

199-203 Henley Road & land to the rear of
205-207 Henley Road, Caversham RG4 6LJ

**Air Quality Assessment for
the proposed care home
development at 199-203
Henley Road and land to the
rear of 205-207 Henley Road,
Caversham, RG4 6LJ**

**Report to Signature Senior
Lifestyle Developments Ltd.**

Title	Air Quality Assessment for the proposed care home development at 199-203 Henley Road and land to the rear of 205-207 Henley Road, Caversham, RG4 6LJ
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1 Introduction

Aether has been commissioned by Signature Senior Lifestyle Developments Ltd. to undertake an air quality assessment for the proposed care home development at Henley Road, Caversham, Reading. The development will consist of the demolition of existing structures and redevelopment to form a care home (Class C2), communal and ancillary facilities, associated parking and landscaping. 41 car parking spaces will be provided with the development and air pollutant emitting on-site energy generation will be included.

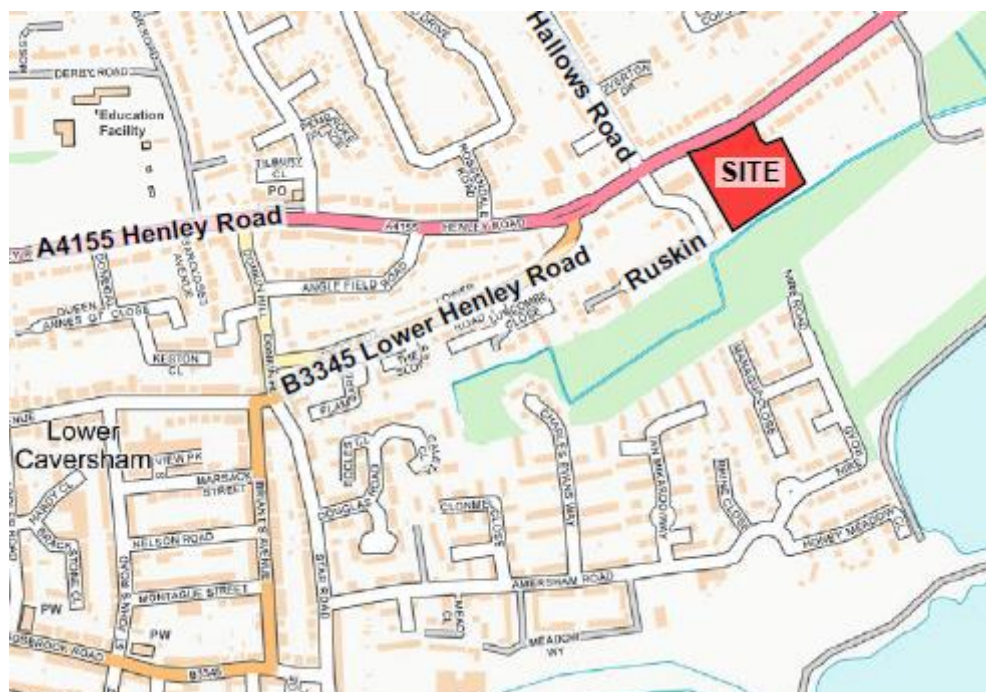
The development falls within Reading Borough Council, which suffers from elevated levels of air pollution, primarily due to high levels of traffic. It is therefore important to assess whether there will be an exceedance of the air quality objectives for particulate matter (PM₁₀) or nitrogen dioxide (NO₂) at the proposed site and then advise whether any action is required to reduce the residents' exposure to air pollution. The assessment utilises ADMS-Roads, a comprehensive dispersion modelling tool for investigating air pollution problems due to small networks of roads and industrial sources.

The expected completion date of the proposed development is 2021. The assessment has therefore been completed for 2022, the expected first full year of occupation.

1.1 The Location of the Development

The proposed development is located at 199-203 Henley Road and land to the rear of 205-207 Henley Road, Caversham RG4 6LJ (**Figure 1**).

Figure 1: Location of the development site



1.2 Assessment Criteria

A summary of the air quality objectives relevant to the Henley Road, Caversham development, as set out in the UK Air Quality Strategy¹, is presented in **Table 1** below.

Table 1: UK Air Quality Objectives for NO₂ and PM₁₀

Pollutant	Concentration	Measured as
Nitrogen Dioxide (NO ₂)	40 µg/m ³	Annual mean
	200 µg/m ³	Hourly mean not to be exceeded more than 18 times per year (99.8th percentile)
Particulate Matter (PM ₁₀)	40 µg/m ³	Annual mean
	50 µg/m ³	24 hour mean not to be exceeded more than 35 times a year (90.4th percentile)

The oxides of nitrogen (NO_x) comprise principally of nitric oxide (NO) and nitrogen dioxide (NO₂). NO₂ is a reddish brown gas (at sufficiently high concentrations) and occurs as a result of the oxidation of NO, which in turn originates from the combination of atmospheric nitrogen and oxygen during combustion processes. NO₂ can also form in the atmosphere due to a chemical reaction between NO and ozone (O₃). Health based standards for NO_x generally relate to NO₂, where acute and long-term exposure may adversely affect the respiratory system.

Particulate matter is a term used to describe all suspended solid matter, sometimes referred to as Total Suspended Particulate matter (TSP). Sources of particles in the air include road transport, power stations, quarrying, mining and agriculture. Chemical processes in the atmosphere can also lead to the formation of particles. Particulate matter with an aerodynamic diameter of less than 10 µm is the subject of health concerns because of its ability to penetrate deep within the lungs and is known in its abbreviated form as PM₁₀.

Further information on the health effects of air pollution can be found in the reports produced by the Committee on the Medical Effects of Air Pollutants².

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

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

Using these definitions, the annual mean objectives will apply at locations where members of the public might be regularly exposed such as building façades of residential properties, schools and hospitals and will not apply at the building façades of offices or other places of work, where members of the public do not have regular access. The 24 hour objective will apply at all locations where the annual mean objective would apply together with hotels. Therefore, in this assessment the annual mean and 24 hour mean objectives will apply at all floors of the care home development. The hourly objective will apply at all locations where members of the public could reasonably be expected to

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007), Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland

² <https://www.gov.uk/government/collections/comeap-reports>

spend that amount of time. Therefore, in this assessment the hourly objective will also apply at all levels of the development.

1.3 Local Air Quality Management

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

Reading Borough Council has declared one AQMA³ covering Reading Town Centre, areas along the major aerial radial routes into Reading and along the main railway lines which pass through built-up areas. The AQMA was declared due to exceedances of the annual and hourly mean nitrogen dioxide (NO₂) objectives. An AQAP was published in 2009, which includes some specific measures such as increased numbers of public transport journeys, walking and cycling trips, and the development of Park and Ride schemes⁴.

1.4 The ADMS-Roads Method

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

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

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

The most recent version of ADMS-Roads (v4.1.1) was issued in January 2018 and requires the following information to assess the impact at sensitive receptor locations:

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

³ https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=201

⁴ https://uk-air.defra.gov.uk/assets/documents/no2ten/Local_zone16_Reading_AQActionplan_1.pdf

2 Methodology

2.1 Local Pollutant Concentrations

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

2.1.1 Local monitoring data

Reading Borough Council has four automatic monitoring sites which monitor nitrogen dioxide (NO₂) and particulate matter (PM₁₀). NO₂ concentrations are also measured passively at diffusion tube sites across the Borough. One of the automatic sites, and three of the diffusion tube sites lie within 2000 m of the development site. Details of these monitoring sites are given in **Table 2**.

Monitoring results have been taken from the Council's latest Annual Status Report (ASR)⁵.

Table 2: Monitoring sites within 2000 m of the Henley Road, Caversham, Reading development

Site Name	Site Type	Pollutant(s)	Grid Reference	Distance to Kerb (m)	Approx. Distance to development site (m)
RD4*	R	NO ₂ , PM ₁₀	473703, 173409	3.5	1,930
DT57 45 Prospect Street	R	NO ₂	471558, 174919	1	1,530
DT60 241 Gosbrook Road	R	NO ₂	471942, 174600	6.0	1,280
DT59 60 Prospect Street	R	NO ₂	471557, 174944	3.0	1,530

*Note: R = roadside, * automatic monitor*

The diffusion tubes were analysed by Gradko International Ltd, who participate in the Proficiency scheme⁶. Whilst diffusion tubes provide an indicative estimate of pollutant concentrations, they tend to under or over read. The data is therefore corrected using a bias adjustment factor. There are two types of bias adjustment factor – local and national. The local factor is derived from co-locating diffusion tubes (usually in triplicate) with automatic monitors, whereas the national factor is obtained from the average bias from all local authorities using the same laboratory. Reading Borough Council has applied a national bias adjustment factor (0.97) to their 2017 diffusion tube results.

Monitoring results are presented in **Table 3**. The data shows that the annual mean NO₂ objective was not exceeded at any of the monitoring sites between 2015 and 2017, although concentrations were within 10% of the objective level at site DT57 in all three years. There were no exceedances of the hourly mean NO₂ objective between 2015 and 2017 at the RD4 automatic monitor; and with 18 exceedances allowed per year, the hourly objective was met. Diffusion tubes do not provide information on hourly

⁵ Not yet publicly available.

⁶ This is a national QA/QC scheme.

exceedances, but research⁷ identified a relationship between the annual and 1 hour mean objective, such that exceedances of the latter were considered unlikely where the annual mean was below 60 µg/m³. Therefore, no exceedances of the hourly mean objectives are expected at the diffusion tube monitoring sites.

There were also no recorded exceedances of the annual or daily mean PM₁₀ objectives at the RD4 automatic monitoring site.

Table 3: Monitoring results for sites within 2 km of the proposed development site, 2015-2017

Objective	Site Name	2015	2016	2017
Annual mean NO ₂ (µg/ m ³)	RD4*	-	32	28
	DT57 45 Prospect Street	39	38	37
Annual mean NO ₂ (µg/ m ³)	DT60 241 Gosbrook Road	35	35	34
Annual mean NO ₂ (µg/m ³)	DT59 60 Prospect Street	35	34	33
Hourly mean NO ₂ (no. exceedances)	RD4*	0	0	0
Annual mean PM ₁₀ (µg/ m ³)	RD4*	0	13	18
Daily mean PM ₁₀ (no. exceedances)	RD4*	0	2	3

Note: * automatic monitor

2.1.2 Background mapped data

Background pollutant concentration maps are available from the Defra LAQM website⁸ and data has been extracted for Reading and South Oxfordshire for this assessment. These 2015 baseline, 1 kilometre grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

The estimated mapped background NO_x, NO₂ and PM₁₀ concentrations around the development site are 21.1 µg/m³, 15.1 µg/m³ and 14.4 µg/m³ respectively in 2017. For 2022 (the estimated first full year of occupation), the concentrations obtained for the same pollutants are 17.3 µg/m³, 12.6 µg/m³ and 14.1 µg/m³ respectively.

Due to the lack of a nearby urban background monitoring site, the 2017 mapped background concentrations have been used in this assessment. To provide a conservative estimate with regards to expected improvements in air quality, the projected improvements in background air quality by 2022 have not been used in the dispersion modelling. This is in line with best practise to apply worst-case assumptions.

⁷ As described in Box 5.2 of LAQM Technical Guidance (TG16).

⁸ <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>

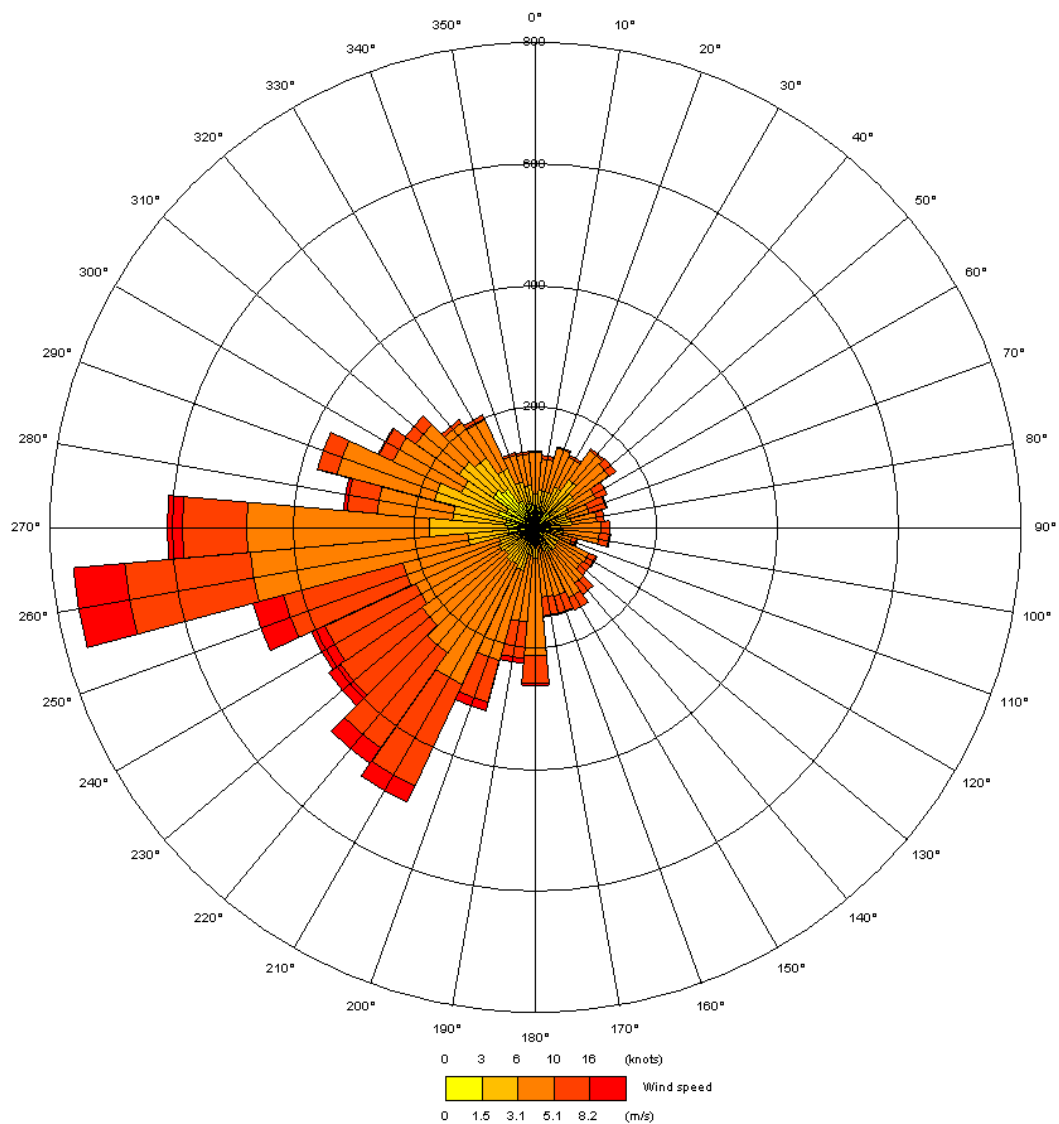
2.2 Energy Centre

The proposed development includes the installation of a gas-fired CHP unit. All plant emissions are in line with best practice guidelines and therefore meet the BREEAM Ultra-Low NO_x emission standards (< 40 mg NO_x/kWh)⁹. The NO_x emission rate for the unit was calculated to be 0.0003 g/s and as a result, can be assumed to have negligible impact on local air quality.

2.3 Model input data

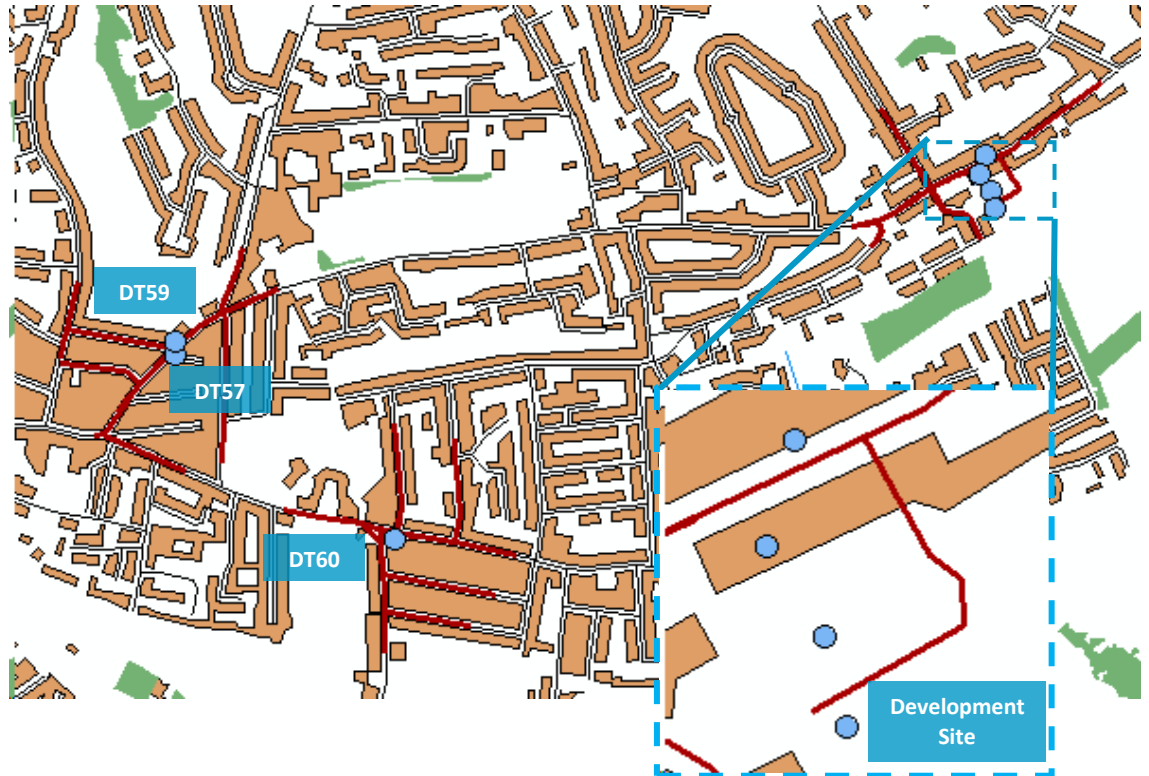
Hourly meteorological data from Heathrow for 2017 has been used in the model. The wind-rose diagram (**Figure 2**) presents this below.

Figure 2: Wind-rose diagram for Heathrow meteorological data, 2017



⁹ 15 KWe unit planned, XRG1 15 model, data provided by Michael Cottle, Harniss Consulting

Figure 3: Road sources and receptors



Contains Ordnance Survey data © Crown copyright and database right [2019]

ArcMap software has been used to model the road source locations (red lines) that are within 200 metres of the receptor locations (blue circles). This data can then be automatically uploaded to ADMS-Roads. This generates an accurate representation of the surrounding area to be assessed in the model in terms of the length of roads and distances between sources and receptors. This is shown in **Figure 3** above. It is assumed that the contribution of other sources to NO₂ and PM₁₀ is included in the background concentrations.

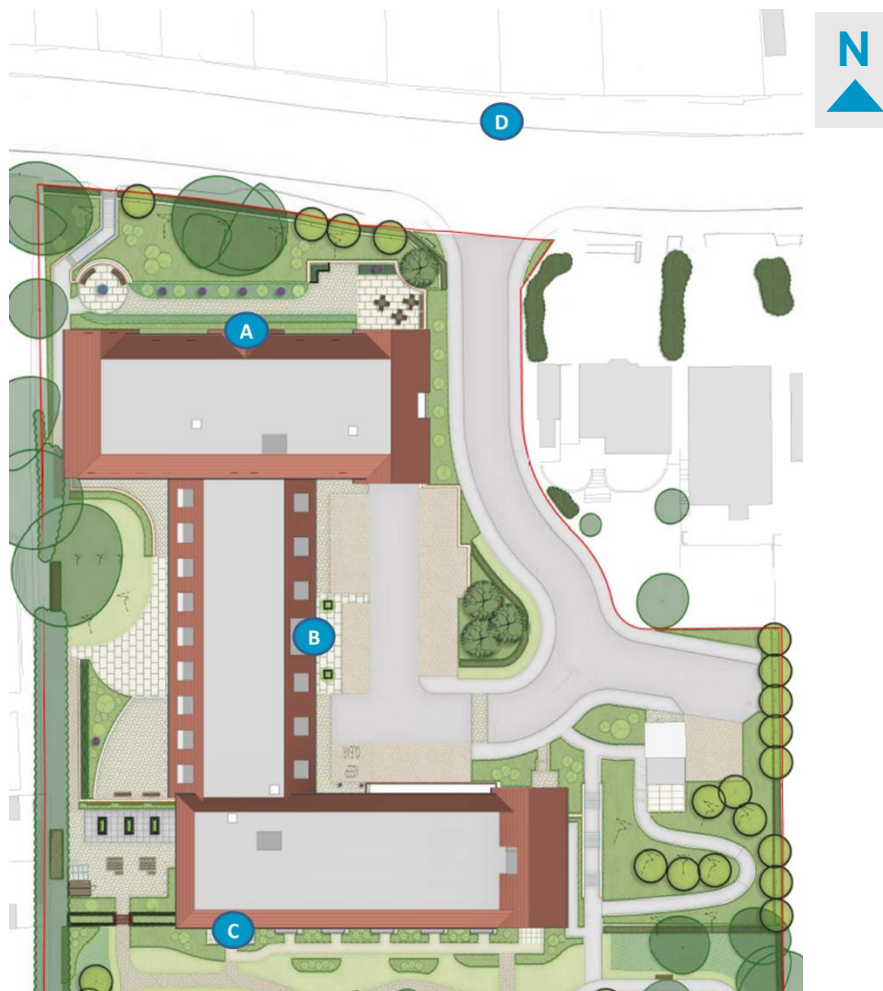
Four sensitive receptor locations have been selected for the assessment:

- A – North facing façade of the development, section of the development located closest to Henley Road.
- B – East facing façade of the development, the entrance to the development.
- C – South facing façade of the development, representing the drop off in pollutant concentrations with distance from the road.
- D – Opposite the development, located roadside on Henley Road, measuring the impact to local residents of increase in traffic flows.

These sites have been chosen to reflect the extremities of the site and their proximity to road traffic sources. The architect's plans (**Figure 4**) show the development site in more detail with receptor locations highlighted (blue circles). An assessment is made for the

receptors at varying heights to assess likely concentrations across floor levels. It has been assumed that background concentrations remain constant at all heights of the development based on the 2017 City Air Quality at Height report¹⁰. Exposure has been assumed to be represented at the mid-point of each floor.

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



¹⁰ <http://www.wsp-pb.com/PageFilesn/80156/WSPPB%20City%20Air%20Quality%20at%20Height.pdf>

2.4 Traffic data

Average annual daily traffic (AADT) count data for 2017 (the selected baseline year) has been obtained for A4155 from Department for Transport (DfT) Traffic Counts¹¹, which provides data for major roads. In the absence of any other data being available for the minor roads, estimates are based upon average values for an 'urban minor road, South East' from the DfT National Road Traffic Survey, 2018¹². Therefore there will be uncertainty in the model input. All roads within 200 metres of the modelled receptors have been included in the assessment. The values are shown in Appendix B.

For the purpose of this assessment, the RTF¹³ model has been utilised to project traffic growth. It has been assumed that traffic on local roads will increase by 6.5 % between 2017 and 2022.

The Transport Assessment¹⁴ concludes that the development will result in a maximum of 192 additional daily vehicular trips. The resulting estimated increase in daily car trips has been taken into account in the assessment for roads with direct access to the site with development in 192. Results (Section 3 of this report) therefore refer to concentrations modelled in 2022 both without and with the proposed development.

An average speed of 25.4 kph has been assumed on all surrounding roads, which is the average traffic speed for local 'A' roads in Reading¹⁵. This provides a worst-case scenario, as it is the slowest time period reported, resulting in highest exhaust emissions. In the absence of any other data being available, average speeds on local minor roads have been assumed based on the speed limit.

2.4.1 Queuing Traffic

Special consideration has been given to the junctions between Henley Road (A4155), Lower Henley Road (B3345) and All Hallows Road. CERC note 60¹⁶ has been used for estimating emissions from queuing traffic. This defines a representative AADT for queuing traffic to be 30,000 at 5 kph, assuming an average vehicle length of 4 m. These figures, along with the traffic composition of the corresponding roads were then input into the Emission Factor Toolkit (EFT)¹⁷ to calculate emission rates. The emission rates were then used within the dispersion model as separate road sources of pre-defined length, representing each queue with time-varying emission profiles applied to represent busy periods.

2.5 Conversion of NO_x to NO₂

¹¹ <http://www.dft.gov.uk/traffic-counts>

¹² <http://www.dft.gov.uk/statistics/series/traffic/>

¹³ <http://laqm.defra.gov.uk/documents/RTF-Automated-Traffic-Growth-Calculator-v3-1.xls>

¹⁴ Transport Statement conducted by PEP Transport Planning and Highway Consultants

¹⁵ <https://www.gov.uk/government/collections/road-congestion-and-reliability-statistics>

¹⁶ Cambridge Environmental Research Consultants Ltd, Modelling Queuing Traffic – note 60, 20th August 2004

¹⁷ Latest version 8.0, <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>

Recent evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹⁸. This means that the relationship between NO_x and NO₂ at the roadside has changed from that currently used in the ADMS model. A NO_x to NO₂ calculator (Published in October 2017)¹⁹ has therefore been developed and has been used in conjunction with the ADMS model to obtain a more accurate picture of NO₂ concentrations.

2.6 Model Verification

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

In the case of NO₂, the model should be verified for NO_x as the initial step and should be carried out separately for the background contribution and the source (i.e. road traffic). Once the NO_x has been verified and adjusted as necessary, a final check should be made against the measured NO₂ concentration.

For this project, modelled annual mean road-NO_x estimates have been verified against the concentrations measured at the three diffusion tube sites (see **Appendix A**). These were selected as they were the closest monitoring stations to the proposed development site.

The adjustment factor determined for annual mean NO_x concentrations was also applied to the modelled annual mean PM₁₀ concentrations. This was done as no PM₁₀ monitoring data that is representative of the development site is available, and this approach was considered more appropriate than not applying any adjustment²⁰.

¹⁸ <http://uk-air.defra.gov.uk/assets/documents/reports/ageg/primary-no-trends.pdf>

¹⁹ <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>

²⁰ Paragraph 7.529 of LAQM TG(16)

3 Results

3.1 Results of the Dispersion Modelling

Table 4 below provides the estimated pollutant concentrations in the development year (2022) without and with²¹ the development. Given the inherent uncertainties in the modelling, background pollutant concentrations and vehicle fleet emission factors have been maintained at 2017 levels in the development year scenarios to provide a conservative estimate with regards to expected improvements to air quality. This is in line with best practise to apply worst-case assumptions. Traffic growth has been predicted using the RTF calculator.

²¹ 'With' development includes the impact of the additional traffic that will be generated with the development (see Section 2).

Table 4: Estimated pollutant concentrations in 2022 without and with the development ($\mu\text{g}/\text{m}^3$)

Floor level	Receptor	Annual mean NO ₂ concentration ($\mu\text{g} / \text{m}^3$)		Annual mean PM ₁₀ concentration ($\mu\text{g} / \text{m}^3$)		NO ₂ Change	PM ₁₀ change
Floor level	Receptor	Without development	With development	Without development	With development	NO ₂ Change	PM ₁₀ change
G	A	21.2	21.3	15.1	15.1	<0.1	<0.1
G	B	18.4	18.5	14.8	14.8	<0.1	<0.1
G	C	17.8	17.9	14.7	14.7	<0.1	<0.1
G	D	20.7	20.7	15.1	15.1	<0.1	<0.1
1	A	20.3	20.4	15.0	15.0	<0.1	<0.1
1	B	18.2	18.2	14.7	14.7	<0.1	<0.1
1	C	17.6	17.6	14.7	14.7	<0.1	<0.1
2	A	19.1	19.1	14.8	14.8	<0.1	<0.1
2	B	17.8	17.8	14.7	14.7	<0.1	<0.1
2	C	17.2	17.3	14.6	14.6	<0.1	<0.1
3	A	17.9	17.9	14.7	14.7	<0.1	<0.1
3	B	17.3	17.3	14.6	14.6	<0.1	<0.1
3	C	16.9	16.9	14.6	14.6	<0.1	<0.1

Note: The changes in NO₂ and PM₁₀ presented may not exactly equal the difference in the constituent parts shown due to rounding.

In the without development scenario, the model predicts annual mean NO₂ concentrations to be below (by 47 %) the annual mean objective at all locations. The worst-case location is identified as receptor A (ground floor). This receptor is located close to Henley Road, and the junction with All Hallows Road, where roadside concentrations will be maximised.

The estimated annual mean NO₂ concentrations at the development site are reasonable when compared to the data collected at the diffusion tube monitoring sites. These sites are located on junctions and as a result would be expected to be exposed to queuing traffic and idling traffic. In addition, the development is set back from the road by 5 – 10 m and pollutant concentrations are expected to drop off with distance from the road. Therefore, it is reasonable that the diffusion tubes have recorded higher levels of pollutant concentrations than those modelled across the development site.

The Guidance states that authorities may assume exceedances of the hourly mean objective are only likely to occur where annual mean concentrations are 60 µg/m³ or above. Therefore, it is considered highly unlikely that this objective will be exceeded at any of the receptors.

The model has also been run for a with development scenario taking into account predicted increases to traffic levels due to the development. The results indicate that annual mean NO₂ concentrations would change by < 0.1 µg/ m³ at worst-case locations.

The model estimates no exceedance against the annual mean PM₁₀ objective. Potential exceedances of the daily mean PM₁₀ objective can be estimated based on the annual mean²², such that:

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

On this basis, it is estimated that in 2022 there will be no exceedances of the daily mean PM₁₀ limit value, regardless of whether the development takes place or not. Therefore, the daily mean PM₁₀ objective would be met as 35 exceedances of limit value are allowed per year.

3.2 Significance

Professional judgement is an important part of the assessment of significance. However, there are various documents available that attempt to qualitatively or quantitatively provide ways of assessing the significance of a development on air quality. The most commonly applied is Environmental Protection UK's Air Quality Guidance Document²³ which outlines how impacts may be assessed quantitatively. The assessment is made up of two steps – firstly to assess the magnitude of change in concentration (e.g. between with and without development) relative to the objective level, and secondly the percentage above/below the objective based upon the total modelled concentration at a given location or receptor. By combining these two values, you can obtain the impact descriptor. This method is presented in **Table 5** below.

²² Paragraph 7.92 of LAQM TG(16)

²³ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

Table 5: Significance of change description

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

In addition to the criteria provided above, the Guidance document states that the table is intended to be used by rounding the change in percentage pollutant concentrations to whole numbers. Changes of 0 % i.e. less than 0.5 % are described as negligible.

The long term average concentration at the ground floor receptor A in the assessment year is 47% of the Air Quality Assessment Level (AQAL) and the change in concentration relative to the AQAL is 0 %.

In applying these criteria, it can be concluded that there is likely to be negligible impact on local annual mean NO₂ concentrations.

However, this is a fairly simplistic conclusion and other factors may also need to be considered in order to make transparent conclusions. Specific factors to consider may include:

1. Number of properties affected by the slight, moderate or major impacts and a judgement of the overall balance
2. Where new exposure is being introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant
3. The magnitude of the changes and descriptions of the impacts at the receptors
4. Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased
5. Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced
6. Uncertainty, including the extent to which worst case assumptions have been made
7. The extent to which an objective or limit value is exceeded, for example an annual mean of 41 µg/m³ should attract less significance than an annual mean of 51 µg/m³.

In this case, none of the above criteria are of significance, suggesting that there will be no concerns in terms of exposure to harmful pollutant concentrations across the study area.

3.3 Mitigation Measures

Based on the ADMS results, there is no specific requirement for mitigation. However, it is widely acknowledged that there is no safe level of exposure to air pollution²⁴, and as

²⁴ <https://www.rcplondon.ac.uk/projects/outputs/every-breath-we-take-lifelong-impact-air-pollution>

such, the developer is encouraged to consider further mitigation measures to reduce emissions arising from the site. The National Planning Policy Framework²⁵, requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments “should ensure that appropriate opportunities to promote sustainable transport can be – or have been taken up”. It states that developments should be located and designed where practical to:

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

Building on the NPPF, the Institute of Air Quality Management (IAQM) has provided guidance on the principles of good practice²⁶ which should be applied to all major development²⁷. Examples of good practice include:

- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floor space. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made.
- Where the development generates significant additional traffic, a detailed travel plan should be implemented.
- All gas-fired CHP plant to meet a minimum emissions standard of:
 - Spark ignition engine: 250 mg NO_x/Nm³
 - Compression ignition engine: 400 mg NO_x/Nm³
 - Gas turbine: 50 mg NO_x/Nm³

3.4 Mitigating the Impacts of the Construction Phase

Emissions and dust from the construction phase of a development can have a significant impact on local air quality. IAQM has produced a document titled ‘Guidance on the assessment of dust from demolition and construction’²⁸ published in May 2015. This guidance contains a methodology for determining the significance of construction developments on local air quality using a simple four step process:

- STEP 1: Screen the requirement for a more detailed assessment
- STEP 2: Assess the risk of dust impacts
- STEP 3: Determine any required site-specific mitigation

²⁵ <https://www.gov.uk/government/publications/national-planning-policy-framework--2> Published in July 2018

²⁶ <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>

²⁷ Major developments can be defined as developments where:

The number of dwellings is 10 or above

The residential development is carried out on a site of more than 0.5ha where the number of dwellings is unknown

The provision of more than 1000 m² commercial floor space

Development carried out on land of 1ha or more

Developments which introduce new exposure into an area of existing poor air quality (e.g. an AQMA) should also be considered in this context.

²⁸ <http://iaqm.co.uk/guidance/>

➤ STEP 4: Define post mitigation effects and their significance.

The risk of dust emissions from a demolition/construction site causing loss of amenity and/or ecological impacts is related to a number of factors, including: the activities being undertaken; the duration of these activities; the size of the site; the mitigation measures implemented and meteorological conditions. In addition, the proximity of receptors to the site and the sensitivity of these receptors to dust, impacts the level of risk from dust emissions. Receptors include both 'human receptors' and 'ecological receptors'. The former refers to a location where a person or property may experience adverse effects for airborne dust or dust soiling, or exposure to PM₁₀, over a time period relevant to the air quality objectives (see **Table 1**). Ecological receptors are defined as any sensitive habitat affected by dust soiling, through both direct and indirect effects. Following assessment of the impacts of dust as a result of the development, a qualitative risk impact level can be assigned, ranging from 'negligible' to 'high risk'. Based on the designated risk impact level, the mitigation measures which are appropriate for all sites and are applicable specifically to demolition, earthworks, construction and trackout can be determined. Examples of the general measures include:

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
- Ensure all vehicles switch off engines when stationary – no idling vehicles
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable
- Ensure all loads entering and leaving the site are covered
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation

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

4 Summary and Conclusions

An air quality assessment has been undertaken for a proposed care home development at 199-203 Henley Road and land to the rear of 205-207 Henley Road, Caversham, RG4 6LJ. Reading Borough Council has declared one Air Quality Management Area (AQMA) due to the exceedance of the annual mean nitrogen dioxide (NO₂) objective. The proposed development falls within the AQMA.

A conservative approach with regards to expected improvements to air quality has been taken in that no improvement in the pollutant background concentrations or road transport emission factors has been assumed between the base year (2017) and the first year of occupation (2022). With expected improvements to the traffic fleet, improvements in pollutant concentrations may however materialise. This is in line with best practise to apply worst-case assumptions.

The ADMS-Roads dispersion model to determine the impact of emissions from road traffic on sensitive receptors. Predicted concentrations have been compared with the air quality objectives. The results of the assessment indicate that annual mean NO₂ concentrations are below the objective in the 'without' development scenario. Concentrations of particulate matter (PM₁₀) are also predicted to be below the annual mean objective in the 'without' development scenario. Based on the evidence it is estimated that there will be no exceedances of either short term objective for NO₂ or PM₁₀. The 'with' development scenario predicts that the development will cause NO₂ and PM₁₀ concentrations to change by < 0.1. Therefore, no mitigation is required as the air quality objectives are predicted to be met and the development impact on local air quality is estimated to be "negligible". Instead, other measures such as providing secure and covered cycle storage, car share schemes, and installing electric charging point(s), should be considered to reduce the emissions arising from the development. In addition, the developer is encouraged to refer to the IAQM's 'Guidance on the assessment of dust from demolition and construction' in order to minimise the impact of the construction phase on local air quality.

Appendix A – Model Verification

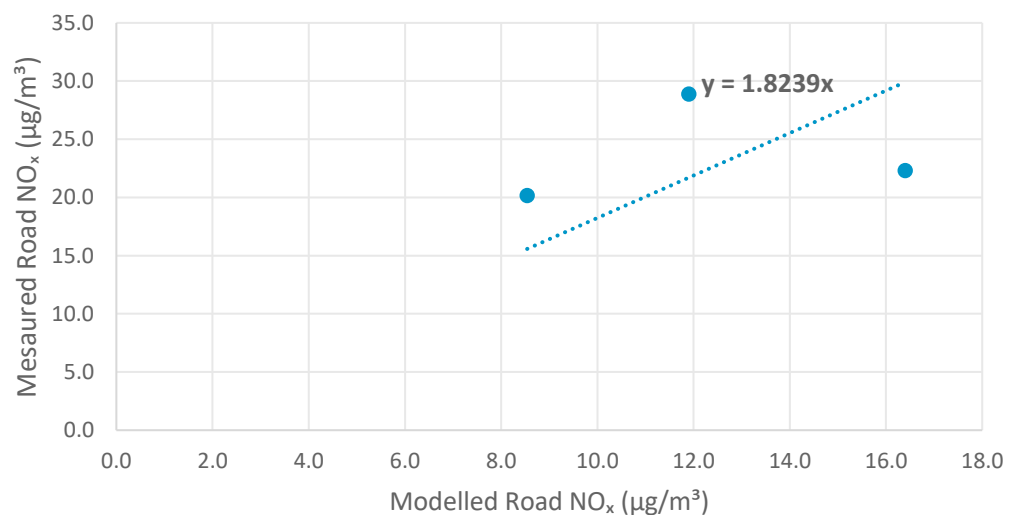
In order to verify modelled pollutant concentrations generated in the assessment, the model has been run to predict the annual mean road-NO_x concentration during 2017 at the three diffusion tube sites described in **Table 2**.

The model output of road-NO_x has been compared with the ‘measured’ road-NO_x. Measured NO_x for the monitoring sites was calculated using the NO_x to NO₂ calculator.

A primary adjustment factor was determined to convert between the ‘measured’ road contribution and the model derived road contribution (**Figure A.1**). This factor was then applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. Total NO₂ concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the 2017 background NO₂ concentration.

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

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



RMSE

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

NO₂: 5.8

If the RMSE values are higher than ±25 % of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. In this case the model is being assessed against the annual mean objective, which is 40 µg/ m³ for NO₂. An RMSE value of less than 10 µg/ m³ is obtained and therefore the model behaviour is acceptable.

Appendix B – Traffic Data

Table B.1: Traffic data for 2017 (and prediction for 2022 without development)

Development/ verification site	Road links	Annual Average Daily Traffic (AADT)	% Heavy Duty Vehicles (HDV)	Speed (kph)
Development site	A4155	9,897 (10,537)	2.5	25
Development site	Minor Roads	2,300 (2,449)	2.0	48

Note: With development results in an average daily traffic increase of 192 vehicles on all roads that have direct access to the site.



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