



Air Quality Assessment: Dodwells Road, Hinckley and Bosworth

May 2017



Experts in air quality
management & assessment

Document Control

Client	Bloor Homes	Principal Contact	Max Whitehead
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Report Prepared By:	Aidan Farrow and Suzanne Hodgson
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Air Quality Consultants Ltd
23 Coldharbour Road, Bristol BS6 7JT Tel: 0117 974 1086
1 Burwood Place, London W2 2UT Tel: 020 3873 4780
aqc@aqconsultants.co.uk

Registered Office: 12 St Oswalds Road, Bristol, BS6 7HT
Companies House Registration No: 2814570

Executive Summary

The air quality impacts associated with the operation of the proposed mixed-use development on Dodwells Road, to the west of Hinckley have been assessed. Existing conditions within the study area show acceptable air quality, with concentrations of all pollutants below the relevant air quality objectives.

The emissions from the additional traffic generated by the proposed development will have *negligible* impacts at the majority of modelled receptors. *Slight adverse* impacts for nitrogen dioxide are predicted near the junction of the A47 and Ashby Road where residences are closest to the carriageway. The impacts are *negligible* for PM₁₀ and PM_{2.5} at all receptors modelled. Concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} will remain below the air quality objectives at all receptor locations.

Air quality conditions for new residents within the proposed development have also been considered. Pollutant concentrations are predicted to be well below the air quality objectives at the worst-case locations assessed, and air quality conditions for new residents will be acceptable.

The assessment has demonstrated that the scheme will not cause any exceedances of the air quality objectives. It is not considered appropriate to propose specific mitigation measures for this scheme.

Overall, the operational air quality effects of the proposed development are judged to be 'not significant'.

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1 Introduction

- 1.1 This report describes the potential air quality impacts associated with the proposed mixed use development on Dodwells Road, to the west of Hinckley. The assessment has been carried out by Air Quality Consultants Ltd on behalf of Bloor Homes.
- 1.2 The proposed development will consist of 850 dwellings, 500 m² of commercial space, a primary school and community facilities. The development will lead to an increase in traffic on the local roads, which may impact on air quality at existing residential properties. The new residential properties will also 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}).
- 1.3 This report describes existing local air quality conditions (base year 2015), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2018, which is the anticipated year of opening.
- 1.4 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with Hinckley and Bosworth Borough Council.

2 Policy Context and Assessment Criteria

Air Quality Strategy

- 2.1 The Air Quality Strategy (Defra, 2007) published by the Department for Environment, Food, and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, 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 Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Planning Policy

National Policies

- 2.2 The National Planning Policy Framework (NPPF) (2012) sets out planning policy for England in one place. It places a general presumption in favour of sustainable development, stressing the importance of local development plans, and states that the planning system should perform an environmental role to minimise pollution. One of the twelve core planning principles notes that planning should “*contribute to...reducing pollution*”. To prevent unacceptable risks from air pollution, planning decisions should ensure that new development is appropriate for its location. The NPPF states that the “*effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account*”.
- 2.3 More specifically the NPPF makes clear that:
- “Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan”.*
- 2.4 The NPPF is now supported by Planning Practice Guidance (PPG) (DCLG, 2017), which includes guiding principles on how planning can take account of the impacts of new development on air

quality. The PPG states that *“Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values”* and *“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”*. The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans *“identify measures that will be introduced in pursuit of the objectives”*.

2.5 The PPG states that:

“Whether or not 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 generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife)”.

2.6 The PPG sets out the information that may be required in an air quality assessment, making clear that *“Assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality”*. It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *“Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact”*.

Local Policies

2.7 The Hinckley & Bosworth Local Plan (Hinckley and Bosworth Borough Council, 2017) sets out policies to guide development and specific land use proposals, these include the Core Strategy, (Hinckley and Bosworth Borough Council, 2009), Hinckley Town Centre Area Action Plan (Hinckley and Bosworth Borough Council, 2011) and Site Allocations and Development Management Policies (Hinckley and Bosworth Borough Council, 2016). Policy 20 of the Core Strategy supports measures to improve air quality in Hinckley. The Hinckley Town Centre Area Action Plan also encourages sustainable transport initiatives to help reduce pollution. With respect to planning applications, the Site Allocations and Development Management Policies states;

“Applicants will be required to demonstrate that new development should not result in adverse impacts, including cumulative impacts upon air quality. Appropriate construction design and mitigation measures, appropriate distances and screening between developments and sensitive uses will protect the amenity of residents and workers and the environment.”

2.8 Furthermore, Site Allocation and Development Management Policy DM7 aims to prevent pollution and flooding, it states;

“Adverse impacts from pollution and flooding will be prevented by ensuring that development proposals demonstrate that... it will not contribute to poor air quality”

- 2.9 And Site Allocation and Development Management Policy DM10 states that developments will be permitted providing that;

“It would not have a significant adverse effect on the privacy and amenity of nearby residents and occupiers of adjacent buildings, including matters of lighting, air quality (including odour), noise, vibration and visual intrusion”

- 2.10 The Council's Carbon Management Plan (Hinckley and Bosworth Borough Council, 2009) includes measures to address carbon dioxide emissions and air quality issues such as emissions from fleet vehicles and staff business miles.

Air Quality Action Plans

National Air Quality Plans

- 2.11 Defra has produced Air Quality Plans to reduce nitrogen dioxide concentrations in major cities throughout the UK (Defra, 2015), although these are to be replaced with new plans by 31st July 2017 following a High Court ruling in November 2016 (Royal Courts of Justice, 2016). Along with a suite of national measures, the original Air Quality Plans identify the need to establish Clean Air Zones within five Zones (Birmingham, Leeds, Southampton, Nottingham and Derby) where exceedances of the EU limit values for nitrogen dioxide have been forecast in 2020 and beyond. Within these Zones, lower-emission vehicles will be encouraged. The precise nature of these Clean Air Zones is still to be decided. In Greater London, Defra will continue to support and monitor the delivery of the Mayor's plans for improving air quality to meet the EU limit value for nitrogen dioxide by 2025. The study area is not in a currently identified Zone.
- 2.12 There is currently no practical way to take account of the effects of these Air Quality Plans on the modelling presented in this report, which is for assessment against the air quality objectives rather than the EU limit values.

Local Air Quality Action Plan

- 2.13 Hinckley and Bosworth Borough Council has not declared any AQMAs and thus has not prepared an air quality action plan.

Assessment Criteria

- 2.14 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set 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. The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality (England) Regulations 2000 (2000) and the Air Quality (England) (Amendment) Regulations 2002 (2002).

- 2.15 The objectives for nitrogen dioxide and PM₁₀ were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The PM_{2.5} objective is to be achieved by 2020. Measurements across the UK have shown that the 1-hour nitrogen dioxide objective is unlikely to be exceeded at roadside locations where the annual mean concentration is below 60 µg/m³ (Defra, 2016b). Therefore, 1-hour nitrogen dioxide concentrations will only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour PM₁₀ objective could be exceeded at roadside locations where the annual mean concentration is above 32 µg/m³ (Defra, 2016b). The predicted annual mean PM₁₀ concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM₁₀ objective. Where predicted annual mean concentrations are below 32 µg/m³ it is unlikely that the 24-hour mean objective will be exceeded.
- 2.16 The objectives apply at locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective. Defra explains where these objectives will apply in its Local Air Quality Management Technical Guidance (Defra, 2016b). The annual mean objectives for nitrogen dioxide and PM₁₀ are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour objective for PM₁₀ is considered to apply at the same locations as the annual mean objective, as well as in gardens of residential properties and at hotels. The 1-hour mean objective for nitrogen dioxide applies wherever members of the public might regularly spend 1-hour or more, including outdoor eating locations and pavements of busy shopping streets.
- 2.17 The European Union has also set limit values for nitrogen dioxide, PM₁₀ and PM_{2.5}. The limit values for nitrogen dioxide are the same numerical concentrations as the UK objectives, but achievement of these values is a national obligation rather than a local one (Directive 2008/50/EC of the European Parliament and of the Council, 2008). In the UK, only monitoring and modelling carried out by UK Central Government meets the specification required to assess compliance with the limit values. Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceeded.
- 2.18 The relevant air quality criteria for this assessment are provided in Table 1.

Table 1: Air Quality Criteria for Nitrogen Dioxide, PM₁₀ and PM_{2.5}

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 µg/m ³ not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m ³
Fine Particles (PM₁₀)	24-hour Mean	50 µg/m ³ not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m ³ ^a
Fine Particles (PM_{2.5}) ^b	Annual Mean	25 µg/m ³

^a A proxy value of 32 µg/m³ as an annual mean is used in this assessment to assess the likelihood of the 24-hour mean PM₁₀ objective being exceeded. Measurements have shown that, above this concentration, exceedances of the 24-hour mean PM₁₀ objective are possible (Defra, 2016b).

^b The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Descriptors for Air Quality Impacts and Assessment of Significance

- 2.19 There is no official guidance in the UK in relation to development control on how to describe air quality impacts, nor how to assess their significance. The approach developed jointly by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) (Moorcroft and Barrowcliffe et al, 2017) has therefore been used. This includes defining descriptors of the impacts at individual receptors, which take account of the percentage change in concentrations relative to the relevant air quality objective, rounded to the nearest whole number, and the absolute concentration relative to the objective. The overall significance of the air quality impacts is determined using professional judgement, taking account of the impact descriptors. Full details of the EPUK/IAQM approach are provided in Appendix A1. The approach includes elements of professional judgement, and the experience of the consultants preparing the report is set out in Appendix A2.

3 Assessment Approach

Consultation

- 3.1 The assessment follows a methodology agreed with Hinckley and Bosworth Borough Council via email correspondence between Giles Rawdon (Air Quality Officer at Hinckley and Bosworth Borough Council) and Suzanne Hodgson (Air Quality Consultants) on 22nd March 2017.

Existing Conditions

- 3.2 Existing sources of emissions within the study area have been defined using a number of approaches. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2017b) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2017). Local sources have also been identified through examination of the Council's Air Quality Review and Assessment reports.
- 3.3 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. Background concentrations have been defined using the national pollution maps published by Defra (2017a). These cover the whole country on a 1x1 km grid.
- 3.4 Exceedances of the annual mean EU limit value for nitrogen dioxide in the study area have been identified using the maps of roadside concentrations published by Defra for 2015 (Defra, 2017c) and for 2020 and 2025 (Defra, 2016a). These are the maps used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedances of the limit value to the EU. The maps are currently available for the past years 2001 to 2015 and the future years 2020, 2025 and 2030. The national maps of roadside PM₁₀ and PM_{2.5} concentrations, which are available for the years 2009 to 2015, show no exceedances of the limit values anywhere in the UK in 2015.

Road Traffic Impacts

Sensitive Locations

- 3.5 Concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} have been predicted at a number of locations both within, and close to, the proposed development. Receptors have been identified to represent worst-case exposure within these locations, being located on the façades of the properties closest to the sources. When selecting these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

Table 2: Description of Receptor Locations

Receptor	Description
Existing properties ^a	
1	Residential property (Lester House) co-located with Diffusion Tube Monitor
2	Residential property on Coventry Road
3	Roadside location on Coventry Road co-located with Diffusion Tube Monitor
4	Residential property on A5 co-located with Diffusion Tube Monitor
5	Residential property between A47 and Odstone Drive
6	Residential property between A47 and Lovetts Close
7	Residential property at junction of A47 and Roston Drive
8	Residential property on Roston Drive
9	Residential property at junction of A47 and Roston Drive
10	Residential property on Roston Drive
11	Residential property between A47 and Livia Close
12	Residential property on Outlands Drive
13	Residential property on Outlands Drive
14	Residential property between A47 and Mulberry Way
15	Residential property between A47 and Mulberry Way
16	Residential property between Wykin Road and Turner Drive
17	Residential property between A47 and Turner Drive
18	Residential property on Wykin Road
19	Residential property between A47 and Reynolds Close
20	Residential property on Triumph Road near A47 junction with Sword Drive
21	Residential property on Stoke Road
22	Residential property between A47 and Frobisher Close
23	Residential property on A47 at junction with Ashby Road
24	Residential property between A47 and Falmouth Drive
Proposed properties ^b	
A	Worst case location within the proposed development and adjacent to A47.
B	Worst case location within the proposed development and adjacent to A47.
C	Worst case location within the proposed development and adjacent to site access road.
D	Worst case location within the proposed development and adjacent to A47.
E	Southern most location within the proposed development.
F	Northern most location within the proposed development.

^a Receptors modelled at a height of 1.5 m.

^b Receptors modelled at heights of 1.5 m, 4.5 m and 7.5 m to represent ground, first and second floor levels.

- 3.6 Twenty-three existing residential properties have been identified as receptors for the assessment. Six additional receptor locations have been identified within the proposed development, which represent exposure to existing sources. These locations are described in Table 2 and shown in Figure 1, further detail of the receptor locations near to the proposed development site is shown in Figure 2. In addition, concentrations have been modelled at the diffusion tube monitoring site located on Coventry Road, in order to verify the model outputs (see Appendix A3 for verification method).

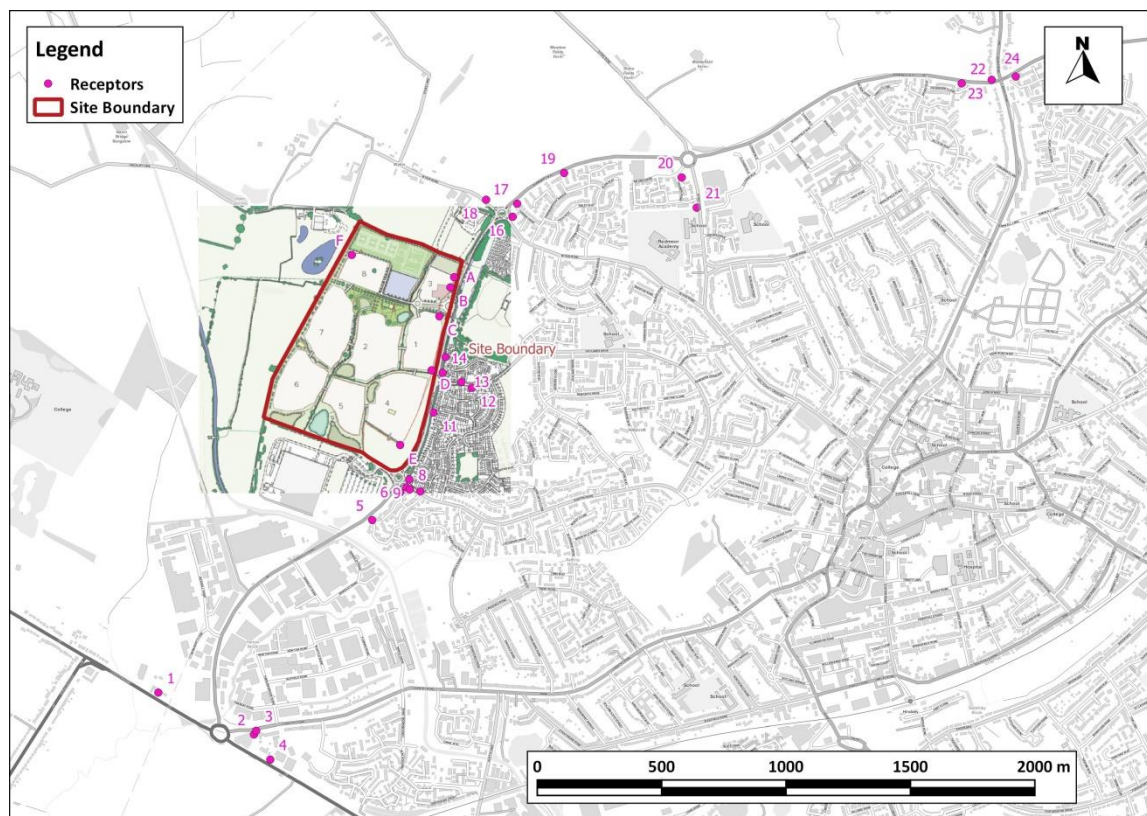


Figure 1: Overview of Receptor Locations

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Figure 2: Receptor Locations near to the Development Site

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- 3.7 Nitrogen dioxide, PM₁₀ and PM_{2.5} concentrations have been predicted for a base year (2015) and the proposed year of opening (2018). For 2018, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). No phasing of the development is considered. With Scheme modelling has been carried out for the opening year with traffic flows representative of a completed development.
- 3.8 In addition to the set of 'official' predictions, a sensitivity test has been carried out for nitrogen dioxide that involves assuming much higher nitrogen oxides emissions from certain vehicles than have been predicted by Defra, using AQC's Calculator Using Realistic Emissions for Diesels (CURED V2A) tool (AQC, 2016a). This is to address the potential under-performance of emissions control technology on modern diesel vehicles (AQC, 2016b).

Modelling Methodology

- 3.9 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs, assumptions and the verification are provided in Appendix A3, together with the method used to derive base and future year background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Traffic Data

- 3.10 Traffic data for the assessment have been provided by Northern Transport Planning Ltd., who have undertaken the Transport Assessment for the proposed development. Further details of the traffic data used in this assessment are provided in Appendix A3.

Uncertainty in Road Traffic Modelling Predictions

- 3.11 There are many components that contribute to the uncertainty of modelling predictions. The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them. There are then additional uncertainties, as models are required to simplify real-world conditions into a series of algorithms.
- 3.12 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix A3). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of base year (2015) concentrations.
- 3.13 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations and vehicle emissions.
- 3.14 Historically, large reductions in nitrogen oxides emissions have been projected, which has led to significant reductions in nitrogen dioxide concentrations from one year to the next being predicted. Over time, it was found that trends in measured concentrations did not reflect the rapid reductions that Defra and DfT had predicted (Carslaw et al., 2011). This was evident across the UK, although the effect appeared to be greatest in inner London; there was also considerable inter-site variation. Emission projections over the 6 to 8 years prior to 2009 suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25%, whereas monitoring data showed that concentrations remained relatively stable, or even showed a slight increase. Analysis of more recent data for 23 roadside sites in London covering the period 2003 to 2012 showed a weak downward trend of around 5% over the ten years (Carslaw and Rhys-Tyler, 2013), but this still falls short of the improvements that had been predicted at the start of this period. This pattern of no clear, or limited, downward trend is mirrored in the monitoring data assembled for this study, as set out later in Paragraph 4.6.

- 3.15 The reason for the disparity between the expected concentrations and those measured relates to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have had to meet progressively tighter European type approval emissions categories, referred to as "Euro" standards. While the nitrogen oxides emissions from newer vehicles should be lower than those from equivalent older vehicles, the on-road performance of some modern diesel vehicles has often been no better than that of earlier models. This has been compounded by an increasing proportion of nitrogen dioxide in the nitrogen oxides emissions, i.e. primary nitrogen dioxide, which has a significant effect on roadside concentrations (Carslaw et al., 2011) (Carslaw and Rhys-Tyler, 2013).
- 3.16 A detailed analysis of emissions from modern diesel vehicles has been carried out (AQC, 2016b). This shows that, where previous standards had limited on-road success, the 'Euro VI' and 'Euro 6' standards that new vehicles have had to comply with from 2013/16¹ are delivering real on-road improvements. A detailed comparison of the predictions in Defra's latest Emission Factor Toolkit (EFT) v7.0 against the results from on-road emissions tests has shown that Defra's latest predictions still have the potential to under-predict emissions from some vehicles, albeit by less than has historically been the case (AQC, 2016b). In order to account for this potential under-prediction, a sensitivity test has been carried out in which the emissions from Euro IV, Euro V, Euro VI, and Euro 6 vehicles have been uplifted as described in Paragraph A3.9 in Appendix A3, using AQC's CURED (V2A) tool (AQC, 2016a). The results from this sensitivity test are likely to over-predict emissions from vehicles in the future (AQC, 2016b) and thus provide a reasonable worst-case upper-bound to the assessment.
- 3.17 It must also be borne in mind that the predictions in 2018 are based on the worst-case assumption that the proposed development is fully operational. This will have overestimated the traffic emissions and hence the 2018 with-scheme concentrations.

¹ Euro VI refers to heavy duty vehicles, while Euro 6 refers to light duty vehicles. The timings for meeting the standards vary with vehicle type and whether the vehicle is a new model or existing model.

4 Site Description and Baseline Conditions

- 4.1 The proposed development site is located to the west of Hinckley, approximately 1.5 km from the town centre. It is currently used as agricultural land. The site is bounded by Normandy Way (A47) to the east, a motorcycle manufacturing facility to the south, and agricultural land to the north and west. There are existing residential properties east of Normandy Way, in an area that also contains community facilities and two schools. The agricultural land to the north and west contains a small number of residential properties and businesses including farm buildings and garages.

Industrial sources

- 4.2 A search of the UK Pollutant Release and Transfer Register (Defra, 2017b) and Environment Agency's 'what's in your backyard' (Environment Agency, 2017) websites has not identified any significant industrial or waste management sources that are likely to affect the proposed development, in terms of air quality. Operations at the motorcycle manufacturing facility are not expected to have an adverse air quality impact on the proposed development.

Air Quality Review and Assessment

- 4.3 Hinckley and Bosworth Borough Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. There are currently no AQMAs declared in the borough and the Council have concluded that there are no exceedances of the objectives for nitrogen dioxide (Hinckley and Bosworth Borough Council, 2016). It is, therefore, reasonable to assume that existing nitrogen dioxide levels will not exceed the objectives within the study area. No monitoring of PM₁₀ or PM_{2.5} concentrations is undertaken in Hinckley and Bosworth, however analysis of DEFRA National Background Maps (Defra, 2017a) suggest that levels will not exceed the objectives within the study area.

Local Air Quality Monitoring

- 4.4 Hinckley and Bosworth Borough Council do not operate automatic monitoring stations within its area. The Council does operate a number of nitrogen dioxide monitoring sites using diffusion tubes prepared and analysed by Environmental Scientifics Group (ESG) (using the 50% TEA in acetone method). These include two deployed on the A5 Watling Street and one deployed on B4666 Coventry Road, all of which are approximately 1.2 km southeast of the proposed development site. A further four diffusion tubes are deployed in central and southern Hinckley, on Trinity Lane, London Road, Rugby Road and Rufford Close. Data for these sites have been provided by Hinckley and Bosworth Borough Council. Results for the years 2011 to 2015 are summarised in Table 3 and the monitoring locations are shown in Figure 3.

Table 3: Summary of Nitrogen Dioxide (NO₂) Diffusion Tube Monitoring (2011-2015)

Site No.	Site Type	Location	2011	2012	2013	2014	2015
Annual Mean (µg/m³)^a							
1	Façade	Trinity Lane	22.1	25.0	25.2	25.2	25.9
2	Roadside ^b	Rufford Close	25.9	26.7	26.0	28.5	27.3
3	Roadside ^b	Coventry Road	24.2	27.3	25.4	25.5	25.3
4	Façade	Lester House A5	24.7	28.0	24.4	26.8	25.9
5	Façade	Weldon A5	24.6	28.0	23.6	24.2	23.4
6	Roadside ^b	Rugby Road	23.5	25.2	24.8	24.1	23.3
7	Roadside ^b	London Road	22.1	25.0	25.2	25.2	25.9
Objective			40				

^a All data have been taken from the 2016 Air Quality Annual Status Report (Hinckley and Bosworth Borough Council, 2016)

^b Roadside data have been distance-adjusted to represent concentrations at the Façade

- 4.5 The monitoring locations include both town centre locations and major roads on the edge of Hinckley where current traffic flows significantly exceed those adjacent to the proposed development. Despite this, no exceedances have been recorded by diffusion tube monitors in Hinckley during the last five years and the highest measured annual mean nitrogen dioxide concentration was well below the objective.
- 4.6 There are no clear trends in monitoring results for the past five years. This contrasts with the expected decline due to the progressive introduction of new vehicles operating to more stringent standards (the implications of this are discussed in Section 3 of this report).
- 4.7 No monitoring of PM₁₀ or PM_{2.5} concentrations is undertaken in Hinckley and Bosworth.

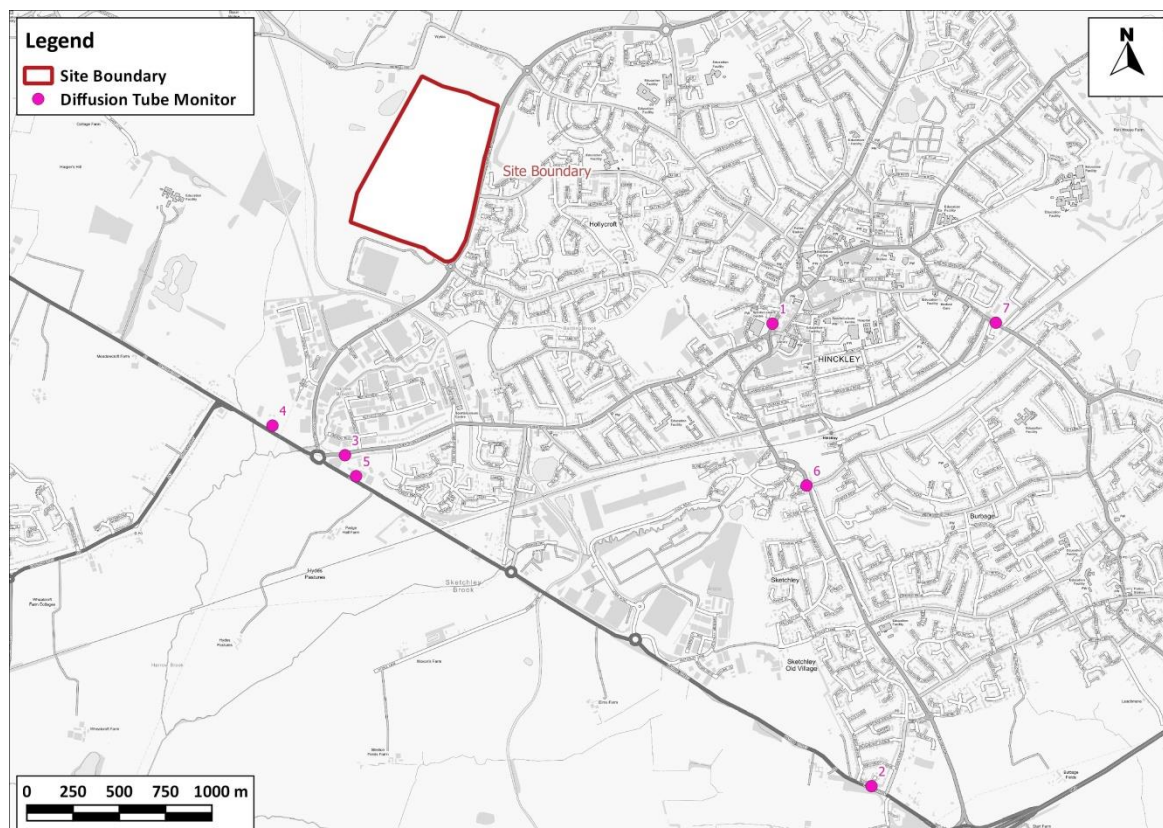


Figure 3: Monitoring Locations

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Exceedances of EU Limit Value

- 4.8 There are no AURN monitoring sites within the within 1 km of the development site with which to identify exceedances of the annual mean nitrogen dioxide limit value. The national maps of roadside annual mean nitrogen dioxide concentrations (Defra, 2017c) used to report exceedances of the limit value to the EU, do not identify any exceedances within 1 km of the development site. Defra's mapping for both 2020 and 2025, which take account of the measures contained in its 2015 Air Quality Plan (Defra, 2015), do not identify any exceedances within 1 km of the development site.

Background Concentrations

- 4.9 Estimated background concentrations at the proposed development have been determined for 2015 and the assessment year 2018 using Defra's background maps (Defra, 2017a). The background concentrations are set out in Table 4 and have been derived as described in Appendix A3. The background concentrations are all well below the objectives.

Table 4: Estimated Annual Mean Background Pollutant Concentrations in 2015 and 2018 ($\mu\text{g}/\text{m}^3$)

Year	NO ₂	PM ₁₀	PM _{2.5}
2015	13.5-20.0	15.2-17.3	10.8-12.2
2018 ^a	11.8-17.5	14.9-16.8	10.5-11.8
<i>2018 Worst-case Sensitivity Test ^b</i>	<i>12.1-18.1</i>	<i>N/A</i>	<i>N/A</i>
Objectives	40	40	25 ^c

N/A = not applicable. The range of values is for the two different 1x1 km grid squares covering the study area.

^a In line with Defra's forecasts.

^b Assuming higher emissions from modern diesel vehicles as described in Appendix A3.

^c The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Baseline Dispersion Model Results

- 4.10 Baseline concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} have been modelled at each of the existing receptor locations (see Figure 1 and Table 2 for receptor locations). The results, which cover both the existing (2015) and future year (2018) baseline (Without Scheme), are set out in Table 5 and Table 6. The predictions for nitrogen dioxide include a sensitivity test which accounts for the potential under-performance of emissions control technology on modern diesel vehicles. In addition, the modelled road components of nitrogen oxides have been increased from those predicted by the model based on a comparison with local measurements (see Appendix A3 for the verification methodology).

Table 5: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide ($\mu\text{g}/\text{m}^3$) at Existing Receptors

Receptor	2015 ^a	2018 Without Scheme ^a	Worst-case Sensitivity Test ^{b,c}	
			2015	2018 Without Scheme
1	31.3	21.9	31.5	23.4
2	28.1	18.7	28.3	19.8
3	29.8	21.4	29.8	22.7
4	29.2	21.0	30.2	23.0
5	27.4	19.7	28.1	21.4
6	29.4	27.4	29.3	28.9
7	28.9	26.1	28.6	27.3
8	26.3	24.1	26.0	25.2
9	31.9	28.0	31.4	29.4
10	26.4	24.1	25.7	25.1
11	28.3	22.8	29.0	24.7
12	19.5	16.4	19.5	17.1
13	21.4	17.8	21.4	18.7
14	33.2	26.4	32.9	27.9
15	29.5	23.6	29.8	25.4
16	28.1	22.8	27.8	23.9
17	31.1	24.9	30.9	26.4
18	22.5	18.8	22.3	19.6
19	25.6	21.0	26.4	22.8
20	21.5	18.1	21.3	18.8
21	20.4	17.4	20.1	18.1
22	29.9	23.9	30.4	25.9
23	39.6	31.7	38.8	33.3
24	36.7	28.9	36.1	30.4
Objective	40			

^a In line with Defra's forecasts.

^b Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.9 in Appendix A3.

^c The methodology for the sensitivity test uses different traffic emissions and required a separate verification (see Appendix A3), which leads to slightly different 2015 values.

Table 6: Modelled Annual Mean Baseline Concentrations of PM₁₀ and PM_{2.5} at Existing Receptors (µg/m³)

Receptor	PM ₁₀ ^a		PM _{2.5}	
	2015	2018 Without Scheme	2015	2018 Without Scheme
1	18.3	17.8	12.6	12.2
2	16.6	16.2	11.7	11.3
3	18.1	17.5	12.5	12.0
4	18.1	17.7	12.5	12.1
5	17.8	17.4	12.3	11.9
6	18.9	18.3	13.2	12.6
7	17.9	17.3	12.7	12.2
8	17.7	17.1	12.5	12.0
9	19.2	18.6	13.3	12.7
10	18.0	17.3	12.7	12.1
11	18.6	18.1	12.8	12.3
12	16.9	16.5	11.8	11.5
13	17.2	16.8	12.0	11.6
14	18.6	18.1	12.9	12.4
15	18.6	18.1	12.8	12.4
16	17.9	17.5	12.5	12.0
17	18.4	17.9	12.8	12.3
18	17.3	16.8	12.1	11.7
19	18.3	17.8	12.6	12.2
20	17.2	16.8	12.0	11.6
21	16.6	16.1	11.7	11.3
22	18.2	17.8	12.7	12.3
23	18.8	18.3	13.2	12.6
24	18.2	17.7	12.8	12.3
Objective / Criterion	32 ^a		25 ^b	

^a While the annual mean PM₁₀ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean PM₁₀ objective is possible, as outlined in LAQM.TG16 (Defra, 2016b). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM₁₀ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

^b The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

2015 Baseline

- 4.11 The predicted annual mean concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} are well below the objectives in 2015 at all receptors. The annual mean PM₁₀ concentrations are below 32 µg/m³ and it is, therefore, unlikely that the 24-hour mean PM₁₀ objective will be exceeded.
- 4.12 These results are consistent with the conclusions of Hinckley and Bosworth Borough Council in the outcome of its air quality review and assessment work.

2018 Baseline

- 4.13 The predicted annual mean concentrations of nitrogen dioxide are well below the objective at all receptor locations. All of the predictions for PM₁₀ and PM_{2.5} are well below the objectives. The annual mean PM₁₀ concentrations are below 32 µg/m³ and it is, therefore, unlikely that the 24-hour mean PM₁₀ objective will be exceeded.

Worst-case Sensitivity Test for Nitrogen Dioxide

- 4.14 The results from the upper-bound sensitivity test show nitrogen dioxide concentrations are not materially different from those derived using the 'official' predictions. The predicted annual mean concentrations of nitrogen dioxide are well below the objective at all receptors and in all scenarios.

5 Impact Assessment

Impacts of Development-Generated Road Traffic Emissions

- 5.1 Predicted annual mean concentrations of nitrogen dioxide, PM₁₀ and PM_{2.5} in 2018 for existing receptors are set out in Table 7, Table 8 and Table 9 for both the “Without Scheme” and “With Scheme” scenarios. These tables also describe the impacts at each receptor using the impact descriptors given in Appendix A1. For nitrogen dioxide, results are presented for two scenarios so as to include a worst-case sensitivity test.

Nitrogen Dioxide

- 5.2 The annual mean nitrogen dioxide concentrations are below the objective at all receptors. The percentage changes in concentrations, relative to the air quality objective (when rounded), are predicted to be 2% or less at all of the receptors. The percentage change is negative at one receptor which reflects the reduction in traffic flow predicted on Roston Drive (Table A1.1). Using the matrix in Table A1.1 (Appendix A1), these impacts are described as *negligible to slight adverse*. The only receptor where *slight adverse* impacts are predicted is near the junction of the A47 and Ashby Road where residences are closest to the carriageway.
- 5.3 The annual mean nitrogen dioxide concentrations are below 60 µg/m³ at all of the receptor locations in 2018. It is, therefore, unlikely that the 1-hour mean nitrogen dioxide objective will be exceeded.

Worst-case Sensitivity Test

- 5.1 The results from the worst-case sensitivity test show are not materially different from those derived using the ‘official’ predictions in line with Defra’s forecasts, the predicted percentage changes remain 2% or below and, these impacts are described as *negligible to slight adverse* (Table A1.1). The predicted impact is *slight adverse* at two receptors in the worst-case sensitivity test, both of which are located near the junction of the A47 and Ashby Road where residences are closest to the carriageway.

Table 7: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2018 ($\mu\text{g}/\text{m}^3$)

Receptor	Without Scheme ^a	With Scheme ^a	% Change ^{a, b}	Impact Descriptor ^a	Worst-case Sensitivity Test ^c			
					Without Scheme	With Scheme	% Change ^b	Impact Descriptor
1	21.9	22.4	1	Negligible	23.4	23.9	1	Negligible
2	18.7	18.8	0	Negligible	19.8	20.0	0	Negligible
3	21.4	21.5	0	Negligible	22.7	22.8	0	Negligible
4	21.0	21.5	1	Negligible	23.0	23.5	1	Negligible
5	19.7	20.1	1	Negligible	21.4	21.8	1	Negligible
6	27.4	27.8	1	Negligible	28.9	29.3	1	Negligible
7	26.1	26.3	1	Negligible	27.3	27.5	1	Negligible
8	24.1	24.2	0	Negligible	25.2	25.3	0	Negligible
9	28.0	28.2	0	Negligible	29.4	29.6	0	Negligible
10	24.1	23.8	-1	Negligible	25.1	24.8	-1	Negligible
11	22.8	23.3	1	Negligible	24.7	25.2	1	Negligible
12	16.4	16.7	1	Negligible	17.1	17.4	1	Negligible
13	17.8	18.2	1	Negligible	18.7	19.0	1	Negligible
14	26.4	27.0	1	Negligible	27.9	28.5	1	Negligible
15	23.6	24.1	1	Negligible	25.4	25.9	1	Negligible
16	22.8	23.5	2	Negligible	23.9	24.7	2	Negligible
17	24.9	25.9	2	Negligible	26.4	27.4	2	Negligible
18	18.8	19.1	1	Negligible	19.6	20.0	1	Negligible
19	21.0	21.8	2	Negligible	22.8	23.6	2	Negligible
20	18.1	18.3	0	Negligible	18.8	19.0	0	Negligible
21	17.4	17.4	0	Negligible	18.1	18.0	0	Negligible
22	23.9	24.5	2	Negligible	25.9	26.5	1	Negligible
23	31.7	32.3	2	Slight Adverse	33.3	33.9	2	Slight Adverse
24	28.9	29.6	2	Negligible	30.4	31.1	2	Slight Adverse
Objective	40	-	-	-	40	-	-	-

^a In line with Defra's forecasts.

^b % changes are relative to the objective and have been rounded to the nearest whole number.

^c Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.9 in Appendix A3.

Table 8: Predicted Impacts on Annual Mean PM₁₀ Concentrations in 2018 (µg/m³)

Receptor	Annual Mean PM ₁₀ (µg/m ³)			
	Without Scheme	With Scheme	% Change ^a	Impact Descriptor
1	17.8	18.0	0	Negligible
2	16.2	16.2	0	Negligible
3	17.5	17.6	0	Negligible
4	17.7	17.8	0	Negligible
5	17.4	17.5	0	Negligible
6	18.3	18.4	0	Negligible
7	17.3	17.4	0	Negligible
8	17.1	17.1	0	Negligible
9	18.6	18.6	0	Negligible
10	17.3	17.2	0	Negligible
11	18.1	18.2	0	Negligible
12	16.5	16.6	0	Negligible
13	16.8	16.8	0	Negligible
14	18.1	18.2	0	Negligible
15	18.1	18.2	0	Negligible
16	17.5	17.6	0	Negligible
17	17.9	18.1	1	Negligible
18	16.8	16.9	0	Negligible
19	17.8	18.0	1	Negligible
20	16.8	16.8	0	Negligible
21	16.1	16.1	0	Negligible
22	17.8	18.0	1	Negligible
23	18.3	18.5	0	Negligible
24	17.7	17.9	0	Negligible
Criterion	32 ^b		-	-

^a % changes are relative to the criterion and have been rounded to the nearest whole number.

^b While the annual mean PM₁₀ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean PM₁₀ objective is possible, as outlined in LAQM.TG16 (Defra, 2016b). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM₁₀ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

Table 9: Predicted Impacts on Annual Mean PM_{2.5} Concentrations in 2018 (µg/m³)

Receptor	Annual Mean PM _{2.5} (µg/m ³)			
	Without Scheme	With Scheme	% Change ^a	Impact Descriptor
1	12.2	12.3	0	Negligible
2	11.3	11.3	0	Negligible
3	12.0	12.1	0	Negligible
4	12.1	12.2	0	Negligible
5	11.9	12.0	0	Negligible
6	12.6	12.7	0	Negligible
7	12.2	12.2	0	Negligible
8	12.0	12.0	0	Negligible
9	12.7	12.8	0	Negligible
10	12.1	12.1	0	Negligible
11	12.3	12.4	0	Negligible
12	11.5	11.5	0	Negligible
13	11.6	11.6	0	Negligible
14	12.4	12.4	0	Negligible
15	12.4	12.4	0	Negligible
16	12.0	12.1	0	Negligible
17	12.3	12.4	0	Negligible
18	11.7	11.7	0	Negligible
19	12.2	12.3	0	Negligible
20	11.6	11.6	0	Negligible
21	11.3	11.3	0	Negligible
22	12.3	12.4	0	Negligible
23	12.6	12.7	0	Negligible
24	12.3	12.4	0	Negligible
Objective	25 ^b		-	-

^a % changes are relative to the criterion and have been rounded to the nearest whole number.

^b The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

PM₁₀ and PM_{2.5}

- 5.2 The annual mean PM₁₀ and PM_{2.5} concentrations are well below the annual mean objectives at all receptors, with or without the scheme. Furthermore, as the annual mean PM₁₀ concentrations are below 32 µg/m³, it is unlikely that the 24-hour mean PM₁₀ objective will be exceeded at any of the receptors.

- 5.3 The percentage changes in both PM₁₀ and PM_{2.5} concentrations, relative to the air quality objective (when rounded), are predicted to be 1% or less at all of the receptors. Using the matrix in Table A1.1 (Appendix A1), these impacts are described as *negligible*.

Impacts of Existing Sources on the Development

- 5.4 Predicted air quality conditions for future residents of the proposed development, taking account of emissions from the adjacent road network, are set out in Table 10 for Receptors A to F (see Table 2 and Figure 1 for receptor locations). All of the values are below the objectives. Air quality for future residents within the development will thus be acceptable.

Table 10: Predicted Concentrations of Nitrogen Dioxide (NO₂), PM₁₀ and PM_{2.5} in 2018 for New Receptors in the Development Site

Receptor	Annual Mean NO ₂ (µg/m ³)		Annual Mean PM ₁₀ (µg/m ³)	Annual Mean PM _{2.5} (µg/m ³)
	'Official' Prediction ^a	Worst-case Sensitivity Test ^b		
A	22.1	23.3	16.9	11.8
B	24.6	25.9	17.2	12.0
C	21.0	22.0	16.3	11.5
D	22.0	23.2	16.2	11.4
E	18.4	19.4	15.6	11.1
F	14.1	14.6	16.1	11.2
Objective/Criterion	40		32 ^c	25 ^d

^a In line with Defra's forecasts.

^b Assuming higher emissions from modern diesel vehicles as described in Paragraph A3.9 in Appendix A3.

^c While the annual mean PM₁₀ objective is 40 µg/m³, 32 µg/m³ is the annual mean concentration above which an exceedance of the 24-hour mean PM₁₀ objective is possible, as outlined in LAQM.TG16 (Defra, 2016b). A value of 32 µg/m³ is thus used as a proxy to determine the likelihood of exceedance of the 24-hour mean PM₁₀ objective, as recommended in EPUK & IAQM guidance (Moorcroft and Barrowcliffe et al, 2017).

^d The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Significance of Operational Air Quality Effects

- 5.5 The operational air quality effects without mitigation are judged to be 'not significant'. This professional judgement is made in accordance with the methodology set out in Appendix A1, and also takes into account the results of the worst-case sensitivity test for nitrogen dioxide. Future year concentrations are expected to lie between the two sets of results, but in order to provide a reasonable worst-case assessment, the judgement of significance focuses primarily on the results from the sensitivity test.

- 5.6 In terms of the two *slight adverse* impacts, the predicted annual mean nitrogen dioxide concentrations at these receptors remains below the objective with or without the scheme and as such, these impacts are not considered to justifiably determine any significant effects.
- 5.7 More specifically, the judgement that the air quality effects will be 'not significant' without mitigation takes account of the assessment that:
- the predicted future air quality both in the absence and presence of the development is improved relative to existing conditions;
 - concentrations of nitrogen dioxide are predicted to be below the objective and the scheme will have *negligible* to *slight adverse* impacts at the modelled roadside receptors;
 - the PM concentrations are all well below the objectives and the scheme will have *negligible* impacts all of the modelled roadside receptors;
 - the short-term nitrogen dioxide and PM₁₀ objectives are not likely to be exceeded;
 - the future population exposure to *slight adverse* impacts is limited to two residential properties;
 - a worst-case approach has been adopted for all assumptions made when undertaking the prediction of impacts; and
 - the traffic flows used in this report include the potential for cumulative impacts from future traffic growth in the local area.

6 Mitigation

Road Traffic Impacts

- 6.1 The assessment has demonstrated that the scheme will not cause any exceedances of the air quality objectives and that the overall effect of the scheme will be 'not significant'. It is, therefore, not considered appropriate to propose specific mitigation measures for this scheme.
- 6.2 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 is written into UK law).

Good Design and Best Practice Measures

- 6.3 The EPUK/IAQM guidance advises that good design and best practice measures should be considered, whether or not more specific mitigation is required. The proposed development incorporates the following good design and best practice measures:
- setting back of the development buildings from major roads by at least 10 m;
 - measures to promote public transport including provision of regular bus services within 400m of all planned properties;
 - measures to promote cycling including improvements to a local cycle way, short and long stay cycle parking, and encouraging provision of facilities for cycle-commuting in development;
 - measures to promote walking including provision of pedestrian access to and from the proposed development and encouraging walking to school;
 - measures to encourage car sharing among future residents;
 - practices that reduce the need to travel including a possible home delivery service from the on-site convenience store; and
 - travel packs will be provided with each new dwelling which will include a voucher for two six month bus passes for use across the local area.

7 Conclusions

- 7.1 The operational impacts of increased traffic emissions arising from the additional traffic on local roads, due to the proposed development, have been assessed. Concentrations have been modelled for 24 worst-case receptors, representing existing properties where impacts are expected to be greatest. In addition, the impacts of traffic emissions from local roads on the air quality for future residents have been assessed at six worst-case locations within the new development itself. In the case of nitrogen dioxide, a sensitivity test has also been carried out which considers the potential under-performance of emissions control technology on modern diesel vehicles.
- 7.2 It is concluded that concentrations of PM₁₀ and PM_{2.5} will remain below the objectives at all existing receptors in 2018, whether the scheme is developed or not. This conclusion is consistent with the outcomes of the reviews and assessments prepared by Hinckley and Bosworth Borough Council, which show that exceedances of the PM₁₀ objective are unlikely at any location.
- 7.3 In the case of nitrogen dioxide, the annual mean concentrations remain below the objective at all existing receptors in 2018, whether the scheme is developed or not and taking account of the worst-case sensitivity test.
- 7.4 The additional traffic generated by the proposed development will affect air quality at existing properties along the local road network. The assessment has demonstrated that the increases in concentrations of PM₁₀ and PM_{2.5} at relevant locations, relative to the objectives, will be no greater than 1% (when rounded) and the impacts will all be *negligible*. In the case of nitrogen dioxide, the percentage increases are predicted to range from 0% to 2%, and the impacts will range from *negligible* to *slight adverse*. *Slight adverse* impacts for nitrogen dioxide are only predicted near the junction of the A47 and Ashby Road.
- 7.5 The effects of local traffic on the air quality for residents living in the proposed development have been shown to be acceptable at the worst-case locations assessed, with concentrations being well below the air quality objectives.
- 7.6 The overall operational air quality effects of the development are judged to be 'not significant'. This conclusion, which takes account of the uncertainties in future projections, in particular for nitrogen dioxide, is based on the concentrations being below the objective for nitrogen dioxide and the impacts being *slight adverse* at a very small number of receptors.
- 7.7 The development will have *slight adverse* effects on local air quality conditions at one location near the application site, and does not introduce new exposure within an area of existing poor air quality, thus no additional mitigation has been proposed for the operational impacts.

- 7.8 The proposed development is consistent with the NPPF, which states that, *“Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants”*. Furthermore, the scheme does not conflict with the requirements of the Hinckley & Bosworth Local Plan (Hinckley and Bosworth Borough Council, 2017) and Core Strategy, policy DM10 of which states that a development will be permitted providing that, *“It would not have a significant adverse effect on the privacy and amenity of nearby residents and occupiers of adjacent buildings, including matters of lighting, air quality”*.

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9 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
AQC	Air Quality Consultants
AQAL	Air Quality Assessment Level
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
CURED	Calculator Using Realistic Emissions for Diesels
DCLG	Department for Communities and Local Government
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
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
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
LLITM	Leicestershire County Council strategic traffic model
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
PPG	Planning Practice Guidance
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEA	Triethanolamine – used to absorb nitrogen dioxide
TEMPro	Trip End Model Presentation Program

10 Appendices

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A1 EPUK & IAQM Planning for Air Quality Guidance

A1.1 The guidance issued by EPUK and IAQM (Moorcroft and Barrowcliffe et al, 2017) is comprehensive in its explanation of the place of air quality in the planning regime. Key sections of the guidance not already mentioned above are set out below.

Air Quality as a Material Consideration

“Any air quality issue that relates to land use and its development is capable of being a material planning consideration. The weight, however, given to air quality in making a planning application decision, in addition to the policies in the local plan, will depend on such factors as:

- *the severity of the impacts on air quality;*
- *the air quality in the area surrounding the proposed development;*
- *the likely use of the development, i.e. the length of time people are likely to be exposed at that location; and*
- *the positive benefits provided through other material considerations”.*

Recommended Best Practice

A1.2 The guidance goes into detail on how all development proposals can and should adopt good design principles that reduce emissions and contribute to better air quality management. It states:

“The basic concept is that good practice to reduce emissions and exposure is incorporated into all developments at the outset, at a scale commensurate with the emissions”.

A1.3 The guidance sets out a number of good practice principles that should be applied to all developments that:

- include 10 or more dwellings;
- where the number of dwellings is not known, residential development is carried out on a site of more than 0.5 ha;
- provide more than 1,000 m² of commercial floorspace;
- are carried out on land of 1 ha or more.

A1.4 The good practice principles are that:

- New developments should not contravene the Council’s Air Quality Action Plan, or render any of the measures unworkable;

- Wherever possible, new developments should not create a new “street canyon”, as this inhibits pollution dispersion;
- Delivering sustainable development should be the key theme of any application;
- New development should be designed to minimise public exposure to pollution sources, e.g. by locating habitable rooms away from busy roads;
- The provision of at least 1 Electric Vehicle (EV) “rapid charge” point per 10 residential dwellings and/or 1000 m² of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made available;
- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety;
- All gas-fired boilers to meet a minimum standard of <40 mgNO_x/kWh;
- Where emissions are likely to impact on an AQMA, all gas-fired CHP plant to meet a minimum emissions standard of:
 - Spark ignition engine: 250 mgNO_x/Nm³;
 - Compression ignition engine: 400 mgNO_x/Nm³;
 - Gas turbine: 50 mgNO_x/Nm³.
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of 275 mgNO_x/Nm³ and 25 mgPM/Nm³.

A1.5 The guidance also outlines that offsetting emissions might be used as a mitigation measure for a proposed development. However, it states that:

“It is important that obligations to include offsetting are proportional to the nature and scale of development proposed and the level of concern about air quality; such offsetting can be based on a quantification of the emissions associated with the development. These emissions can be assigned a value, based on the “damage cost approach” used by Defra, and then applied as an indicator of the level of offsetting required, or as a financial obligation on the developer. Unless some form of benchmarking is applied, it is impractical to include building emissions in this approach, but if the boiler and CHP emissions are consistent with the standards as described above then this is not essential”.

A1.6 The guidance offers a widely used approach for quantifying costs associated with pollutant emissions from transport. It also outlines the following typical measures that may be considered to

offset emissions, stating that measures to offset emissions may also be applied as post assessment mitigation:

- Support and promotion of car clubs;
- Contributions to low emission vehicle refuelling infrastructure;
- Provision of incentives for the uptake of low emission vehicles;
- Financial support to low emission public transport options; and
- Improvements to cycling and walking infrastructures.

Screening

Impacts of the Local Area on the Development

“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”.*

Impacts of the Development on the Local Area

A1.7 The guidance sets out two stages of screening criteria that can be used to identify whether a detailed air quality assessment is required, in terms of the impact of the development on the local area. The first stage is that you should proceed to the second stage if any of the following apply:

- 10 or more residential units or a site area of more than 0.5 ha residential use;
- more than 1,000 m² of floor space for all other uses or a site area greater than 1 ha.

A1.8 Coupled with any of the following:

- the development has more than 10 parking spaces;

- the development will have a centralised energy facility or other centralised combustion process.

A1.9 If the above do not apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area. If they do apply then you proceed to stage 2, which sets out indicative criteria for requiring an air quality assessment. The stage 2 criteria relating to vehicle emissions are set out below:

- the development will lead to a change in LDV flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- the development will lead to a change in HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will lead to a realigning of roads (i.e. changing the proximity of receptors to traffic lanes) where the change is 5m or more and the road is within an AQMA;
- the development will introduce a new junction or remove an existing junction near to relevant receptors, and the junction will cause traffic to significantly change vehicle acceleration/deceleration, e.g. traffic lights or roundabouts;
- the development will introduce or change a bus station where bus flows will change by more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- the development will have an underground car park with more than 100 movements per day (total in and out) with an extraction system that exhausts within 20 m of a relevant receptor; and

A1.10 The criteria are more stringent where the traffic impacts may arise on roads where concentrations are close to the objective. The presence of an AQMA is taken to indicate the possibility of being close to the objective, but where whole authority AQMAs are present and it is known that the affected roads have concentrations below 90% of the objective, the less stringent criteria are likely to be more appropriate.

A1.11 On combustion processes (including standby emergency generators and shipping) where there is a risk of impacts at relevant receptors, the guidance states that:

“Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NO_x gas boiler or a 30kW CHP unit operating at <95mg/Nm³.

In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent

buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates.

Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable”.

- A1.12 Should none of the above apply then the development can be screened out as not requiring a detailed air quality assessment of the impact of the development on the local area, provided that professional judgement is applied; the guidance importantly states the following:

“The criteria provided are precautionary and should be treated as indicative. 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”.

- A1.13 Even if a development cannot be screened out, the guidance is clear that a detailed assessment is not necessarily required:

“The use of a Simple Assessment may be appropriate, where it will clearly suffice for the purposes of reaching a conclusion on the significance of effects on local air quality. The principle underlying this guidance is that any assessment should provide enough evidence that will lead to a sound conclusion on the presence, or otherwise, of a significant effect on local air quality. A Simple Assessment will be appropriate, if it can provide this evidence. Similarly, it may be possible to conduct a quantitative assessment that does not require the use of a dispersion model run on a computer”.

- A1.14 The 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.

Impact Descriptors and Assessment of Significance

- A1.15 There is no official guidance in the UK in relation to development control on how to describe the nature of air quality impacts, nor how to assess their significance. The approach within the EPUK/IAQM guidance has, therefore, been used in this assessment. This approach involves a two stage process:

- a qualitative or quantitative description of the impacts on local air quality arising from the development; and
- a judgement on the overall significance of the effects of any impacts.

Impact Descriptors

A1.16 Impact description involves expressing 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 A1.1 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the table presented in the guidance document. For the assessment criterion the term Air Quality Assessment Level or AQAL has been adopted, as it covers all pollutants, i.e. those with and without formal standards. Typically, as is the case for this assessment, the AQAL will be the air quality objective value. Note that impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

Table A1.1: Air Quality Impact Descriptors for Individual Receptors for All Pollutants ^a

Long-Term Average Concentration At Receptor In Assessment Year ^b	Change in concentration relative to AQAL ^c				
	0%	1%	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

^a Values are rounded to the nearest whole number.

^b This is the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration where there is an increase.

^c AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

Assessment of Significance

A1.17 The guidance recommends that the assessment of significance should be based on professional judgement, with the overall air quality impact of the scheme described as either 'significant' or 'not significant'. In drawing this conclusion, 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 and, 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; 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.

A1.18 The guidance is clear that other factors may be relevant in individual cases. It also states that the effect on the residents of any new development where the air quality is such that an air quality objective is not met will be judged as significant. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.

A1.19 A judgement of the significance should be made by a competent professional who is suitably qualified. A summary of the professional experience of the staff contributing to this assessment is provided in Appendix A2.

A2 Professional Experience

Penny Wilson, BSc (Hons) CSci MEnvSc MIAQM

Ms Wilson is an Associate Director with AQC, with more than seventeen years' relevant experience in the field of air quality. She has been responsible for air quality assessments of a wide range of development projects, covering retail, housing, roads, ports, railways and airports. She has also prepared air quality review and assessment reports and air quality action plans for local authorities and appraised local authority assessments and air quality grant applications on behalf of the UK governments. Ms Wilson has arranged air quality and dust monitoring programmes and carried out dust and odour assessments. She has provided expert witness services for planning appeals and is Member of the Institute of Air Quality Management and a Chartered Scientist.

Suzanne Hodgson, BSc (Hons) MSc CSci MEnvSc MIAQM

Miss Hodgson is a Principal Consultant with AQC, with over ten years' experience in the field of air quality management and assessment. She has been responsible for a wide range of air quality projects covering impact assessments for new residential, commercial and industrial developments, local air quality management, ambient air quality monitoring of various pollutants and the assessment of nuisance odours and construction dust. She has extensive modelling experience, including the modelling of road traffic, energy centre (including energy from waste) and odour sources, and is familiar with preparing stand-alone air quality reports as well as chapters for inclusion within an Environment Statement. Suzanne has worked with a variety of clients to provide expert air quality services and advice, including local authorities, planners, developers and process operators. She is a Member of the Institute of Air Quality Management and is a Chartered Scientist.

Dr Aidan Farrow, BSc (Hons) PhD

Dr Farrow is a Consultant with AQC, having joined the company in 2016. He previously worked for four years as a research scientist at the University of Hertfordshire's Centre for Atmospheric and Instrumentation Research. There he was responsible for the National Centre for Atmospheric Science Air Quality Forecast, as well as working on research projects with a variety of Climate, Weather and Air Quality models. He is now gaining experience in the field of air quality assessment.

Full CVs are available at www.aqconsultants.co.uk.

A3 Modelling Methodology

Model Inputs

- A3.1 Predictions have been carried out using the ADMS-Roads dispersion model (v4.0). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 7.0) published by Defra (2017a).
- A3.2 Hourly sequential meteorological data from Coleshill for 2015 have been used in the model. The Coleshill meteorological monitoring station is located at Hawkeswell Farm, Coleshill, Birmingham, approximately 20 km to the west of the proposed development site. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of the proposed development site; both the development site and the Coleshill meteorological monitoring station are located in the Midlands where they will be influenced by the effects of inland meteorology over flat-lying topography.
- A3.3 AADT flows and vehicle fleet composition data have been provided by Northern Transport Planning Ltd, who have undertaken the transport assessment work for the proposed development. The traffic forecasts were produced initially by reference to Leicestershire County Council strategic traffic model (LLITM). Outputs from LLITM were then used as input to a local PARAMICS model to produce the traffic forecasts to the future year of 2026. 2026 traffic data has been applied to 2018, which is considered to be a worst case assessment, since it is likely, in the most part to have led to an elevated baseline in the future year of opening. This approach was considered to be more appropriate than factoring back the 2026 traffic data to 2018, which would have applied an unrealistic linear reduction in traffic.
- A3.4 The total number of vehicle trips within the network increases each year and the proposed development also increases total number of trips. The traffic model used in the assessment reassigns some trips to alternative routes as traffic flow changes in future years. This will lead to predictions of reduced traffic flow on some roads near to the development in the future assessment year. For this reason traffic on some roads is predicted to decrease on some roads within the study area.
- A3.5 The traffic data used in this assessment are summarised in Table A3.1.

Table A3.1: Summary of Traffic Data used in the Assessment (AADT Flows) ^a

Road Link	2015		2026 (Without Scheme)		2026 (With Scheme)	
	AADT	%HDV	AADT	%HDV	AADT	%HDV
A5 West	30771	7	31544	7	34277	6
A5 East	16695	14	17357	14	19562	12
Coventry Road	13989	4	13083	4	12689	5
A47 South of Roston Drive	18535	12	19878	12	22025	11
A47 South of Outlands Drive	21772	9	22359	9	24206	8
A47 South of Site Entrance	22539	8	23109	8	24628	8
A47 South of Wykin Road	22539	8	23109	8	26887	7
A47 North of Wykin Road	21441	8	22197	8	25552	7
A47 West of Ashby Road	27757	8	29549	8	32118	7
A47 East of Ashby Road	27757	8	29549	8	32118	7
Ashby Road North	11882	7	13912	7	15386	7
Ashby Road South	11247	5	10742	5	10942	5
Stoke Road North	6923	0	8557	0	8261	0
Stoke Road South	9564	1	10286	1	9682	1
Sword Drive	1786	0	1150	0	1141	0
Wykin Road East	4900	1	4916	1	4948	1
Wykin Road West	2705	1	2874	1	2838	1
Site Entrance	0	0	0	0	6385	0
Outlands Drive	2580	4	2777	4	3089	3
Roston Drive	8945	1	7826	1	6985	1
Triumph Factory Entrance	2515	5	2855	5	2923	5

^a This is just a summary of the data entered into the model, which have been input as hourly average flows of total flow and the percentage of HDV traffic.

A3.6 Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2015).

A3.7 Figure A3.1 shows the road network included within the model and defines the study area.

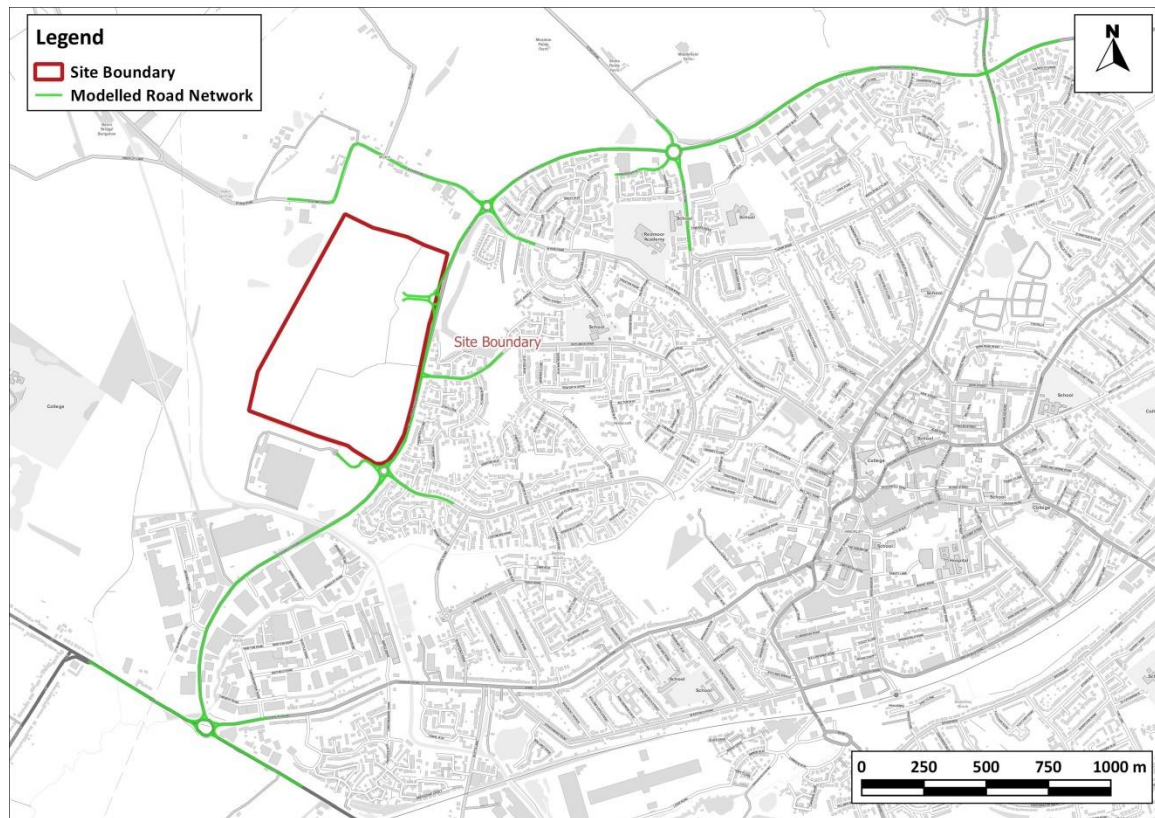


Figure A3.1: Modelled Road Network

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- A3.8 Traffic speeds have been estimated based on professional judgement, taking account of the road layout, speed limits and the proximity to a junction. Figure A3.2 shows the road network included within the model

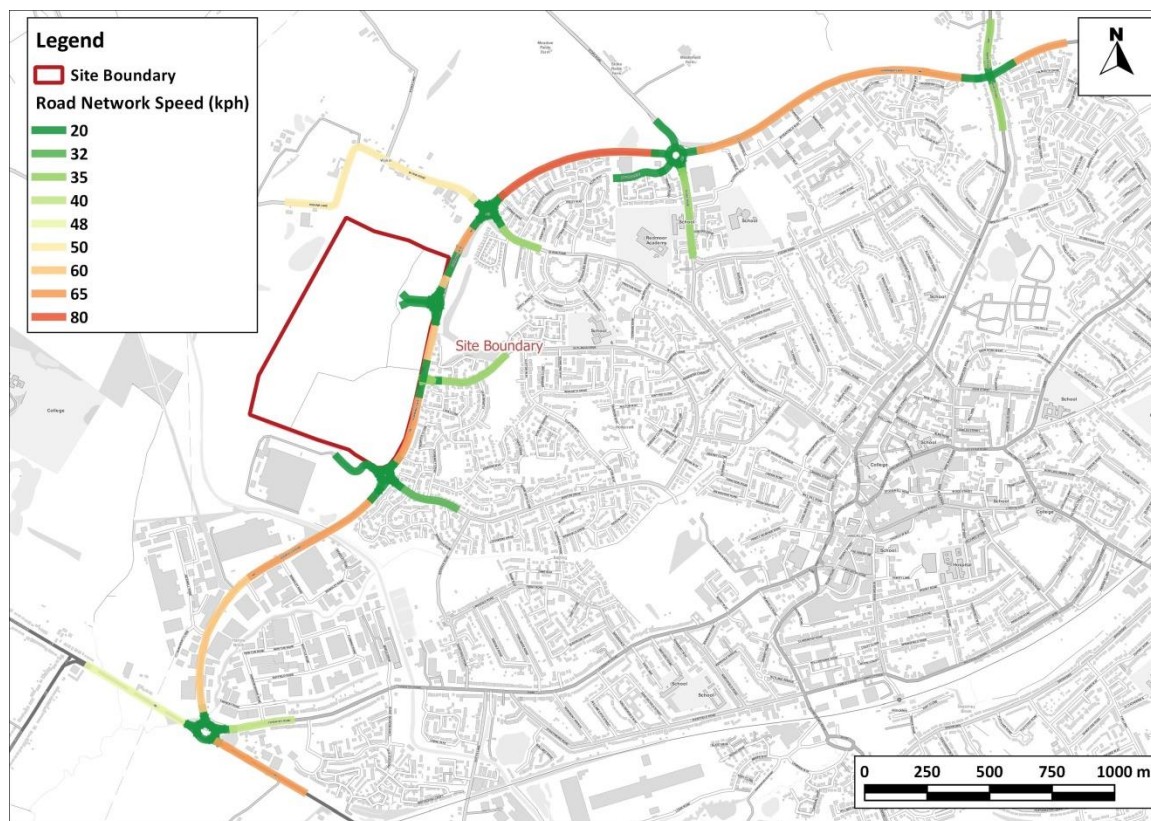


Figure A3.2: Modelled Road Speeds (kph)

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Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

A3.9 As explained in Section 3, AQC has carried out a detailed analysis which showed that, where previous standards had limited on-road success in reducing nitrogen oxides emissions from diesel vehicles, the 'Euro VI' and 'Euro 6' standards are delivering real on-road improvements (AQC, 2016b). Furthermore, these improvements are expected to increase as the Euro 6 standard is fully implemented. Despite this, the detailed analysis suggested that, in addition to modelling using the EFT (V7.0), a sensitivity test using elevated nitrogen oxides emissions from certain diesel vehicles should be carried out (AQC, 2016b). A worst-case sensitivity test has thus been carried out by applying the adjustments set out in Table A3.2 to the emission factors used within the EFT², using AQC's CURED (V2A) tool (AQC, 2016a). The justifications for these adjustments are given in AQC (2016b). Results are thus presented for two scenarios: first the 'official prediction', which uses the EFT with no adjustment, and second the 'worst-case sensitivity test', which applies the

² All adjustments were applied to the COPERT functions. Fleet compositions etc. were applied following the same methodology as used within the EFT.

adjustments set out in Table A3.2. The results from this sensitivity test are likely to over-predict emissions from vehicles in the future and thus provide a reasonable worst-case upper-bound to the assessment.

Table A3.2: Summary of Adjustments Made to Defra's EFT (V7.0)

Vehicle Type		Adjustment Applied to Emission Factors
All Petrol Vehicles		No adjustment
Light Duty Diesel Vehicles	Euro 5 and earlier	No adjustment
	Euro 6	Increased by 78%
Heavy Duty Diesel Vehicles	Euro III and earlier	No adjustment
	Euro IV and V	Set to equal Euro III values
	Euro VI	Set to equal 20% of Euro III emissions ^a

^a Taking account of the speed-emission curves for different Euro classes as explained in AQC (2016b).

Background Concentrations

A3.10 The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2017a). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030. The background maps for 2015 have been calibrated against concurrent measurements from national monitoring sites. The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment year than that derived from the Defra maps (AQC, 2016c).

Background NO₂ Concentrations for Sensitivity Test

A3.11 The road-traffic components of nitrogen dioxide in the background maps have been uplifted in order to derive future year background nitrogen dioxide concentrations for use in the sensitivity test. Details of the approach are provided in the report prepared by AQC (2016c).

Model Verification

A3.12 In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements.

Background Concentrations

A3.13 Background concentrations of nitrogen dioxide for the verification sites have been taken from the national maps of background concentrations available from the Defra LAQM Support website (Defra, 2017a). The background concentrations for the verification sites are presented in Table A3.3.

A3.14 The 2015 background concentrations for the diffusion tube sites have been derived from the national maps, having been calculated using the same approach as described in Paragraph A3.9/A3.10. The background concentrations for each of the diffusion tube locations are presented in Table A3.3.

Table A3.3: Background Concentrations used in the Verification for 2015

Year	NO _x	NO ₂	PM ₁₀	PM _{2.5}
2015	27.4	18.8	16.2	11.7
2018 ^a	23.7	16.6	15.8	11.3
2018 Worst-case Sensitivity Test ^b	24.3	17.0	N/A	N/A
Objectives	-	40	40	25 ^c

N/A = not applicable.

^a In line with Defra's forecasts.

^b Assuming higher emissions from modern diesel vehicles as described in Appendix A3.

^c The PM_{2.5} objective, which is to be met by 2020, is not in Regulations and there is no requirement for local authorities to meet it.

Nitrogen Dioxide

A3.15 Most nitrogen dioxide (NO₂) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NO_x = NO + NO₂). The model has been run to predict the annual mean NO_x concentrations during 2015 at the Coventry Road diffusion tube monitoring site. Concentrations have been modelled at 2.5 m, the height of the monitor.

A3.16 The Coventry Road diffusion tube monitoring site was selected because it is the only roadside monitor in the study area. The diffusion tube monitors at Lester House and Weldon were not used for validation because of their location on building façades, away from the carriageway. In addition their setting by the A5 is less representative of conditions near the proposed development.

A3.17 The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x. Measured road-NO_x has been calculated from the measured NO₂ concentration and the predicted background NO₂ concentration using the NO_x from NO₂ calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2017a).

A3.18 An adjustment factor has been determined as the ratio of the 'measured' road contribution and the model derived road contribution. This factor has then been applied to the modelled road-NO_x concentration for each receptor to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO₂ concentration within the NO_x to NO₂ calculator (Defra, 2017a).

A3.19 The data used to calculate the adjustment factor are provided below:

- Measured NO₂ : 29.8 µg/m³
- Background NO₂ : 18.81 µg/m³
- 'Measured' road-NO_x (using NO_x from NO₂ calculator): 22.4 µg/m³
- Modelled road-NO_x = 14.1 µg/m³
- Road-NO_x adjustment factor: $22.4/14.1 = 1.5883^3$

A3.20 The factor implies that the unadjusted model is under-predicting the road-NO_x contribution. This is a common experience with this and most other road traffic emissions dispersion models.

Model Verification for NO_x and NO₂ Sensitivity Test

A3.21 The approach set out above has been repeated using the predicted road-NO_x and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 1.3512, which has been applied to all modelled road-NO_x concentrations within the sensitivity test.

PM₁₀ and PM_{2.5}

A3.22 There are no nearby PM₁₀ or PM_{2.5} monitors. It has therefore not been possible to verify the model for PM₁₀ or PM_{2.5}. No adjustment factor has been applied to the road-PM₁₀ concentration.

Model Post-processing

A3.23 The model predicts road-NO_x concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO₂, has been processed through the NO_x to NO₂ calculator available on the Defra LAQM Support website (Defra, 2017a). The traffic mix within the calculator has been set to "All urban UK traffic", which is considered suitable for the study area. The calculator predicts the component of NO₂ based on the adjusted road-NO_x and the background NO₂.

³ Based on un-rounded values.