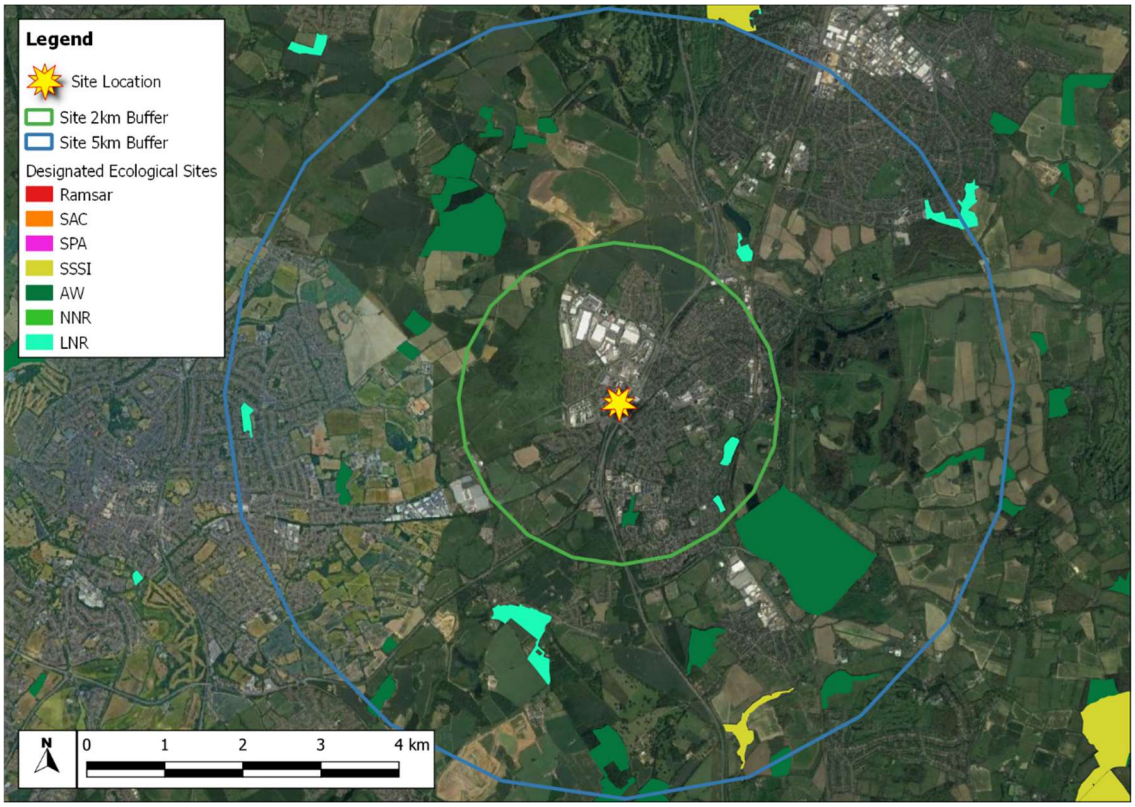

Figure notes: Imagery © 2022 Google, Map data © 2022.

Impacts of On-site Combustion Plant on the Local Area

A1.13. The Proposed Development will have its heating and hot water provided electrically; there will therefore be no significant onsite emissions associated with combustion plant and the impacts will be negligible.

A2. Legislation, Policy and Guidance

A2.1. There are a large number of policy, guidance and strategy documents published regarding air quality at a national, regional and local level. The documents all provide useful context, information and justification in support of the approaches in this assessment. Details of relevant documents are provided below.

National

Planning Practice Guidance

A2.2. The NPPF is supported by Planning Practice Guidance (PPG) (Ministry of Housing, Communities & Local Government, 2019b). The PPG on air quality published in November 2019 states:

Paragraph: 001 Reference ID: 32-001-20191101: *"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit, or where the need for emissions reductions has been identified."*

Paragraph: 002 Reference ID: 32-002-20191101: *"It is important to take into account air quality management areas, Clean Air Zones and other areas including sensitive habitats or designated sites of importance for biodiversity where there could be specific requirements or limitations on new development because of air quality".*

Paragraph: 005 Reference ID: 32-005-20191101: *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity.*

Where air quality is a relevant consideration the local planning authority may need to establish:

- *the 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality".*

Paragraph: 007 Reference ID: 32-007-20191101: *"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".*

Paragraph: 008 Reference ID: 32-008-20191101: *"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented".*

Clean Air Strategy

A2.3. Defra published the Clean Air Strategy in January 2019 (Defra, 2019a). The strategy focuses on exposure to toxic pollutants like nitrogen oxides, ammonia, particulate matter, non-methane volatile organic compounds and sulphur dioxide. The strategy aims to reduce emissions of pollutants including the aim to reduce particulate matter emissions by 30% by 2020, and by 46% by 2030.

A2.4. This strategy sets out the aim for new enforcement powers at a national and local level, across all sectors of society and sets out the comprehensive action that is required from government and society to meet these targets. The strategy includes actions to reduce emissions from transport (including road, maritime, rail, aviation and NRMM), homes, farming and industry.

A2.5. The strategy states that:

"New legislation will create a stronger and more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem".

The Industrial Strategy

A2.6. The Government has published a white paper that sets out a long-term 'Industrial Strategy' for the UK (HM Government, 2017). It includes a key policy to *"support electric vehicles through a £400m charging infrastructure investment and an extra £100m to extend the plug-in car grant*" and states "*the UK's road and rail network could dramatically reduce carbon emissions and other pollutants*". Unlike their fossil fuel counterparts, electric vehicles do not release NOx emissions; if the strategy is fulfilled then NOx emissions will reduce significantly over the coming decades.

The Clean Growth Strategy

A2.7. An ambitious blueprint for Britain's low carbon future was set out by the Government in a Policy paper (HM Government, 2018) in April 2018. Although this strategy focuses on reducing the UK's carbon footprint, it contains several policies and proposals that relate to air quality, including:

22. *"End the sale of new conventional petrol and diesel cars and vans by 2040*
23. *Spend £1 billion supporting the take-up of ultra low emission vehicles (ULEV), including helping consumers to overcome the upfront cost of an electric car*
24. *Develop one of the best electric vehicle charging networks in the world by:*

- *Investing an additional £80 million, alongside £15 million from Highways England, to support charging infrastructure deployment*
- *Taking new powers under the Automated and Electric Vehicles Bill, allowing the Government to set requirements for the provision of charging points*

25. *Accelerate the uptake of low emission taxis and buses by:*
    - *Providing £50 million for the Plug-in Taxi programme, which gives taxi drivers up to £7,500 off the purchase price of a new ULEV taxi, alongside £14 million to support 10 local areas to deliver dedicated charge points for taxis*
    - *Providing £100 million for a national programme of support for retrofitting and new low emission buses in England and Wales*
26. *Work with industry as they develop an Automotive Sector Deal to accelerate the transition to zero emission vehicles*
27. *Announce plans for the public sector to lead the way in transitioning to zero emissions vehicles*
28. *Invest £1.2 billion to make cycling and walking the natural choice for shorter journeys*
29. *Work to enable cost-effective options for shifting more freight from road to rail, including using low emission rail freight for deliveries into urban areas, with zero emission last mile deliveries*
30. *Position the UK at the forefront of research, development and demonstration of Connected and Autonomous Vehicle technologies, including through the establishment of the Centre for Connected and Autonomous Vehicles and investment of over £250 million, matched by industry The Clean Growth Strategy 15*
31. *Innovation: Invest around £841 million of public funds in innovation in low carbon transport technology and fuels including:*
    - *Ensuring the UK builds on its strengths and leads the world in the design, development and manufacture of electric batteries through investment of up to £246 million in the Faraday Challenge*
    - *Delivering trials of Heavy Goods Vehicle (HGV) platoons, which could deliver significant fuel and emissions savings".*

The 25 Year Environment Plan

A2.8. The Government has published a Policy paper called the '25 Year Environment Plan' (HM Government, 2019) which set out what the government will do to improve the environment within a generation. This includes the first goal 'Clean air' where the government states *"we will achieve clean air by:*

- *Meeting legally binding targets to reduce emissions of five damaging air pollutants. This should halve the effects of air pollution on health by 2030.*
- *Ending the sale of new conventional petrol and diesel cars and vans by 2040.*
- *Maintaining the continuous improvement in industrial emissions by building on existing good practice and the successful regulatory framework".*

Road to Zero

A2.9. The Office for Low Emission Vehicles (OLEV) and Department for Transport (DfT) published a Policy Paper (DfT, 2018) in July 2018 outlining how the government will support the transition to zero tailpipe emission road transport and reduce tailpipe emissions from conventional vehicles during the transition.

A2.10. This paper confirms the Government's pledge to end the sale of new conventional petrol and diesel cars and vans by 2040, and states that the Government expects the majority of new cars and vans sold to be 100% zero tailpipe emission and all new cars and vans to have significant zero tailpipe emission capability by 2040, and that by 2050 almost every car and van should have zero tailpipe emissions. It states that the Government wants to see at least 50%, and as many as 70%, of new car sales, and up to 40% of new van sales, being ultra-low emission by 2030.

A2.11. The paper sets out a number of measures by which Government will support this transition, but is clear that Government expects this transition to be industry and consumer led. If these ambitions are realised then road traffic-related NOx emissions can be expected to reduce significantly over the coming decades.

Air Quality Plan

A2.12. Defra has produced an Air Quality Plan to tackle roadside NO_2 concentrations in the UK (Defra, 2017). Alongside a package of national measures, the Plan requires those English Local Authorities (or the GLA in the case of London Authorities) that are predicted to have exceedances of the limit values beyond 2020 to produce local plans by December 2018. These plans are undertaken in stages and must have measures to achieve the statutory limit values within the shortest possible time, which may include the implementation of a charging Clean Air Zone (CAZ).

A3. Professional Experience

Dr Austin Cogan, MPhys (Hons) PhD CEnv MIEnvSc MIAQM

Dr Cogan is a Director and cofounder of Air Pollution Services, is a Chartered Environmentalist and has nearly 15 years' experience in environmental sciences. He has extensive experience of air quality, dust, and odour assessments, having been involved in hundreds of projects including residential and commercial developments, road schemes, airports, waste management processes, industrial processes, power generating facilities and agricultural facilities. This has included provision of expert witness services at several public inquiries and hearings. Austin has also supported many local authorities with Clean Air Zone studies (such as Bath, Bristol, Newcastle, Gateshead, North Tyneside and South Gloucestershire), Borough Plan modelling, microsimulation modelling and developing AQMAs and AQAPs. He has also contributed to multiple guidance documents, including DMRB and GLA evidence bases, and most recently IAQM's guidance on indoor air quality. Furthermore, Austin led the development of AirChecker, a bespoke air quality conveyancing search report, providing useful information on air quality to home and commercial property buyers and renters. Austin is also an international expert in the field of climate change, having monitored greenhouse gases globally. Austin gained two years' experience in scientific instrument design and spent four years' pioneering research in satellite observations of greenhouse gases and aerosols at the Space Research Centre, Leicester. Austin has worked with many international bodies, including NASA, JAXA, CNES and ESA, and published numerous scientific papers and presented at conferences both nationally and internationally. Additionally, he led the development of officially licensed quality assured observational meteorological data at APS, which is used regularly by most of the air quality and odour industry in the UK.

Thomas Wescott, BSc (Hons) AMIEnvSc AMIAQM

Mr Wescott is an Assistant Consultant at APS, with over two years' air quality, dust, and odour consultancy experience, having previously worked at ACCON UK and as a freelancer. He has significant experience working on assessment to support planning applications as well as working on some infrastructure projects. He has used a range of dispersion models, including ADMS Roads, ADMS 5, Breeze AERMOD and Breeze Roads. Thomas completed a BSc in Chemistry from Plymouth University. He is currently gaining further experience at APS of air quality and odour assessments for planning as well as learning to complete air quality assessments for environmental permitting and indoor air quality.

A4. Assessment Approach

A4.1. Standard practice is to assess the impacts of a proposed development on local air quality using the EPUK and IAQM guidance *on Land-Use Planning & Development Control: Planning For Air Quality*.

A4.2. The EPUK and IAQM guidance provides a staged approach to considering air quality assessments:

Stage 1) Initial screening

Stage 2) Detailed screening

Stage 3) Simple or Detailed assessment

A4.3. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A3.

Stage 1

Impacts of the Development on the Local Area

A4.4. Table 6.1 of the EPUK and IAQM guidance provides the Stage 1 screening criteria. The approach first considers the size and parking provision of a development; if the development is residential and is for fewer than ten homes or covers less than 0.5 ha, or is non-residential and will provide less than 1,000 m^2 of floor space or cover a site area of less than 1 ha, and will provide ten or fewer parking spaces, then there is no need to progress to a Stage 2 and in general there is no need to consider the impacts of the development on the local area.

Impacts of Emissions Sources on the Development

A4.5. The EPUK and IAQM guidance explains that there:

"may be a requirement to carry out an air quality assessment for the impacts of the local area's emissions on the proposed development itself, to assess the exposure that residents or users might experience. This will need to be a matter of judgement and should take into account:

- *the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular nitrogen dioxide), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development".*

Stage 2 Screening Criteria

A4.6. The EPUK and IAQM guidance provides example criteria and states the following in relation to the criteria:

"They are intended to function as a sensitive "trigger" for initiating an assessment in cases where there is a possibility of significant effects arising on local air quality. This possibility will, self-evidently, not be realised in many cases. The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement, bearing in mind that the objective is to identify situations where there is a possibility of a significant effect on local air quality".

A4.7. The guidance notes that consideration should still be given to the potential impacts of neighbouring sources on the site, even if an assessment of impacts of the development on the surrounding area is screened out.

Road Traffic Assessments

A4.8. The second stage of the EPUK and IAQM guidance then compares the changes in vehicle flows on local roads that a development will lead to against specified screening criteria. Where these criteria are exceeded, a detailed assessment is required, although the guidance advises that "the criteria provided are precautionary and should be treated as indicative", and "*it may be appropriate to amend them on the basis of professional judgement*".

A4.9. The criteria relating to road traffic are:

- A change of Light Duty Vehicle (LDV) flows of:
    - more than 100 AADT within or adjacent to an AQMA
    - more than 500 AADT elsewhere.
- A change of Heavy Duty Vehicle (HDV) flows of:
    - more than 25 AADT within or adjacent to an AQMA
    - more than 100 AADT elsewhere.
- Where roads are realigned near to sensitive receptors and the change in alignment is 5 m or more and the road is within an AQMA.
- Applies to junctions that cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights, or roundabouts.
- Where bus flows will change by:
    - more than 25 AADT within or adjacent to an AQMA
    - more than 100 AADT elsewhere.

Simple or Detailed Assessments

A4.10. Where an air quality assessment is identified as being required, then this may take the form of either a Simple Assessment or a Detailed Assessment. It is not uncommon for assessments to utilise detailed dispersion models to predict pollutant concentrations and impacts on local air quality (Detailed Assessment), however, it should be noted that exceeding a screening criterion in Table

6.2 of the guidance does not automatically lead to the requirement for a Detailed Assessment and the use of professional judgement and sufficient evidence can be considered appropriate at times (Simple Assessment).

A4.11. The EPUK and IAQM guidance also outlines what the content of the air quality assessment should include, and this has been adhered to in the production of this report.

Long-term (Annual Mean) Impacts on Human Health

A4.12. The approach set out in the EPUK and IAQM guidance provides a method for describing the impacts on local air quality arising from development.

A4.13. Impact descriptors for individual receptors are used which expresses the magnitude of incremental change as a proportion of a relevant assessment level and then examining this change in the context of the new total concentration and its relationship with the assessment criterion. Table A 1 sets out the matrix for determining the impact descriptor for annual mean concentrations at individual receptors, based on Table 6.3 in the EPUK and IAQM guidance document.

A4.14. Where the impacts are negligible the overall significance is judged to be 'not significant'.

Table A 1: Annual Mean Impacts Descriptors for Individual Receptors

Annual Mean Concentration with Proposed Development (µg/m³)	% Change in Concentration relative to the AQO (µg/m³)			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76-94% of AQO	Negligible	Slight	Moderate	Moderate
95-102% of AQO	Slight	Moderate	Moderate	Substantial
103-109% of AQO	Moderate	Moderate	Substantial	Substantial
75% or less of AQO	Moderate	Substantial	Substantial	Substantial
Table notes: -				

Short-term Impacts on Human Health

A4.15. Previous research carried out on behalf of Defra and the devolved administrations identified that exceedences of the 1-hour mean NO_2 AQO are unlikely to occur where the annual mean is below 60 µg/m^3 (Defra, 2021). Similarly, exceedences of the 24-hour mean PM_{10} AQO are unlikely to occur where the annual mean is below 32 µg/m^3. Where annual mean concentrations are below these levels the short-term impacts are considered negligible.

Significance

A4.16. The approach developed by EPUK and IAQM (2017) has been used. The guidance is that the assessment of significance should be based on professional judgement, with the overall air quality impact of the development described as either "significant" or "not significant".

A4.17. If none of the criteria in Stage 1 and 2 are met, then there should be no requirement to carry out an air quality assessment for the impact of the development on the local area, and the impacts can be considered as having a not significant effect.

A4.18. Where a Simple or Detailed assessment is carried out, in drawing the determination of significance, the following factors should be taken account of:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted when undertaking the prediction of impacts;
- the potential for cumulative impacts. In such circumstances, several impacts that are described as “slight” individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area, especially where it is proving difficult to reduce concentrations of a pollutant. Conversely, a “moderate” or “substantial” impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health; and
- the judgement on significance relates to the consequences of the impacts; i.e. will they have an effect on human health that could be considered as significant? In the majority of cases, the impacts from an individual development will be insufficiently large to result in measurable changes in health outcomes that could be regarded as significant by health care professionals.

A4.19. The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the users of any new development where the air quality is such that an air quality objective is not met will be judged as significant.

A5. Modelling

The model

A5.1. Parameters and data relating to the detailed dispersion modelling approach are set out below.

Vehicle Emissions

A5.2. Emissions of road-NOx (i.e. the contribution from vehicles using roads), road-PM_{10} and road-$PM_{2.5}$ have been derived from the latest version of Defra's Emission Factor Toolkit (EFT) (v11.0) using the traffic data presented in Table A1. The EFT is based on the COPERT 5 (Computer Programme to calculate Emissions from Road Transport) vehicle emission model and provides speed-average based emission rates. The EFT provides vehicle emission rates for the years 2017 – 2030; future years are based on a range of factors, such as expected vehicle fleet release dates, anticipated improvements in emission reduction technologies, expected uptake rates of different vehicles based on government policies, etc. It is therefore possible that the expected future emission rates in the EFT may differ from reality.

Car Park Emissions

A5.1. Emissions for vehicles travelling through the car parks have been derived from Defra's EFT assuming a vehicle speed of 5 kph. In addition, excess emissions from cold-starting of vehicle engines has been taken into account; these emissions have been calculated based on cold-start emission factors from Defra's EXEMPT Cold Start Tool and applied over a length of approximately 51 m. These lengths are the calculated average length over which vehicles will travel to exit the car parks.

Fraction of Primary NO_2

A5.2. In addition to emission rates, the fraction of primary NO_2 (f-NO_2) has been obtained from the EFT. This represents the amount of NO_2 released from vehicle exhausts, before any further chemical reactions in the atmosphere, which becomes an important variable when post-processing the model predictions. In order to obtain the f-NO_2 value at each receptor location, the NOx emission rates have been multiplied by f-NO_2 values to derive NO_2 emission rates. These NO_2 emissions have been included in the model and primary NO_2 concentrations have been predicted at the receptors. The predicted NOx concentrations have been divided by the predicted primary NO_2 concentrations to calculate the f-NO_2 values at the receptor locations. The f-NO_2 values have then been used in the model post-processing (see paragraph A3.35).

Time-Based Profiles

A5.3. Vehicle emissions vary over time depending on the volume of traffic, this includes hourly, daily and seasonal variations. Seasonal (monthly) and diurnal (hourly) traffic flow profiles have been taken from DfT national statistics (DfT, 2019). Both the profiles have been assumed to follow an urban traffic profile for all modelled roads. These have been used in the model to adjust the emissions for each hour of the year modelled. These profiles are shown in Figure A2 and Figure A3.

Figure A2: Urban diurnal profile for each day of the week used in the model, where the factor is the value that the average daily emissions are multiplied by in the model

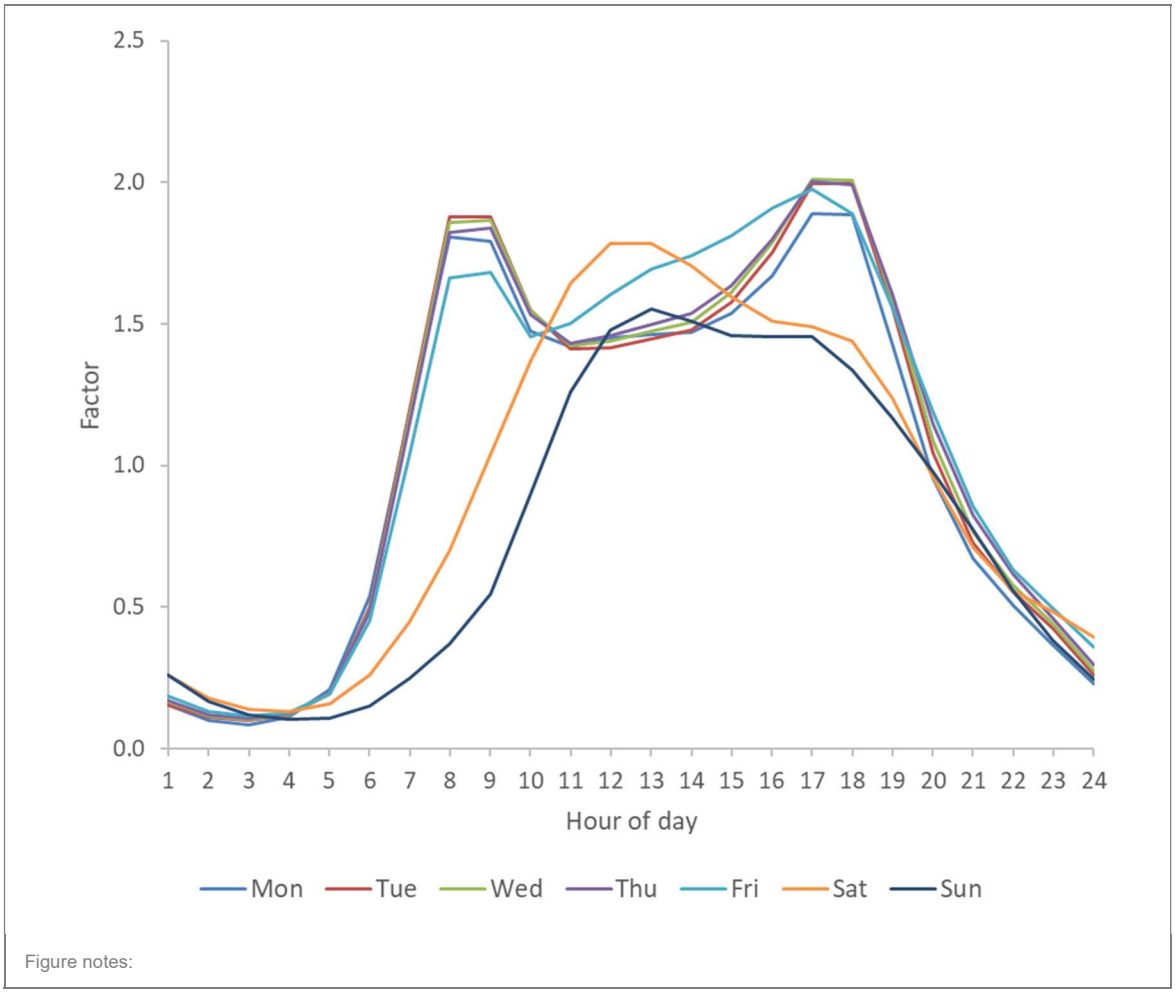

Figure notes:

Figure A3: Urban seasonal profile for each month of the year used in the model

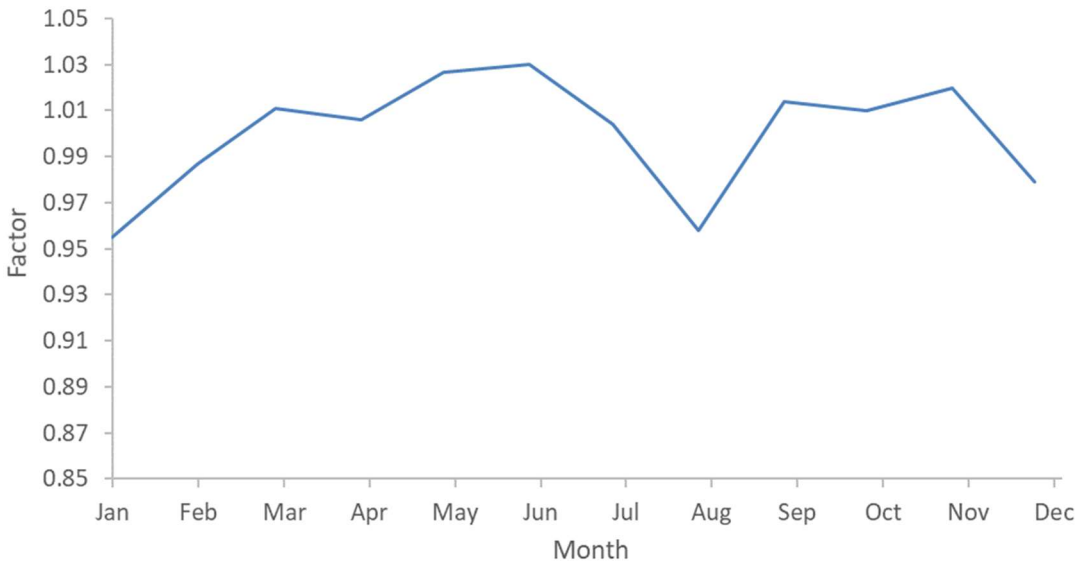

Figure notes:

Traffic Flows

Table A2: Traffic data used in the model

Link	2019		2024	
	AADT	HDV (%)	AADT [a]	HDV%
A1001 Comet Way, northbound carriageway near Site	9,250	8.4	10,056	8.3
A1001 Comet Way, southbound carriageway near Site	10,200	5.1	11,078	5.1
A1001 Comet Way, single carriageway near Diffusion Tube WH19	19,450	6.7	21,031	6.7
A1 (M) near diffusion tube WH19	96,159	6.7	103,570	6.7
A1 (M) near diffusion tube WH24	19,005	8.8	20,552	8.8
A1057, eastbound carriageway near Comet Roundabout	3,841	1.4	4,236	1.4
A1057, westbound carriageway near Comet Roundabout	3,994	1.4	4,401	1.4
A1001 Comet Way, northbound carriageway south of Comet Roundabout	10,038	10.1	10,904	10.1
A1001 Comet Way, southbound carriageway south of Comet Roundabout	8,965	7.3	9,749	7.3
B6426 Cavendish Way, eastbound carriageway	3,785	1.4	3,444	1.4
B6426 Cavendish Way, westbound carriageway	3,938	1.4	4,048	1.4

Table notes:

Wake effects

A5.4. As vehicles travel along a road a wake is left behind the vehicles as air in the path of travel is forced around the vehicle. The wake can be considered the turbulence induced by the movement of the vehicle, which affects the dispersion of pollution away from roads. The AADT traffic flows have been

entered into the ADMS-roads dispersion modeling in order to account for vehicle wake effects which will vary on each link depending on the proportion of large vehicles to small vehicles.

Street Canyons

A5.5. Roads in the local area are enclosed by buildings and vegetation, leading to restricted dispersion of pollution away from the roads and higher pollutant concentrations close to the roads. This is known as a 'street canyon' effect. The roads have therefore been modelled as asymmetric street canyons using the Advanced Street Canyon Module, within the ADMS-Roads model, accounting for the fraction of covered 'canyons'.

Meteorology

A5.6. Meteorological data has been taken from the Luton Airport Meteorological Station for the year of 2019. This meteorological station is located approximately 10.8 km east of the application site and is considered representative of meteorological conditions in Hatfield. Meteorological data for the year of 2019 is considered to provide typical conditions and was used within model as the air quality monitoring data was measured in 2019. Illustrations of wind speed and direction for 2019 and other recent years (2016, 2017, 2018, 2019 and 2020) are presented in Figure A4.

Figure A4: Windrose of wind speed and direction for each year from 2016 (lop left) to 2020 (bottom right), at the Luton Airport Meteorological Station

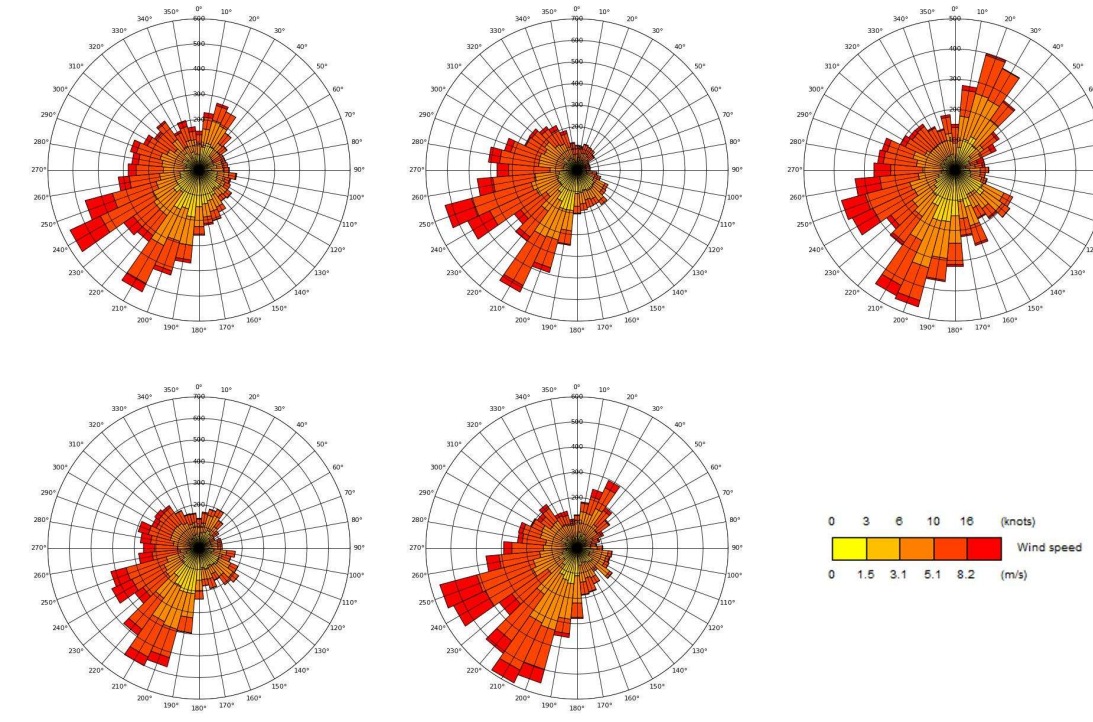

Figure notes:

Meteorological Parameters

A5.7. In addition to the meteorological data, the model requires values to be set for a number of meteorological related parameters, for both the meteorological station and the dispersion site (the

development). Details of the parameter values used in the modelling are provided in Table A3 below.

A5.8. Land-use and surface characteristics have an important influence in determining turbulent fluxes and, hence, the stability of the boundary layer and atmospheric dispersion.

A5.9. Surface roughness length used within the model represents the aerodynamic effects of surface friction and is defined as the height at which the extrapolated surface layer wind profile tends to zero. This value is an important parameter used by the built-in meteorological pre-processor of ADMS to interpret the vertical profile of wind speed and estimate friction velocities which are, in turn, used to define heat and momentum fluxes and, consequently, the degree of turbulent mixing. Surface roughness values for different land-use classifications are provided in the 2018 Corine Land Use dataset (Copernicus, 2018). Figure A5 shows the values used across the modelled domain.

Figure A6: Surface Roughness

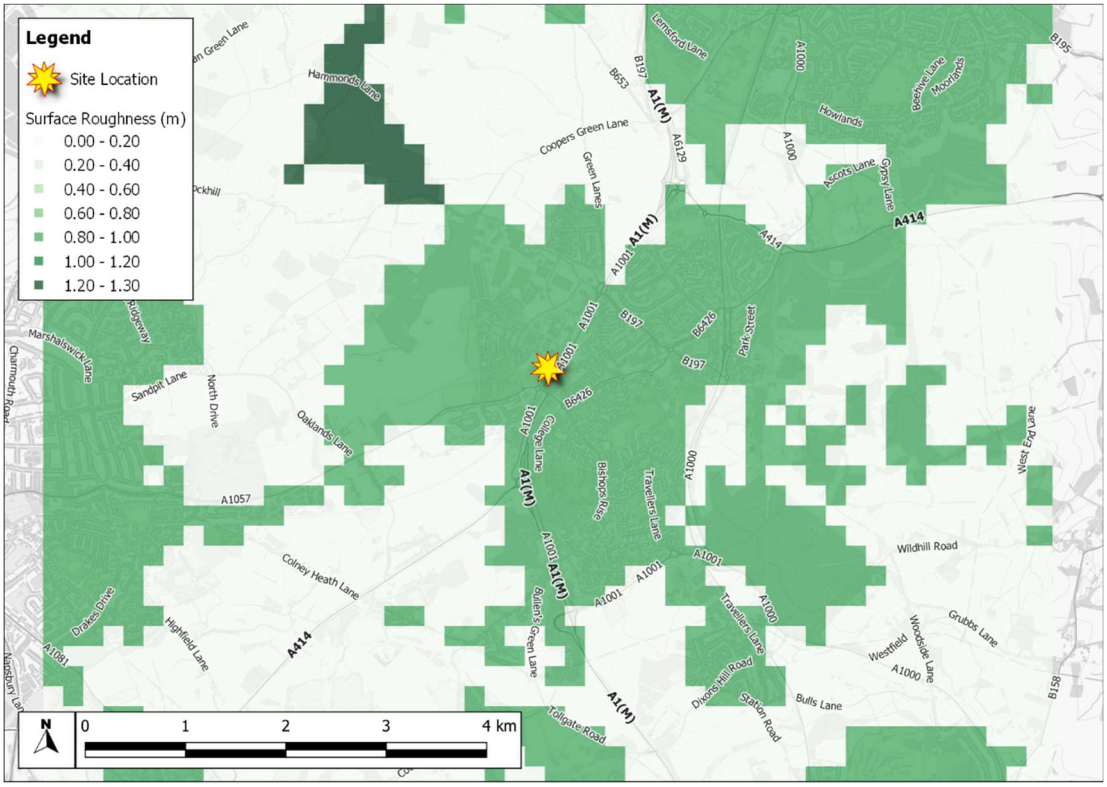

Figure notes: Contains OS data © Crown copyright and database right (2022).

A5.10. The surface albedo is the ratio of reflected to incident shortwave solar radiation at the surface of the earth. This varies depending on the land use, and thus area-weighted average albedos have been derived for the meteorological and dispersion sites and used in the models. Albedo values have been taken from US Environmental Protection Agency (EPA) guidance (2018) and associated with the different land uses in the 2018 Corine Land Use dataset (Copernicus, 2018).

A5.11. The Priestley-Taylor parameter is a parameter representing the surface moisture available for evaporation. A Priestley-Taylor parameter of 1 has been set in the model.

A5.12. The CERC user guide explains that "the Monin-Obukhov length provides a measure of the stability of the atmosphere. In very stable conditions in a rural area its value would typically be 2 to 20 m. In urban areas, there is a significant amount of heat generated from buildings and traffic, which warms the air above the town/city". For large urban areas this is known as the urban heat island. It has the effect of preventing the atmosphere from ever becoming very stable. The model has the ability to define the minimum Monin-Obukhov length to account for the urban heat island effect which is not represented by the meteorological data. This varies depending on the land use, and thus area-weighted average minimum Monin-Obukhov lengths have been derived for the meteorological and dispersion sites and used in the models.

Table A3: Meteorological parameters values used in the model

Parameter	Meteorological Site Value	Dispersion Site Value
Latitude (°)	n/a	51.7625
Surface roughness (m)	0.007	n/a
Surface albedo	0.215	0.199
Minimum Monin-Obukhov length (m)	18.58	24.591
Priestley-Taylor parameter	1	1
Table notes:		

A5.13. The meteorological parameters alter the meteorological data inputted into the model to reflect conditions at the dispersion site. For example, if the dispersion site has a higher surface roughness value than the meteorological site, then the model will reduce the wind speed at the dispersion site to reflect this. Figure A4 shows the frequency of wind speeds and directions measured at the meteorological station in 2019 (left), which has been inputted into the model, as well as the frequency of wind speeds and directions processed by the ADMS-roads model for the dispersion site (right). These illustrate that wind predominantly comes from the southwest and that the model has slightly lower wind speeds at the dispersion site.

Figure A 7: Windrose showing the frequency of wind speed and wind direction for Luton Airport Meteorological Station (Left) and the modelled dispersion site (Right) for the year of 2019

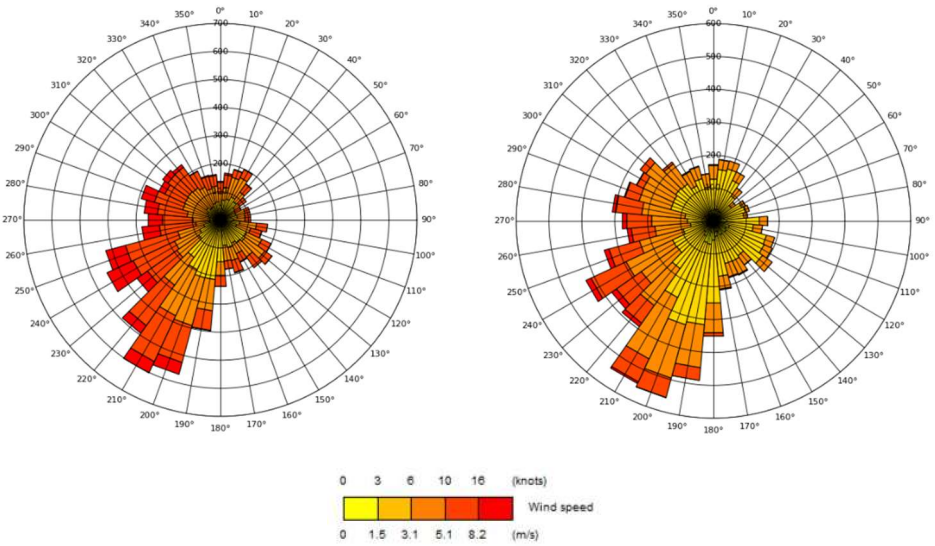

Figure notes:

Model Performance

A5.14. The modelling will inherently have some uncertainties and may not reflect real conditions in the local area. An important part of modelling is reviewing the model results carefully and checking the model setup parameters and input data to minimise uncertainties.

A5.15. LAQM.TG.16 (Defra, 2021), provides local authorities with advice on good practice for modelling air quality. This advice is widely applied for air quality assessments of proposed developments, although it is specifically aimed at local authority's duties to review and assess air quality. LAQM.TG.16 states that model verification, defined as a comparison of modelled results with monitoring results at relevant locations, is necessary (paragraph 7.520).

A5.16. There are many reasons why there may be a difference between modelled and monitored concentrations and LAQM.TG.16 states *"Model verification is the process by which these and other uncertainties are investigated and where possible minimised."* (paragraph 7.512). It provides a list of the factors that may explain the differences including meteorological data, source activity data (e.g. traffic flow and speed), emission factors, model input parameters such as roughness length, and monitoring data.

A5.17. The advice in LAQM.TG.16 is generic for all dispersion models. ADMS has been shown to predict concentrations well given sufficiently accurate data inputs.

A5.18. It is important to review the results of the modelling carefully and check the model setup parameters and input data. Once reasonable efforts have been made to reduce the uncertainties of input data for a model, further comparison of modelled and monitored results should be undertaken. Where discrepancies remain, consideration may be given to adjusting the model.

A5.19. Using good modelling techniques provides confidence that the model is performing as well as possible everywhere in the modelling area in the base year, not just at the monitoring locations. Modelling is often an iterative process of improving the model setup and evaluating the impact on model performance. The same principles need to be applied to the entire modelling study area to ensure the model performs well throughout the study area.

A5.20. All reasonable efforts have been made to improve the model inputs. The model has gone through several modelling iterations to consider whether the performance of the modelled inputs can be improved. Improvements are based on comparison with the measured concentrations at specific monitoring locations and where improvements have been made, they have been applied as a wholistic approach with systematic updates to the entire model study area to ensure that the model is not performing well exclusively at the monitoring locations. Iterations to the model include changes in streetscape, diameter of road links and examining of traffic data to improve the model performance on a wholistic approach and provide a model representative of the modelling study area.

A5.21. A final model verification exercise has been undertaken to determine whether there are any remaining discrepancies and to derive a factor with which to adjust the predicted concentrations from the model so that they match local conditions as closely as possible.

Final Model Verification

A5.22. A final model verification exercise has been undertaken, following the guidance set out by Defra in Box 7.14 and Box 7.15 of LAQM.TG(16) (Defra, 2021).

A5.23. Concentrations of road-NOx and primary NO_2 have been predicted for the year of 2019 using the ADMS-roads dispersion model at the two most relevant passive monitoring sites in WHBC. Predictions have been made at the heights of the monitor inlets.

NO_2

A5.24. Initially, the measured NO_2 concentrations at the monitoring sites have been inputted into Defra's NOx to NO_2 Calculator, along with the background NO_2 concentrations and f-NO_2 values, in order to obtain 'measured' road-NOx concentrations at the monitoring sites. The primary NO_2 emission factor (f-NO_2) at each monitoring site was calculated by taking the ratio of predicted primary NO_2 concentration to predicted road-NOx concentration.

A5.25. The predicted road-NOx concentrations have been compared to the 'measured' road-NOx concentrations and NO_x factor calculated for both monitors, see Table A4. Note that monitor WH7 was also modelled as part of the verification exercise but as there were additional sources of road pollution nearby (mainly a surface car park) that couldn't be taken account of, due to a lack of available data, it wasn't possible to produce a reasonable verification factor at this location.

Table A4: Measured and Modelled NOx Comparison

Monitor	Measured NO_2	Background NO_2	Predicted f-NO_2	Measured Road-NOx	Modelled Road-NOx	NOx Factor
WH24	36.0	17.6	0.27	34.8	34.8	2.553
WH19	42.0	17.6	0.28	52.9	52.9	2.271
Table notes:						

A5.26. Table A4 demonstrates that the model is underpredicting at both monitoring sites to a similar degree. The model verification has been based upon both monitoring sites in Table A4. The comparison of predicted road-NOx concentrations to 'measured' road-NOx concentrations is presented in Figure A 7. An adjustment factor of 2.356 has been derived from the equation of the linear trend line that has been fitted through zero. The calculated NOx adjustment factor has been applied to all predicted road-NOx concentrations to uplift the values to broadly match those measured at the monitoring sites. This is illustrated in Figure A8, which shows a comparison of the measured NO_2 concentrations and the total (i.e. road plus background) predicted NO_2 concentrations. Statistics of this comparison are given in Table A 5, which demonstrate that the predicted NO_2 concentrations have an insignificant fractional bias (~0) and an acceptable root mean square error (RMSE <10).

Figure A8: Comparison of predicted NOx to 'measured' road-NOx

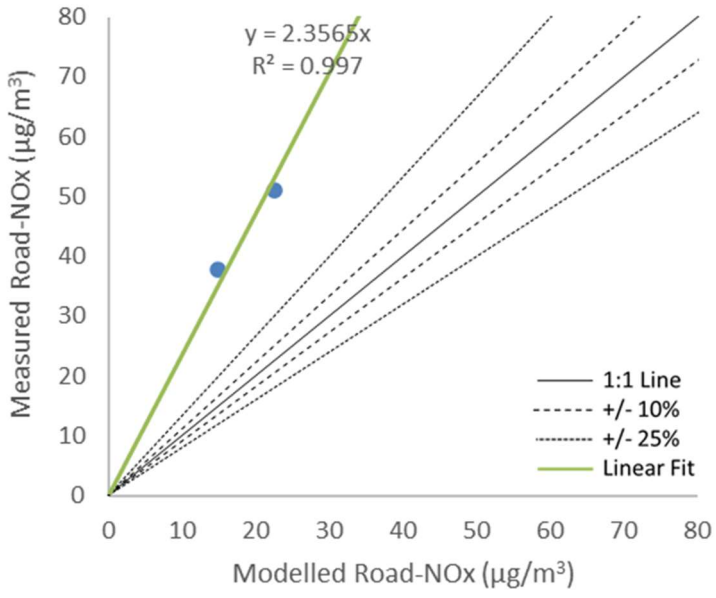

Figure notes:

Figure A9: Comparison of predicted NO_2 to measured NO_2

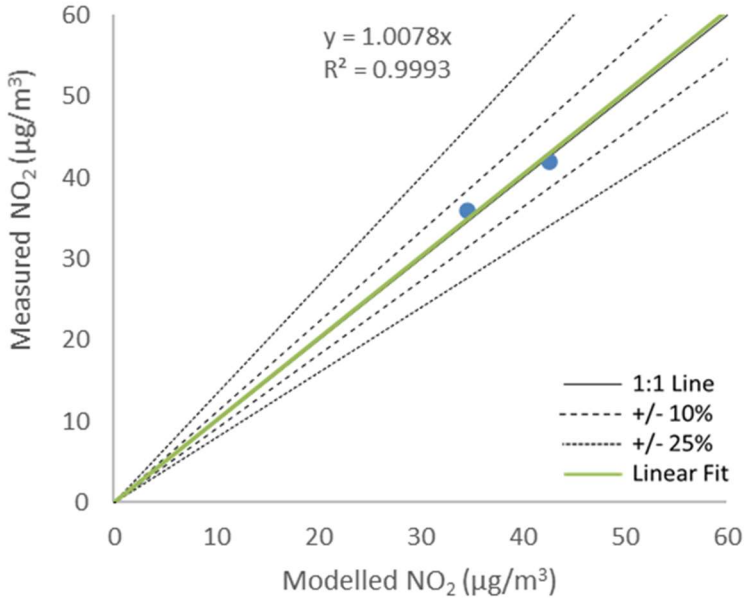

Figure notes:

Table A 5: Model Verification Statistics

Statistic	NO_2
Correlation Coefficient (r) [a]	1.008
Root Mean Squared Error (RMSE) [b]	1.109
Fractional Bias (FB) [c]	0.011

Table Notes:

a This is used to measure the linear relationship between predicted and measured concentrations. A value of zero means no relationship and a value of 1 means absolute relationship (ideal value).

b RMSE is used to define the average error or uncertainty in the model. The ideal value for NO_2 is zero, and a value within 10% of the objective (i.e., 4 µg/m³) is general acceptable although models should always be improved where possible even where the value is less than 10% of the objective. If the value is greater than 25% of the objective (i.e., 10 µg/m³) then it is recommended that the model be revisited (this only applies to NO_2).

c This is used to identify if the model shows a systematic tendency to over or under predict. FB values range between -2 and +2 and has an ideal value of zero. Negative values indicate a model over-prediction and positive values indicate a model under-prediction.

PM_{10} and $PM_{2.5}$

A5.27. WHBC do not operate any monitoring sites that measure roadside concentrations of PM_{10} or $PM_{2.5}$ in close proximity to the Proposed Development. In the absence of relevant monitoring sites with which to verify the model predictions of PM against, the model adjustment factor for road-NOx has been used to uplift all predicted road-PM concentrations.

Post Processing

A5.28. Concentrations of road-NOx and primary NO_2 have been predicted at each receptor using the ADMS-Roads model. The primary NO_2 emission factor (f-NO_2) at each receptor has been calculated by taking the ratio of predicted primary NO_2 concentration to road-NOx concentration.

A5.29. The f-NO_2 values along with the adjusted modelled road-NOx concentrations and background NO_2 concentrations have been inputted into Defra's NOx to NO_2 calculator (v8.1) in order to obtain predicted road-NO_2 concentrations at each receptor. This tool has been run assuming the traffic is described as 'All other Urban UK traffic', which is considered appropriate for the traffic associated within the local area. It should be noted, however, that receptor specific f-NO_2 values have been used in the NOx to NO_2 calculator, which supersede the traffic selection.

A5.30. The road-NO_2 concentrations have then been added to the background NO_2 concentrations to obtain total NO_2 concentrations at the receptors. Similarly, the adjusted road-PM_{10} and road-$PM_{2.5}$ concentrations have been added to the background PM_{10} and $PM_{2.5}$ concentrations to obtain total PM_{10} and $PM_{2.5}$ concentrations at the receptors.

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