



Air Quality Assessment	
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1 Introduction

1.1. Proposed Development

- 1.1.1 Air Quality Assessments Ltd (AQA) has been commissioned by Luxgrove Capital Partners to undertake an air quality assessment for the proposed residential development of the first and second floor at 533 Oxford Road, Reading, RG30 1HJ. The proposed development will retain a 2-bed flat on the second floor and convert the first floor to two 2-bed flats.
- 1.1.2 Reading Borough Council has declared Reading Town Centre and the major radial routes into Reading an Air Quality Management Area (AQMA) for exceedances of the annual mean nitrogen dioxide (NO₂) objective and the application site lies within this area.

1.2. Scope of Assessment

- 1.2.1 The proposed development does not have any car parking spaces and will not increase traffic on the local road network; therefore, there will not be any air quality impacts on existing local receptors.
- 1.2.2 The new residential properties will be subject to the impacts of road traffic emissions from the adjacent road network. The main air pollutants of concern related to traffic emissions are nitrogen dioxide (NO₂) and fine particulate matter (PM₁₀ and PM_{2.5}).
- 1.2.3 The assessment has been prepared taking into account all relevant local and national guidance and regulations.
- 1.2.4 The references and a glossary of common air quality terminology used in this assessment are shown in **Section 10** and **Section 11** respectively.

2 Air Quality Legislation and Policy

2.1. EU Limit Values

- 2.1.1 The European Union's Directive on ambient air quality and cleaner air for Europe (European Parliament, Council of the European Union, 2008) set legally binding limit values for NO₂, PM₁₀ and PM_{2.5}. The Air Quality Standards Regulations 2010 (The Stationary Office, 2010) implement the EU Directive limit values in English legislation. Achievement of the limit values is a national obligation rather than a local one.
- 2.1.2 The limit values are the same as the objective values (see **Table 1**); however, the compliance dates differ, and the limit values apply at all locations (apart from where the public does not have access, where health and safety at work provisions apply and on the road carriageway). The PM₁₀ and NO₂ limit value applied from 2005 and 2010 respectively, whereas the PM_{2.5} limit value applied from 2015.
- 2.1.3 The United Kingdom left the European Union on 31st January 2020; however, EU legislation will continue to operate in UK law during the transition period, which will last until the end of December 2020.

2.2. Clean Air Strategy

- 2.2.1 Part IV of The Environment Act 1995 required the UK Government to prepare an Air Quality Strategy which includes standards and objectives for air quality and sets out measures which are to be taken by local authorities and the government in order to achieve those objectives. The Clean Air Strategy provides an overview of the actions that the government will take to improve air quality and promises new legislation that will tackle air pollution (Defra, 2019).
- 2.2.2 Standards are the concentrations of pollutants in the atmosphere, below which there is a minimum risk of health effects or ecosystem damage; they are set with regard to scientific and medical evidence. Objectives are the policy targets set by the Government, taking account of economic efficiency, practicability, technical feasibility and timescale, where the standards are expected to be achieved by a certain date.
- 2.2.3 Part IV of the Environment Act 1995 also describes the system of Local Air Quality Management (LAQM), which requires every local authority to carry out regular review and assessments of air quality in its area. Where an objective has not been, or is unlikely to be achieved, the local authority must declare an AQMA, and prepare an action plan which sets out appropriate measures to be introduced in pursuit of the objectives.
- 2.2.4 The objectives for NO₂ and PM₁₀, as prescribed by the Air Quality (England) Regulations 2000 and the Air Quality (England) (Amendment) Regulations 2002 (The Stationary Office, 2000; The Stationary Office, 2002), are shown in **Table 1**. The objectives for PM₁₀ and NO₂ were to have been achieved by 2004 and 2005 respectively, and continue to apply in all future years thereafter. The PM_{2.5} objective, also shown in **Table 1**, is to be achieved by 2020; however, although local authorities in London have a flexible role in working towards reducing emissions and concentrations of PM_{2.5}, there is no obligation for local authorities to try to meet the PM_{2.5} objective, and it is not included in the Regulations.

Table 1: The Objectives for NO₂, PM₁₀ and PM_{2.5}

Pollutant	Concentration Measured As	Objective
NO₂	1-hour Mean	200 µg/m ³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m ³
PM₁₀	24-hour Mean	50 µg/m ³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m ³
PM_{2.5}	Annual Mean	25 µg/m ³

2.2.5 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed for a period of time appropriate to the averaging period of the objective. Examples of where the objectives should apply are provided in the Local Air Quality Management Technical Guidance (Defra, 2016) issued by the Department for Environment, Food and Rural Affairs (Defra). The annual mean NO₂ and PM₁₀ objectives should apply at the building façades of residential properties, schools, hospitals, care homes etc.; they should not apply at the building façades of places of work, hotels, gardens or kerbside sites. The 24-hour mean PM₁₀ objective should apply at all locations where the annual mean objective applies, as well as the gardens of residential properties and hotels. The 1-hour mean NO₂ objective should apply at all locations where the annual and 24-hour mean objectives apply, as well as at kerbside sites where the public have regular access, e.g. the pavements of busy shopping streets.

2.3. Planning Policy

National Policies and Guidance

2.3.1 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied (Ministry of Housing, Communities & Local Government, 2019). It provides a framework within which locally-prepared plans for development can be produced. It states that the purpose of the planning system is to contribute to the achievement of sustainable development and includes an overarching environmental objective:

"to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.3.2 The NPPF states that:

"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."

2.3.3 With specific reference to air quality, the NPPF states that:

"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."

2.3.4 The NPPF goes on to say that:

"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."

2.3.5 The NPPF is supported by Planning Practice Guidance (PPG) (DCLG, 2019). The PPG states that:

"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 relevant Limit Values. It is important that the potential impact of new development on air quality is taken into account 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."

2.3.6 The PPG goes on to state that:

"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."

2.3.7 The PPG also sets out the information that may be required in an air quality assessment, stating that:

"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."

- 2.3.8 It also provides guidance on options for mitigating air quality impacts, and makes clear that:

“Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact.”

Local Policies

- 2.3.9 The Reading Local Plan includes Policy EN15: Air Quality, which states (Reading Borough Council, 2019a):

“Development should have regard to the need to improve air quality and reduce the effects of poor air quality.

i. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

- *Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would worsen air quality;*
- *Whether the development is within, or accessed via, an Air Quality Management Area; and*
- *Whether it can be demonstrated that a local worsening in air quality that would not detrimentally affect human health or the environment would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.*

ii. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application. If there are significant detrimental effects that cannot be mitigated, the application should be refused.

iii. Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring.”

Air Quality Action Plan

- 2.3.10 Reading Borough Council has developed a Clean Air Action Plan for the AQMA (Reading Borough Council, 2016). The Action Plan sets out measures that the council intends to implement in order to help meet the objectives.

3 Methodology

3.1. Existing Conditions

3.1.1 Information on existing air quality within the study area has been collated from the following sources:

- The results of monitoring and the LAQM review and assessment reports undertaken by Reading Borough Council (Reading Borough Council, 2019b);
- Maps of roadside concentrations published by Defra, to identify current exceedances of the annual mean NO₂ EU limit value (Defra, 2020a)¹; and
- Background pollutant concentration maps published by Defra (Defra, 2020b). These cover the whole country on a 1 x 1 km grid.

3.2. Road Traffic Impacts

Modelling Methodology

3.2.1 Concentrations have been predicted using the ADMS Roads (v4.1.1.0) dispersion model. The model requires the input of a range of data, details of which are provided in **Appendix A1**.

Sensitive Locations

3.2.2 Receptors have been identified at the façade of the proposed development where the impact from existing sources is likely to be greatest and where there will be relevant exposure. The receptors are described in **Table 2** and are shown in **Figure 1**. Concentrations have been modelled at receptor heights of 4.5m and 7.5m to represent exposure at the first and second floor level. No residential use is proposed on the ground floor and there will be no relevant exposure at this level.

Table 2: Description of Receptors

Receptor	Location	x	y	z
R1	Development Façade	469505.81	173680.4	4.5 & 7.5
R2	Development Façade	469509.56	173678.9	4.5 & 7.5
R3	Development Façade	469513.31	173677.3	4.5 & 7.5

¹ There are no exceedances of the PM₁₀ limit values.

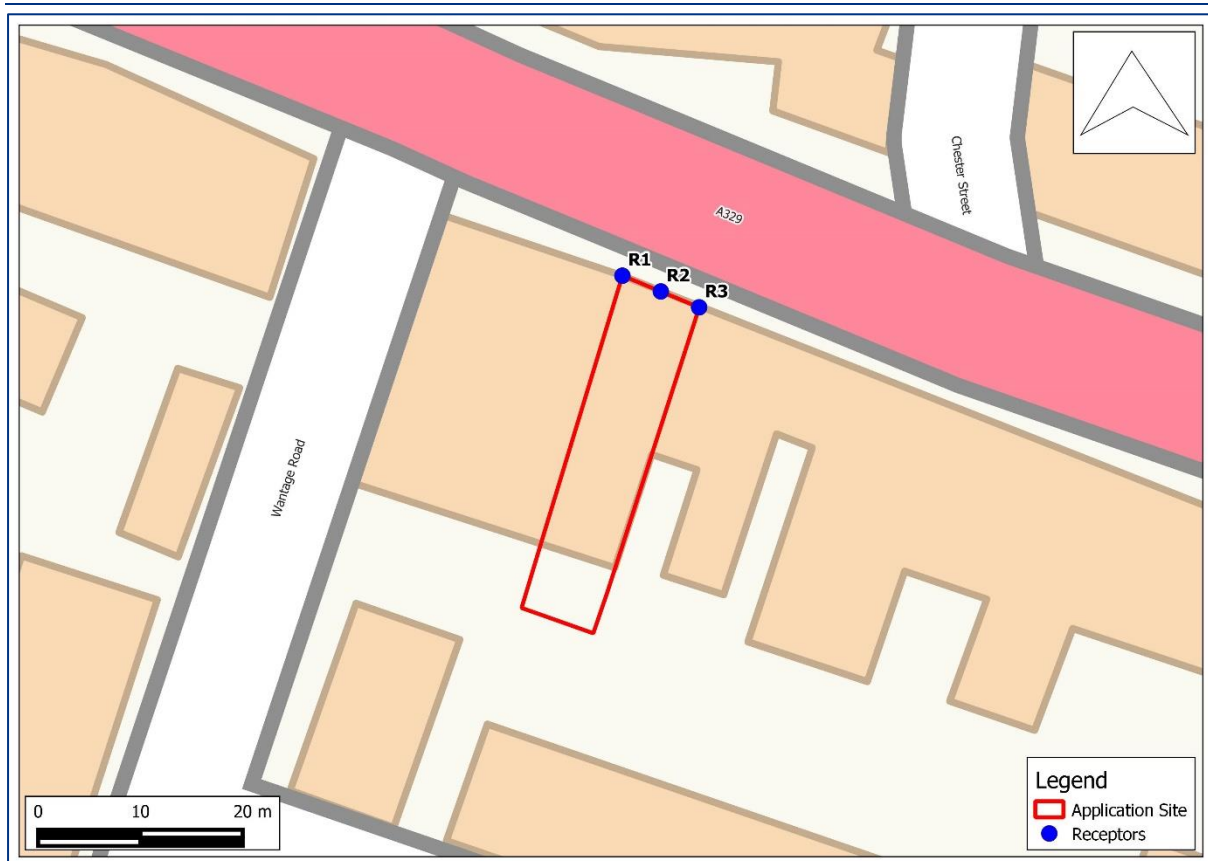


Figure 1: Location of Receptors

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Assessment Scenarios

- 3.2.3 Concentrations of NO₂, PM₁₀ and PM_{2.5} have been predicted at the receptors assuming an opening year of 2020.
- 3.2.4 Concentrations have also been predicted at automatic monitoring site RD3 and diffusion tube monitoring sites DT24, DT25, DT28, DT30 and DT32 in 2018 in order to verify the model (see **Appendix A1**).

3.3. Uncertainty

- 3.3.1 There are many factors that contribute to uncertainty when predicting pollutant concentrations. The emission factors utilised in the air quality model are dependent on traffic data, which have inherent uncertainties associated with them. There are also uncertainties associated with the model itself, which simplifies real world conditions into a series of algorithms. The model verification process, as described in **Appendix A1**, minimises the uncertainties; however, future year predictions use projected traffic data, emissions data, and background concentrations. The most recent emission factors and background data published by Defra have been used in this assessment.
- 3.3.2 Past analysis has shown a disparity between historical monitoring data and the projected background concentrations published by Defra (Carslaw, et al., 2011). This disparity is believed to have arisen due to the actual on-road performance of diesel

vehicles when compared with emissions calculations based on the Euro standards and published in the Emissions Factor Toolkit (EFT) used for modelling. Air Quality Consultants Ltd (AQC) historically produced the Calculator Using Realistic Emissions for Diesels (CURED) tool that applied adjustments to diesel emission factors from the EFT to account for the possible underprediction of future emissions (AQC, 2018).

- 3.3.3 Recent research has identified a significant reduction in roadside NO_x concentrations in recent years (AQC, 2020a). Analysis of annual mean NO_x concentrations at roadside monitoring sites, adjusted to remove inter-year differences due to meteorology, show an overall decrease of 6.4µg/m³/yr between 2013 and 2019, with an even greater rate of reduction between 2016 and 2019.
- 3.3.4 AQC have compared the scale of reductions in NO_x emissions predicted by the latest version of the EFT (v9.0) with the reductions observed at roadside monitoring sites (AQC, 2020b). At an average site in the UK, the EFT is likely to under-predict the rate at which NO_x emissions fall in the near future. Therefore, provided a dispersion model is verified against measurements made in 2016, or later, the use of EFT emissions will result in the most likely, or even conservative, future predicted NO_x concentrations.
- 3.3.5 AQC consider that there is little value in continuing to use, or update, the CURED tool. Based on the evidence in the reports published by AQC, it is not considered necessary to undertake a sensitivity analysis with regard to future emissions.

3.4. Assessment Criteria and Significance

- 3.4.1 There is no official guidance in the UK on how to describe air quality impacts, nor how to assess their significance. The approach suggested by Environmental Protection UK (EPUK) and the IAQM in guidance on Land-Use Planning & Development Control: Planning for Air Quality (EPUK and IAQM, 2017) has been used for this assessment.
- 3.4.2 A predicted exceedance of an air quality assessment level (AQAL) will be considered as significant, unless provision is made to reduce the exposure by some other means. Predicted concentrations below the AQALs will be considered as insignificant. The AQALs for NO₂ and PM_{2.5} are based on the annual mean objectives (as shown in **Table 1**). The AQAL for PM₁₀ is an annual mean concentration of 32 µg/m³ as measured data show that the 24-hour PM₁₀ objective could be exceeded where annual mean concentrations are above 32 µg/m³ (Defra, 2016).
- 3.4.3 The determination of the significance of the effects includes elements of professional judgement and the professional experience of the consultant preparing the report is set out in **Appendix A2**.

4 Baseline Conditions

4.1. EU Limit Values

- 4.1.1 There are no AURN monitoring sites within the study area. Oxford Road is included in modelling undertaken by Defra and an annual mean NO₂ concentration of 29.3/μm³ has been predicted adjacent to the application site in 2018; therefore, the EU limit value is achieved.

4.2. LAQM Review and Assessment

- 4.2.1 Reading Borough Council has declared Reading Town Centre and the major radial routes into Reading an Air Quality Management Area (AQMA) for exceedances of the annual mean NO₂ objective.

4.3. Local Air Quality Monitoring

- 4.3.1 Reading Borough Council currently operates four automatic monitoring sites, with one of these sites located on Oxford Road approximately 950m to the west of the application site. Reading Borough Council also operates a number of diffusion tube monitoring sites and data from sites within 1km of the application site are presented. The monitoring locations are shown in **Figure 1**, and data are provided in **Table 3**, **Table 4** and **Table 5**.
- 4.3.2 Annual mean roadside NO₂ concentrations have exceeded the objective at diffusion tube monitoring sites DT24, DT25, DT30 and DT32. Annual mean NO₂ concentrations at monitoring sites within 1km of the application site ranged from 28 to 55 μg/m³ between 2014 and 2018. The data shows a decreasing trend in annual mean NO₂ concentrations from 2014 to 2018 and the objective was exceeded at just two sites in 2018, DT25 and DT32. Annual mean NO₂ concentrations at monitoring sites within 1km of the application site ranged from 28 to 47 μg/m³ in 2018.
- 4.3.3 No exceedances of the 1-hour mean objective have been measured at the Oxford Road automatic monitoring site between 2014 and 2018. .
- 4.3.4 Annual mean and 24-hour mean roadside PM₁₀ concentrations have remained below the objectives in all years between 2014 and 2018 at the Oxford Road automatic monitoring site.

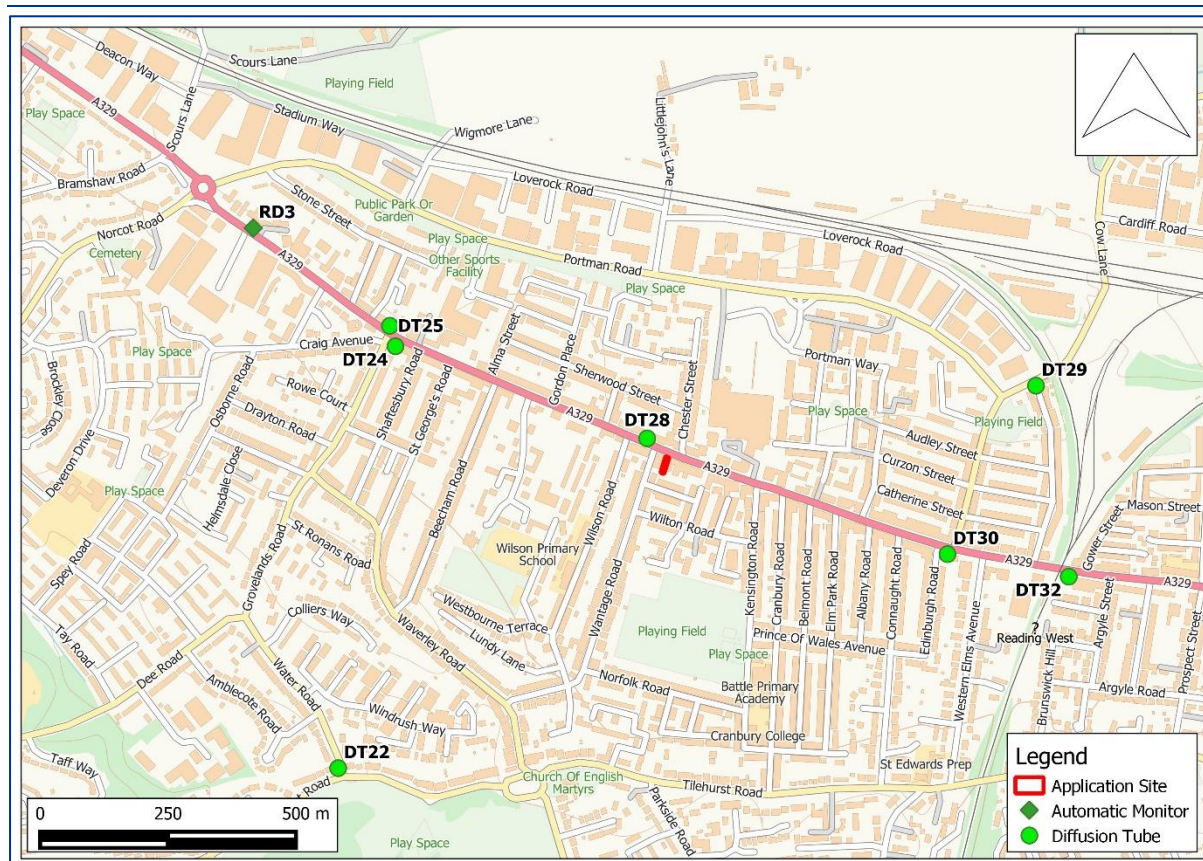


Figure 2: Air Quality Monitoring Sites

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Table 3: Measured Annual Mean NO₂ Concentrations (2014 to 2018) ^a

Site ID	Location	Site Type	Annual Mean (µg/m ³)				
			2014	2015	2016	2017	2018
RD3	Oxford Rd	R	35	31	30	28	28
DT22	Tilehurst Rd/Water Rd	R	37	34	32	32	31
DT24	689 Oxford Rd	R	45	40	40	41	37
DT25	744 Oxford Rd	R	55	47	46	42	47
DT28	494 Oxford Rd	R	38	35	37	32	35
DT29	Cow Lane Bridges	R	37	31	32	33	29
DT30	327 Oxford Rd	R	49	43	40	40	39
DT32	281 Oxford Rd	R	48	45	44	45	42
Objective			40				

^a Exceedences are shown in bold. R = roadside.

Table 4: Exceedence Statistics for the 1-hour Mean NO₂ Objective (2014 to 2018) ^a

Site ID	Location	Site Type	Number of Hours > 200 µg/m ³				
			2014	2015	2016	2017	2018
RD3	Oxford Rd	R	0	0	0	1	0
Objective			18				

a R = roadside.

Table 5: Summary of PM₁₀ Monitoring Data (2014 to 2018) ^a

Table 3: Summary of PM ₁₀ Monitoring Data (2014 to 2018)							
Site ID	Location	Site Type	2014	2015	2016	2017	2018
Annual Mean (µg/m ³)							
RD3	Oxford Rd	R	20	23	22	21	23
Objective			40				
Number of Days > 50 µg/m ³							
RD3	Oxford Rd	R	3	7	3	8	2
Objective			35				

a R = roadside.

4.4. Background Concentrations

4.4.1 Estimated background concentrations at the application site are shown in **Table 6**. The background concentrations have been derived from data in the national maps published by Defra. The background concentrations are all well below the objectives.

Table 6: Estimated Annual Mean Background Concentrations in 2018 and 2020 (µg/m³)

Year	NO _x	NO ₂	PM ₁₀	PM _{2.5}
2018	24.9	17.1	16.2	11.7
2020	22.6	15.7	15.8	11.3
Objective	-	40	40	25

5 Road Traffic Impacts

5.1.1 Predicted concentrations of NO₂, PM_{2.5} PM₁₀ at the first and second floor façade of the proposed development are shown in **Table 7**. Annual mean concentrations are predicted to be well below the AQALs at all of the receptors; therefore, air quality at the proposed development will be acceptable.

Table 7: Predicted Impacts on the Proposed Development in 2020

Receptor	Annual Mean (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}
First Floor (4.5m) ^a			
R1	25.1	19.3	13.4
R2	24.9	19.3	13.4
R3	24.7	19.3	13.4
Second Floor (7.5m) ^a			
R1	19.7	17.3	12.2
R2	19.7	17.3	12.2
R3	19.7	17.4	12.2
AQAL	40	32	25

^a There is no relevant exposure at the ground floor level.

6 Mitigation

- 6.1.1 The assessment has demonstrated that the scheme will not introduce receptors into an area where the objectives are exceeded. Mitigation 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. Therefore, as pollutant concentrations at the façade of the proposed development would be expected to decrease into the future, it is not considered appropriate to propose further mitigation measures for this scheme.

7 Residual Impacts

- 7.1.1 The residual impacts will be the same as those identified in **Section** Error! Reference source not found..

8 Conclusions

- 8.1.1 The impacts on air quality at the proposed development due to emissions from the local road network have been shown to be acceptable, with predicted concentrations being below the air quality objectives.
- 8.1.2 The operational air quality impacts on the development are judged to be insignificant. This professional judgement takes account of the conclusion that no residents of the proposed development will be exposed to exceedances of the objectives.
- 8.1.3 There should be no constraints to the development with regard to air quality, as the proposed development is consistent with the relevant parts of:
 - The NPPF; and
 - Policy EN15 of the Reading Local Plan.

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10 Glossary

AQAL	Air quality assessment level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
Defra	Department for Environment, Food and Rural Affairs
EPUK	Environmental Protection UK
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
µg/m³	Microgrammes per cubic metre
NO	Nitric oxide
NO₂	Nitrogen dioxide
NO_x	Nitrogen oxides (taken to be NO ₂ + NO)
NPPF	National Planning Policy Framework
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides
PM₁₀	Small airborne particles, more specifically particulate matter less than 10 micrometres in aerodynamic diameter
PM_{2.5}	Small airborne particles less than 2.5 micrometres in aerodynamic diameter
SPG	Supplementary Planning Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal

11 Appendices

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A1 Modelling Methodology

A1.1. Traffic Data

A1.1.1 The AADT flows and the vehicle fleet composition data have been determined using data from the interactive web-based map provided by the Department for Transport (DfT) (DfT, 2019a). The traffic flows have been factored forward to the assessment year (2021) using the TEMPRO System v7.2b (DfT, 2019b). Traffic speeds have been estimated based on the speed limits, reduced to 20km/h within 25m of a junction stop line. The traffic data are shown in **Table A1**. The modelled road network is shown in **Figure 3**.

A1.1.2 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by the DfT (DfT, 2019c).

Table A1: Summary of Traffic Data used in the Assessment

Road Link	DfT Count Point	AADT		Fleet Composition (%) ^a					
		2018	2020	Car	LGV	Rigid HGV	Artic HGV	Bus	MC
Oxford Rd (A329)	6924	13,613	13,956	77.7	15.0	3.0	0.9	2.3	1.1

a LGV = light goods vehicle, HGV = heavy goods vehicle, MC = motorcycle.

Emissions

A1.1.3 Emissions have been calculated using the most recent version of the Emissions Factor Toolkit (EFT) v9.0 (Defra, 2014). The traffic data were entered into the EFT in order to calculate a combined emission rate for each of the road links in the modelled network.

Meteorological Data

A1.1.4 The model has been run using the full year of meteorological data that corresponds with the most recent set of nitrogen dioxide monitoring data (2018). The meteorological data has been taken from the monitoring station located at Heathrow Airport, which is considered suitable for the area.

A1.2. Background Concentrations

A1.2.1 Background concentrations have been assumed to be the same as those published by Defra (Defra, 2014). These cover the whole country on a 1 km by 1 km grid and are published for each year from 2017 to 2030. The current maps have been verified against measurements undertaken during 2017.



A1.3.1 The verification process seeks to minimise uncertainties associated with the air quality model by comparing the model output with locally measured concentrations. The model has been verified against 2018 data from the Oxford Road (RD3) automatic monitoring site and the DT24, DT25, DT28, DT30 and DT32 diffusion tube monitoring sites, as shown in **Figure 3**. The verification methodology is described below.

A1.3.2 The model output of road-NO_x has been compared with the ‘measured’ road-NO_x, calculated from the measured annual mean NO₂ concentrations and the background concentrations using the NO_x from NO₂ calculator v7.1 published by Defra (Defra, 2020b).

A1.3.3 The slope of the best-fit line between the ‘measured’ road-NO_x contribution and the model derived road-NO_x contribution, forced through zero, has been used to determine the adjustment factor (**Figure 4**). The adjustment factor of 4.36 has been applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. The NO_x to NO₂ calculator has then been used to determine total NO₂ concentrations from the adjusted modelled road-NO_x concentrations and the background NO₂ concentrations.

- A1.3.4 A comparison of the final adjusted modelled total NO₂ at each monitoring site to the measured total NO₂ shows close agreement (**Figure 5**).
- A1.3.5 The results imply that the model has under-predicted the road-NO_x contribution. This is a common experience with this and most other models. An evaluation of the model performance using statistical methods is shown in **Table A2**.

PM₁₀ and PM_{2.5}

- A1.3.6 An adjustment factor has been determined as the ratio of the 'measured' road-PM₁₀ contribution and the model derived road-PM₁₀ contribution at the Oxford Road (RD3) automatic monitoring site. The data used to calculate the adjustment factor are provided below:
- Measured PM₁₀: 23 µg/m³
 - 'Measured' road-PM₁₀ (measured – background at monitor): 23 – 14.9 = 8.1 µg/m³
 - Modelled road-PM₁₀ = 0.83 µg/m³
 - Road-PM₁₀ adjustment factor: 8.1/0.83 = **9.68**

A1.4. Model Post-processing

NO₂

- A1.4.1 The NO_x to NO₂ calculator v7.1 published by Defra has been used to convert the modelled, verified road-NO_x output for each receptor to road-NO₂. The background NO₂ concentrations have then been added to the predicted road-NO₂ concentrations and adjusted using the secondary verification factor to give the final predicted concentrations.

PM₁₀ and PM_{2.5}

- A1.4.2 The verified road-PM outputs need no further processing and have been added to the background concentrations to give the final predicted concentrations.

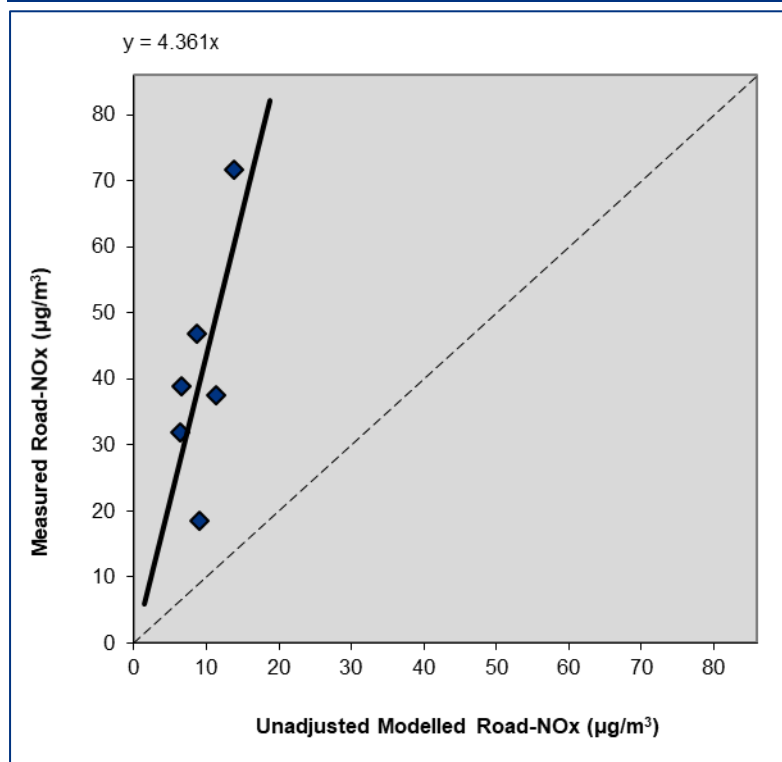


Figure 4: Comparison of Measured Road NO_x to Unadjusted Modelled Road NO_x Concentrations.

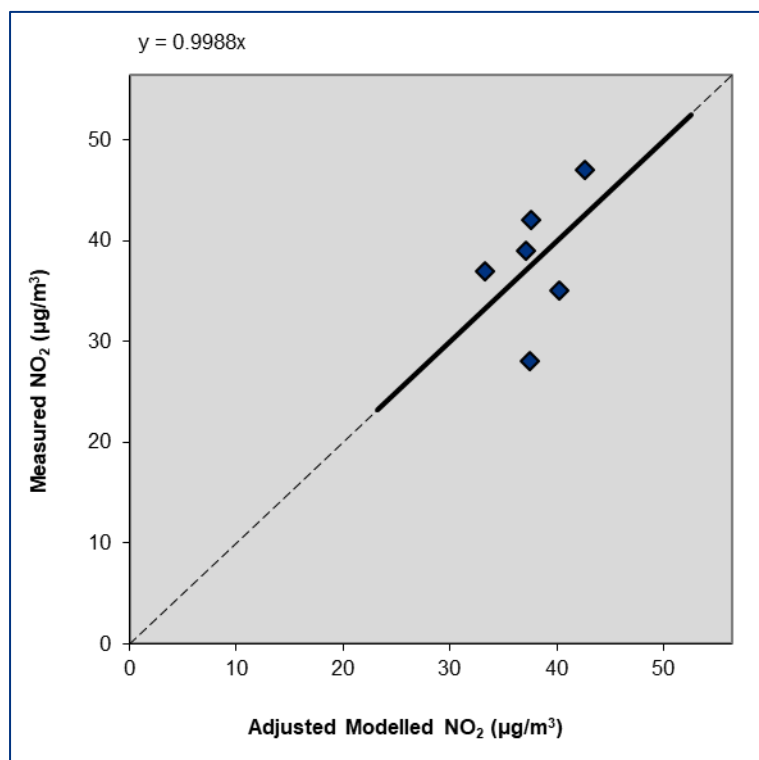


Figure 5: Comparison of Measured Total NO₂ to Primary Adjusted Modelled Total NO₂ Concentrations.

Table A2: Evaluation of Model Performance

Statistical Parameter	Description	Values		
		Before verification (Figure 4)	After verification (Figure 5)	Ideal
Correlation coefficient	Linear relationship between predicted and observed data. Less useful for small datasets as single high/low values can have a large effect.	0.65	0.42	1
Fractional bias	Identifies systematic tendency to over/under predict (negative = over-predict, positive = under-predict).	1.26	0.00	0.0
Root mean square error (RMSE)	Average error of the model ($\mu\text{g}/\text{m}^3$). Ideally within 10% of the annual mean NO_2 objective, i.e. $4 \mu\text{g}/\text{m}^3$; however, within 25% acceptable, i.e. $10 \mu\text{g}/\text{m}^3$.	34.78	5.36	0.0

A2 Professional Experience

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Bob Thomas is a Director at AQA, with over twelve years' experience in the field of air quality management and assessment. He has carried out air quality assessments for a wide range of developments, including residential, commercial, industrial, minerals and waste developments. He has been responsible for air quality projects that include ambient air quality monitoring of nitrogen dioxide, dust and PM₁₀, the assessment of nuisance odours and dust, and the preparation of Review and Assessment reports for local authorities. He has extensive dispersion modelling experience for road traffic, energy centre and industrial sources, and has completed many stand-alone reports and chapters for inclusion within an Environmental Statement. Bob has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers, architects and process operators, and has provided expert witness services at public inquiry. He is a Chartered Scientist, a Member of the Institute of Air Quality Management and a Member of the Institution of Environmental Sciences.

A full CV for Bob Thomas is available at <http://aqassessments.co.uk/about>