MAGNA PARK Extension

HYBRID PLANNING APPLICATION:

15/01531/OUT

Update to Environmental Statement Chapter 10 – Air Quality

Volume 2: Update to ES Chapter 10

6 July 2017

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Hybrid Planning Application 15/01531/OUT

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Author/Amended by:	**Authorised by**	**Date:**	**Version:**
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10.1 Introduction

10.1.1 This Chapter describes the potential air quality effects associated with the proposed development of land immediately adjacent to, and linked to, Magna Park Lutterworth (MPL) (“The Magna Park Extension”). The assessment has been carried out by Air Quality Consultants Ltd on behalf of IDI-Gazeley Ltd (IDI-G). This Chapter provides an update to the Hybrid Application ES Chapter 10 that was published in September 2015. More specifically, this revised Chapter takes account of:

- new information that has come to light on the expected future emissions performance of road vehicles;
- new developments that have been granted planning permission (Land at Coventry Road (15/01665/OUT)) and are intended to be granted planning permission (Land south of Lutterworth Road (16/01288/OUT)), and which need to be considered with regard to potential cumulative effects in line with the request to Now Planning from HDC on 17 March 2017; and
- the grant of planning permission for the DHL Supply Chain Application (15/00919/FUL).

10.1.2 This Chapter considers the potential effects associated with the operation of the Proposed Development. An assessment of the potential construction dust effects was previously considered in the ES Chapter 10 (September 2015), and remains unchanged. The potential effects associated with construction traffic movements are explicitly considered in the operational effects, as the construction flows have been included into the relevant operational scenarios.

10.1.3 The Proposed Development comprises two zones. In air quality terms, the pertinent features of the proposals are:

Outline application (Zone 1), comprising:

- Distribution warehousing and ancillary office space (Classes B8 and B1a), up to 427,350 sq.m (including 100,844 sq. m for the DHL Supply Chain that has been granted planning approval);
- Class D1 and B1a, B1b uses, up to 11,000 sq.m;
- Innovation Centre, up to 2,325 sq.m; and
- New Site access arrangements, including a four-arm roundabout on Mere Lane (which formed part of the DHL Supply Chain Application) and a new roundabout on the A5 at the northern end of the Site.

Detailed Application (Zone 2), comprising:

- Rail freight shuttle terminal; and
- HGV Parking (140 spaces).

10.1.4 The Proposed Development lies close to an Air Quality Management Area (AQMA) declared by Harborough District Council (HDC) for exceedances of the annual mean nitrogen dioxide objective. The Proposed Development will lead to an increase in traffic on the local roads, which may impact on air quality at existing residential properties. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$).

10.1.5 This Chapter describes existing local air quality conditions and the predicted air quality in the future assuming that the proposed development does, or does not proceed. Three future-year scenarios have been considered, which are founded on the phasing programme for the proposed development. For each scenario, a worst-case assumption has been made regarding the rate of development (and thus, the incremental change to traffic generation) which represents a very conservative approach. The scenarios considered are:

- 2019 (Opening Year) – comprising Plots H, F, I and E (D2) (104,659 sq.m) to be developed over the period 2019 to 2021;
- 2022 (Interim Year) – comprising Plots E (B1), J and K (111,825 sq.m) to be developed over the period 2022 to 2024; and
- 2025 (Completion Year) – comprising Plots K and L (116,500 sq.m) to be developed over the period 2025 to 2026.

10.1.6 Within each scenario, the DHL Supply Chain development is assumed to be fully operational, and traffic associated with this component of the scheme is included in the relevant future baseline.

10.1.7 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with Harborough District Council (HDC) through a formal Scoping Opinion, a meeting with HDC (held on 6 April 2017) and a letter to HDC (dated 2 May 2017) setting out the approach to deal with requirements under Regulation 22(1) and (10) to provide further information.

10.2 Policy and Guidance

Air Quality Strategy

10.2.1 The Air Quality Strategy published by the Department for Environment, Food, and Rural Affairs (Defra) provides the policy framework (Defra, 2007) 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.

NPPF

10.2.2 National planning policy in England is contained within the National Planning Policy Framework (NPPF, 2012) which was published in March 2012. The specific policies of the NPPF that relate to issues of air quality are set out below.

10.2.3 Paragraph 17 states that "planning should contribute to conserving and enhancing the natural environment and reducing pollution".

10.2.4 Paragraph 109 states that "the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, unacceptable levels of air pollution".

10.2.5 Paragraph 124 states 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 cumulative impacts on air quality from individual sites in local areas".

PPG

10.2.6 In March 2014, the Government launched the Planning Practice Guidance (PPG) website (DCLG, 2017). The PPG is intended to be read alongside the NPPF and set out below is the guidance that is most relevant to consideration of air quality.

10.2.7 Part ID32 of the PPG gives more detailed guidance on the relevance of air quality to a planning decision. Paragraph 005 (ID: 32-005-20140306) identifies where air quality could be relevant to a planning decision. Considerations include changes in traffic in the vicinity of the proposed development site or further afield, introduction of new point sources of air pollution, construction phase impacts, and the impact on biodiversity. Paragraph 006 (ID: 32-006-20140306) states where there are concerns about the air quality, the local planning authority may want to know about the baseline local air quality, whether the proposed development could significantly change air quality, and/or whether there is likely to be a significant increase in the number of people exposed to the problem.

10.2.8 Paragraph 007 (ID: 32-007-20140306) states that assessments should be proportionate to the nature and scale of development proposed and the level of concern about air quality, and because of this are likely to be location specific. Paragraph 008 (ID: 32-008-20140306) identifies that should mitigation measures be necessary they need to be location specific and proportionate to the likely impact.

Core Strategy

10.2.9 Policy CS14 of the Harborough District Core Strategy (HDC, 2011) states that transport interventions associated with additional development in and around Lutterworth will focus on improving air quality and reducing the adverse impacts of traffic flows in the town centre. This will be achieved by measures including resisting development that would result in additional HGVs passing through the town centre, supporting routeing schemes for Magna Park and locating future HGV generating business development to the south of the town with good access to the M1, A4303 and A426.

Saved LP Policies

10.2.10 Policy EV/23 of the Harborough District Local Plan (HDC, 2007) states that, where appropriate, the Council will impose conditions on planning permission to ensure that development does not have an adverse effect on the character of its surroundings, or harm the amenities of nearby uses through air pollution.

Air Quality Action Plans

National Air Quality Plans

10.2.11 Defra has produced Air Quality Plans to reduce nitrogen dioxide concentrations in major cities throughout the UK (Defra, 2015). Following a High Court ruling in November 2016 (Royal Courts of Justice, 2016), Defra undertook to replace these Plans with a new Plan by 31st July 2017. To this end, Defra began consultation on its new draft Plan (Defra, 2017a) in May 2017. There is currently no practical way to take account of the effects of either of the existing Plans, or the new draft Plan, in relation to the assessment presented in this Chapter. This assessment has principally been carried out in relation to the air quality objectives, rather than the EU limit values that are the focus of the new draft Plan.

Local Air Quality Action Plan

10.2.12 HDC has published a revised Air Quality Action Plan (HDC, 2013) which sets out the methodology for the assessment of traffic management and road layout modification schemes for which funding may be attainable. It notes that measures short-listed for inclusion within the emerging Action Plan will be considered for their suitability on highways grounds, and identifies a number of key aims.

Assessment Criteria

Health Criteria

10.2.13 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, Statutory Instrument 928(2000) and the Air Quality (England) (Amendment) Regulations 2002, Statutory Instrument 3043(2002).

10.2.14 The objectives for nitrogen dioxide and PM_{10} 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 where the annual mean concentration is below 60 $\mu g/m^3$ (Defra, 2016b). Therefore, 1-hour nitrogen dioxide concentrations need only be considered if the annual mean concentration is above this level. Measurements have also shown that the 24-hour PM_{10} objective could be exceeded at roadside locations where the annual mean concentration is above 32 $\mu g/m^3$ (Defra, 2016b). The predicted annual mean PM_{10} concentrations are thus used as a proxy to determine the likelihood of an exceedance of the 24-hour mean PM_{10} objective. Where predicted annual mean concentrations are below 32 $\mu g/m^3$ it is unlikely that the 24-hour mean objective will be exceeded

10.2.15 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 PM_{10} are considered to apply at the façades of residential properties, schools, hospitals etc.; they do not apply at hotels. The 24-hour objective for PM_{10} 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.

10.2.16 The European Union has also set limit values for nitrogen dioxide, PM_{10} 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.

10.2.17 The relevant air quality criteria for this assessment are provided in Table 10.1.

Table 10.1 Air Quality Criteria for Nitrogen Dioxide, PM_{10} and $PM_{2.5}$

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour Mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles (PM_{10})	24-hour Mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year
	Annual Mean	40 $\mu g/m^3$
Fine Particles ($PM_{2.5}$) [a]	Annual Mean	25 $\mu g/m^3$

[a] 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.

10.3 Assessment Method

Baseline Conditions

10.3.1 Existing sources of emissions within the study area have been defined using a number of approaches. A site visit has been carried out to identify existing sources from a visual inspection of the area. Industrial and waste management sources that may affect the area have been identified using Defra's Pollutant Release and Transfer Register (Defra, 2017c) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2017). Local sources have also been identified through discussion with HDC's Regulatory Services, as well as through examination of the Council's Air Quality Review and Assessment reports.

10.3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers both the study area and nearby sites, the latter being used to provide context for the assessment. A 3-month monitoring survey (30 June – 22 September 2014) was also undertaken at sites along the A5 and A4303; the results of this survey are included within the assessment.

10.3.3 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, 2017d). These are the maps used by the UK Government, together with the results from national Automatic Urban and Rural Network (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 PM_{10} 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.

10.3.4 The background concentrations across the study area have been defined using the national pollution maps published by Defra (2017b). These cover the whole country on a 1x1 km grid.

Descriptors for Air Quality Impacts and Assessment of Significance

10.3.5 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 the Institute of Air Quality Management (IAQM) and Environmental Protection UK (Moorcroft and Barrowcliffe et al, 2017) has therefore been used.

10.3.6 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.

10.3.7 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 10.2 sets out the method for determining the impact descriptor for annual mean concentrations at individual receptors, having been adapted from the guidance document. For the assessment criterion, the term Air Quality Assessment Level or AQAL has been adopted; for this assessment, the AQAL will be the air quality objective value. Impacts may be adverse or beneficial, depending on whether the change in concentration is positive or negative.

10.3.8 It is important to differentiate between the terms "impact" and "effect" with respect to the assessment of air quality. The term impact is used to describe a change in pollutant concentration at a specific location. The term effect is used to describe an environmental response resulting from an impact, or series of impacts. Within this Chapter, the air quality assessment has used published guidance and criteria described in the following sections to determine the likely air quality impacts at a number of sensitive locations. The potential significance of effects has then been determined by professional judgement, based on the frequency, duration and magnitude of predicted impacts and their relationship to appropriate air quality objectives. The professional experience of the consultants is provided in Appendix 10.1.

Table 10.2: 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)'.

10.3.9 Judgement on the overall significance of the effect of the Proposed Development has taken into account factors such as:

- the existing and future air quality conditions without the Proposed Development;
- the extent of current and future population exposure to the impacts;
- the influence and validity of any assumptions adopted in 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 obviously not 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.

Assessment of Road Traffic Impacts

Sensitive Receptors

10.3.10 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations close to the Proposed Development[1]. The receptors have been located on the façades of the properties closest to the road sources. Fifteen existing residential properties have been identified as receptors for the assessment. These locations are described in Table 10.3 and are shown in Figure 10.1. In addition, concentrations have been modelled at sites where diffusion tube monitoring has been carried out for this assessment, in order to verify the modelled results (see Appendix 10.2 for verification method).

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[1] The Proposed Development will lead to small increase in non-HGV traffic through the Lutterworth AQMA (A426). For completeness, a separate sensitivity assessment has been carried out in Appendix 10.3.

Table 10.3 Description of Receptor Locations[a]

Receptor	Description
1	Residential property at Watling House, adjacent to the A5.
2	Residential property at Alma House, adjacent to the A5.
3	Residential property at Peach Tree Cottage, adjacent to the A5.
4	Residential property at Wibtoft Cottage, adjacent to the A5.
5	Residential property at White House Farm, adjacent to the A5.
7	Residential property at Wood Farm, adjacent to Coal Pit Lane.
8	Residential property at Walton Lodge Farm, adjacent to the B4027.
9	Residential property at 44 Lutterworth Road (B4027).
10	Residential property at 14 Lutterworth Road (B4027).
11	Residential property at 44 Coventry Road (B4027).
12	Residential property at Cross In Hand Farm, adjacent to the A5.
13	Residential property at Glebe Farm, adjacent to the A4303.
14	Residential property at Woodbrig House Farm, adjacent to the A4303.
15	Residential property at 56 Azalea Close, adjacent to Coventry Road.
16	Residential property at 11 Alexander Drive, near to the A4303.

[a] Receptors modelled at a height of 1.5 m

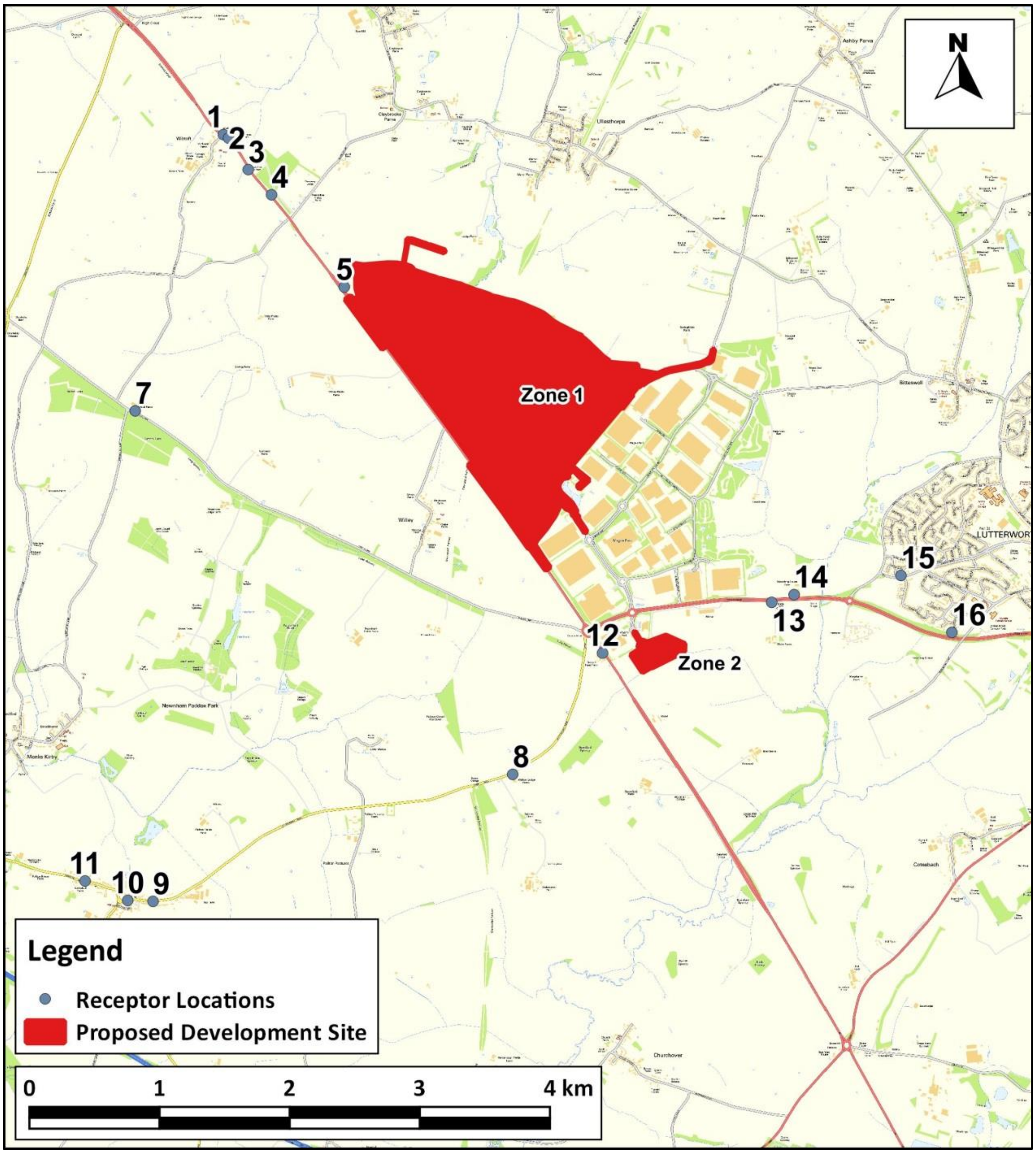

Figure 10.1 Receptor Locations and Proposed Development Site

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Assessment Scenarios

10.3.11 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out 2019, 2022 and 2025. For 2019, 2022 and 2025, predictions have been made assuming both that the development does proceed (With Development), and does not proceed (Without Development). 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

10.3.12 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs and the model verification are provided in Appendix 10.2, together with the method used to derive current and future year background nitrogen dioxide concentrations.

10.3.13 Traffic data for the assessment have been provided by Aecom, who have undertaken the Transport Assessment for the proposed development. Further details of the traffic data used in this assessment are provided in Appendix 10.2.

Uncertainty in Road Traffic Modelling Predictions

10.3.14 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.

10.3.15 An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix 10.2). This can only be done for the road traffic model.

10.3.16 Predicting pollutant concentrations in a future year will always be subject to some 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.

10.3.17 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, Beevers, Westmoreland, & Williams, 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 & 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 this Chapter.

10.3.18 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, Beevers, Westmoreland, & Williams, 2011) (Carslaw & Rhys-Tyler, 2013).

10.3.19 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 2013/16 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 Appendix 10.2, 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.

10.3.20 It must also be borne in mind that the predictions in 2019, 2022 and 2025 are based on worst-case assumptions regarding the increase in traffic flows, such that all committed developments are assumed to be fully operational, and that the phasing of the scheme is accelerated. This will have overestimated the traffic emissions and hence the concentrations in all scenarios.

10.4 Baseline Conditions

Air Quality Management Areas

10.4.1 In July 2006, HDC declared an Air Quality Management Area (AQMA) for exceedances of the annual mean nitrogen dioxide objective in Lutterworth town centre. Subsequent Review and Assessment reports confirmed the exceedance of the objective, and that an area to the south of the AQMA was also likely to be exceeding the annual mean objective for nitrogen dioxide. The Further Assessment (HDC, 2012) concluded that the AQMA needed to be extended, and in 2013 an Amendment Order was published. The AQMA currently incorporates the junction of George Street in Lutterworth, going south along Market Street and High street to the junction of Rugby Road, High Street and Stoney Hallow, along Rugby Road to the bridge over the River Swift.

10.4.2 Rugby Borough Council (RBC) has also declared an AQMA for exceedances of the annual mean objective for nitrogen dioxide. This area covers the whole urban area of Rugby, bounded by the southern boundary with Daventry District Council, the A5, M6, minor roads to the west of Long Lawford, A45 and M45. The RBC AQMA is approximately 5 km to the south of the application site and Lutterworth.

Industrial sources

10.4.3 A search of the UK Pollutant Release and Transfer Register (Defra, 2017c) and Environment Agency's 'what's in your backyard' (Environment Agency, 2017) websites did not identify any significant industrial or waste management sources that are likely to affect receptors in the vicinity of the proposed development, in terms of air quality.

Site Visit

10.4.4 A site visit was carried out on 30 June 2014. Other than road traffic, no significant sources of air pollution were identified.

Air Quality Monitoring

Monitoring Carried Out By Local Authorities

10.4.5 HDC does not operate any automatic monitoring stations. There is a national network (AURN) station close to Market Harborough, but this is a rural site and unlikely to be representative of general air quality conditions in the study area.

10.4.6 HDC operates a network of passive nitrogen dioxide monitoring sites across the District. These include a number of sites in Lutterworth, both within and outside of the AQMA (see Figure 10.2). There are additional sites in Walcote and Theddingworth, located on the A4304, approximately 1.7 and 12 km to the east of Lutterworth respectively. In 2015, HDC commissioned two new diffusion tube monitoring sites at properties on the A5 (at Alma House and White House Farm). In recent years, concentrations have only exceeded the objective at three sites in the Lutterworth AQMA (sites 01n, 24n and 26n). Outside the AQMA, concentrations are below the objective. A summary of the measured concentrations over the period 2012 to 2016 is shown in Table 10.4.

10.4.7 Diffusion tube monitoring is also carried out by Hinckley & Bosworth Borough Council, including two sites located along the A5, to the west of the M69. A summary of the measured concentrations over the period 2012 to 2015 is also shown in Table 10.4; levels have all been well below the objective.

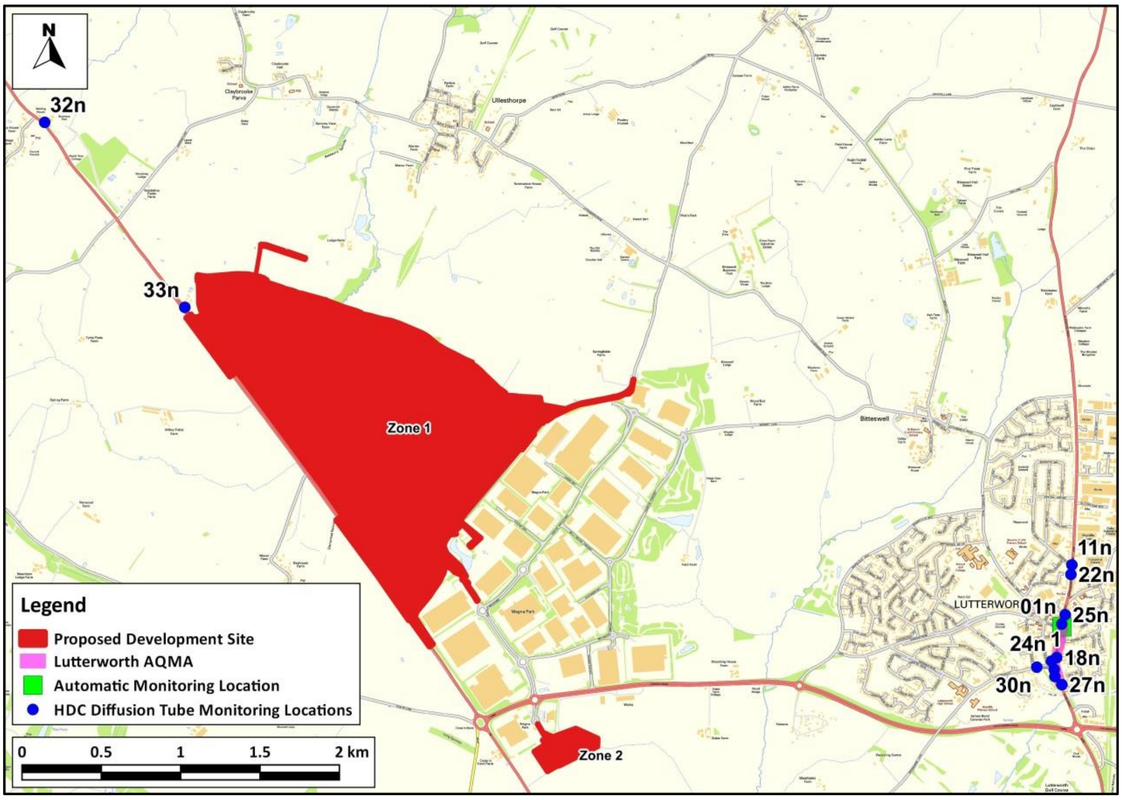

Figure 10.2 HDC Monitoring Locations and Lutterworth AQMA

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Table 10.4 Summary of Annual Mean Nitrogen Dioxide (NO_2) Monitoring (2012-2016) [a b]

Site No.	Site Type	Location	2012	2013	2014	2015	2016
Harborough DC - Lutterworth							
01n	R	Lutterworth Service Shop	**48.7**	**45.5**	39.8	**43.5**	**42.3**
11n	R	Day Nursery	34.8	36.2	35.8	36.1	37.1
18n	R	Jazz Hair	**43.3**	42.2	39.2	37.5	34.1
22n	R	77 Leicester Road	22.3	21.0	19.9	19.5	19.1
23n	R	6 The Terrace, Rugby Road	31.5	34.2	27.6	28.9	28.5
24n	R	4-9 Regent Road	**51.4**	**47.5**	38.8	**47.8**	**45.3**
25n	R	26 Market Street	31.1	37.8	34.9	34.4	29.6
26n	R	24 Rugby Road	**41.8**	**41.0**	**40.7**	**40.6**	39.0
27n	R	17 Rugby Road	33.9	32.9	29.8	32.3	29.8
Harborough DC – A5							
32n	R	Alma House, Watling Street	n/a	n/a	n/a	25.3	29.9
33n	R	White House Farm, Watling St	n/a	n/a	n/a	26.5	25.3
Harborough DC - Walcote							
16n	R	Walcote	24.5	23.8	21.4	22.4	19.1
Harborough DC - Theddingworth							
28n	R	Spencerdene Main St	23.3	19.3	21.1	19.4	19.8
29n	R	Homeside Main St	31.1	31.4	27.5	28.2	27.3
Hinckley & Bosworth BC							
4	F	Lester House (Façade)	28.0	24.4	26.8	25.9	n/a
5	F	Weldon (Façade)	28.0	23.6	24.2	23.4	n/a

Notes

K – Kerbside Site

R – Roadside Site

F – Building Façade Site

a Exceedances of the objective level are shown in bold.

b Diffusion tube data for Harborough has been provided by HDC. Diffusion tube data for Hinckley and Bosworth have been taken from the 2016 Air Quality Status Report (Hinckley & Bosworth BC, 2014).

Monitoring Carried Out for IDI-G

10.4.8 Three months of diffusion tube monitoring at six sites; three sites adjacent to the A5 and three sites near to the A4303 has been undertaken on behalf of IDI-G. At one of the sites next to the A4303 three diffusion tubes were collocated to test the consistency of the diffusion tube measurements. These were prepared and analysed by Gradko International. The results, which have been bias adjusted and annualised, are summarised in Table 10.5 and the monitoring locations are shown in Figure 10.3. The diffusion tube site locations and data adjustments were previously provided in Chapter 10: Appendix G4, G5 and G6, and are not reproduced. Measured concentrations at these monitoring locations have been used to verify the model predictions, as set in Appendix 10.2. Monitoring location 5 has been excluded from the model verification (see Appendix 10.2).

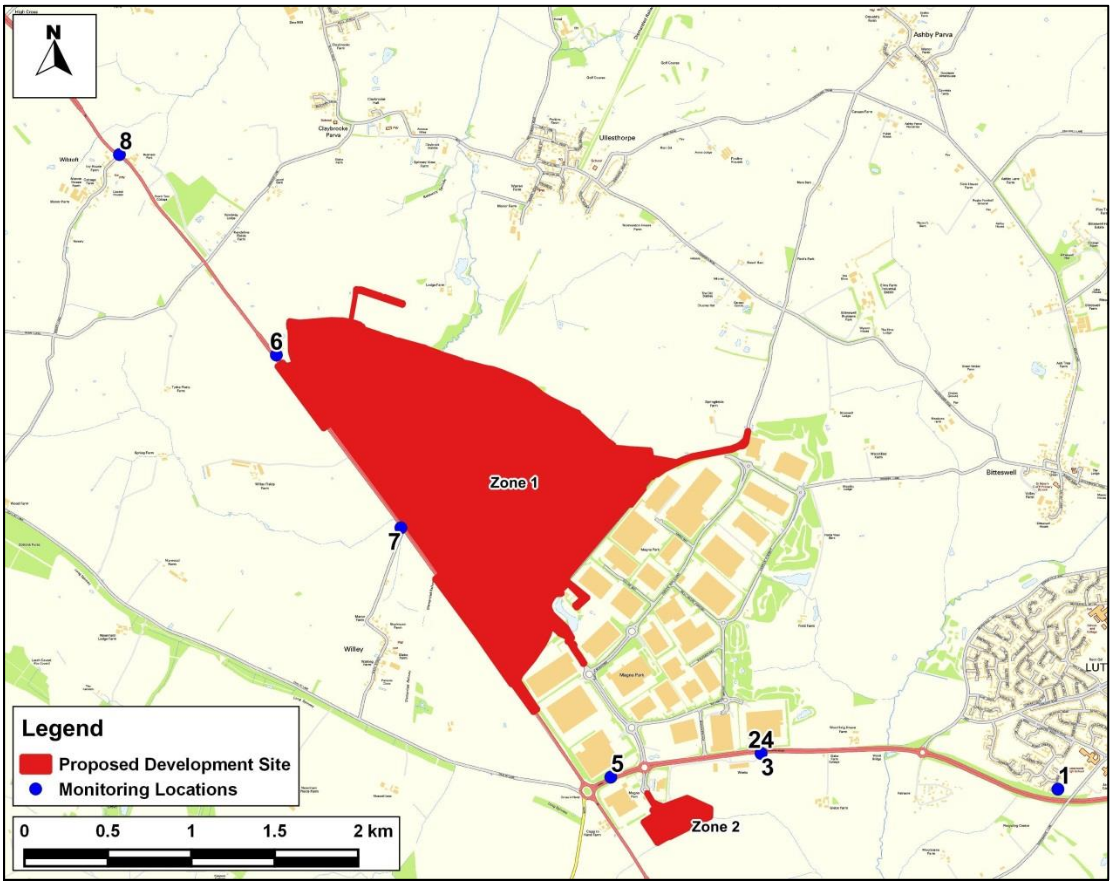

Figure 10.3 IDI-G Diffusion Tube Monitoring Locations

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Table 10.5 Monitored Nitrogen Dioxide Concentrations (μg/m^3)

Monitoring Location	Location	Annualised Concentration [a]
1	Alexander Drive, Near A4303	20.6
2, 3, 4	A4303, Near TT Electronics	**41.2** [b]
5	A4303, Near MPL	**94.0** [c]
6	A5, Near White House Farm	30.4
7	A5, Near Main Street	19.1
8	A5, Near Green Lane	**45.0**
Objective		**40**

[a] Exceedences of the objective are shown in bold.

[b] This is based on the average of triplicate tubes each month during the monitoring period.

[c] One tube was lost/stolen and therefore monitoring only took place over 2-months.

10.4.9 The measured annual mean nitrogen dioxide concentration exceeded the objective at two diffusion tube sites located alongside the A4303, where there is no relevant exposure. The objective is also exceeded at the diffusion tube site located at the kerbside of the A5 near to Green Lane, where there is relevant exposure (i.e. residential properties) nearby.

Background Concentrations

10.4.10 In addition to these locally measured concentrations, estimated background concentrations across the study area have been determined for 2014 (verification year) and the future years of 2019, 2022 and 2025 (Table 10.6). In the case of nitrogen dioxide, two sets of backgrounds are presented to take into account uncertainty in future year vehicle emission factors. The derivation of background concentrations is described in Appendix 10.2. The background concentrations are all well below the objectives.

Table 10.6 Estimated Annual Mean Background Pollutant Concentrations in 2014, 2019, 2022 and 2025 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2014	13.7 – 15.8	15.6 – 16.6	10.9 – 11.4
2019 [a]	10.7 – 12.2	14.7 – 15.8	10.2 – 10.7
2019 Worst-case sensitivity test [b]	11.0 – 12.8	n/a	n/a
2022 [a]	9.6 – 10.9	14.5 – 15.6	10.0 – 10.6
2022 Worst-case sensitivity test [b]	10.1 – 11.8	n/a	n/a
2025 [a]	8.8 – 10.0	14.4 – 15.5	9.9 – 10.5
2025 Worst-case sensitivity test [b]	9.5 – 11.2	n/a	n/a
Objectives	**40**	**40**	**25**

n/a= not applicable. The range of values is for the different 1 x 1 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 10.2

Exceedances of EU Limit Value

10.4.11 There are no AURN monitoring sites 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, 2017d), used to report exceedances of the limit value to the EU, do not identify any exceedances within the study area in 2015. Defra's mapping for 2020 and 2025, which takes account of the measures contained in its 2015 Air Quality Plan (Defra, 2015), also does not identify any exceedances within the study area. Defra is in the process of updating its air quality plan and associated modelling, but it has not yet published its revised maps.

Baseline Dispersion Model Results

10.4.12 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations (see Table 10.3 and Figure 10.1). The results, which cover the future year (2019, 2022 and 2025) baselines (Without Development), are set out in Table 10.7, Table 10.8 and Table 10.9. 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, PM_{10} and $PM_{2.5}$ have been increased from those predicted by the model based on a comparison with local measurements (see Appendix 10.2 for the verification methodology). The modelled road components of nitrogen oxides concentrations have been adjusted by a factor of 3.0999, which was derived during the model verification process (see Appendix 10.2 for details of the model verification). There are no nearby monitors that measured PM_{10} or $PM_{2.5}$ to verify the modelled results, and therefore the modelled components for particulate matter have also been adjusted by the same factor.

2019 Baseline

10.4.13 The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations. The predicted concentrations at Alma House (Receptor 2) and White House Farm (Receptor 5) are broadly comparable with HDC measured values at these locations in 2015 and 2016. All of the predictions for annual mean PM_{10} and $PM_{2.5}$ are well below the objectives. All annual mean PM_{10} concentrations are well below the threshold (32 $\mu g/m^3$) at which an exceedance of the daily mean objective is likely.

2019 Baseline Worst-case Sensitivity Test for Nitrogen Dioxide

10.4.14 The results from the upper-bound sensitivity test are not materially different from those derived using the “official” emissions forecasts, and all concentrations are below the objective.

2022 Baseline

10.4.15 The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations. All of the predictions for annual mean PM_{10} and $PM_{2.5}$ are well below the objectives. All annual mean PM_{10} concentrations are well below the threshold (32 $\mu g/m^3$) at which an exceedance of the daily mean objective is likely.

2022 Baseline Worst-case Sensitivity Test for Nitrogen Dioxide

10.4.16 The results from the upper-bound sensitivity test are not materially different from those derived using the “official” emissions forecasts, and all concentrations are below the objective.

2025 Baseline

10.4.17 The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations. All of the predictions for annual mean PM_{10} and $PM_{2.5}$ are well below the objectives. All annual mean PM_{10} concentrations are well below the threshold (32 $\mu g/m^3$) at which an exceedance of the daily mean objective is likely.

2025 Baseline Worst-case Sensitivity Test for Nitrogen Dioxide

10.4.18 The results from the upper-bound sensitivity test are not materially different from those derived using the “official” emissions forecasts, and all concentrations are below the objective.

Table 10.7 Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m^3) [a]

Receptor	2019[a]	2022[a]	2025[a]	Worst-case Sensitivity Test[b]		
				2019	2022	2025
1	30.7	25.3	22.2	32.9	28.8	26.6
2	28.6	23.7	20.9	30.7	26.9	24.8
3	24.5	20.4	18.1	26.3	23.1	21.4
4	27.5	22.8	20.1	29.4	25.8	23.8
5	21.0	17.7	15.7	22.4	19.8	18.4
7	14.9	13.1	11.9	15.0	13.9	13.1
8	12.9	11.3	10.3	13.1	12.0	11.3
9	16.2	14.0	12.5	16.4	15.0	14.1
10	22.3	18.8	16.5	21.9	19.9	18.6
11	18.8	16.0	14.2	18.7	17.0	15.9
12	22.0	18.1	15.9	23.6	20.4	18.8
13	19.3	16.1	14.3	20.8	18.2	16.8
14	20.3	16.9	15.0	22.0	19.2	17.6
15	18.5	16.2	14.5	18.3	17.1	16.2
16	18.4	15.4	13.7	19.9	17.4	16.0

a In line with Defra’s forecasts.
b Assumes higher emissions from diesel vehicles based on CURED emissions tool

Table 10.8 Modelled Baseline Annual Mean Concentrations of PM_{10} (µg/m^3)

Receptor	2019	2022	2025
1	19.9	19.8	19.8
2	19.4	19.3	19.2
3	18.5	18.3	18.2
4	19.2	19.0	18.9
5	17.9	17.7	17.7
7	15.9	15.7	15.6
8	15.2	15.0	14.9
9	16.0	15.8	15.7
10	17.1	16.9	16.7
11	16.0	15.7	15.6
12	17.3	17.2	17.1
13	17.0	16.8	16.7
14	17.3	17.1	16.9
15	15.9	15.7	15.5
16	17.1	16.9	16.8

While the annual mean PM_{10} objective is 40 µg/m^3, 32 µg/m^3 is the annual mean concentration above which an exceedance of the 24-hour mean PM_{10} concentration is possible, as outlined in LAQM.TG16 (Defra, 2016b). A value of 32 µg/m^3 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 10.9 Modelled Baseline Annual Mean Concentrations of $PM_{2.5}$ ($\mu g/m^3$)

Receptor	2019	2022	2025
1	13.3	12.2	12.9
2	13.0	12.0	12.6
3	12.4	11.6	12.1
4	12.8	11.9	12.5
5	12.0	11.4	11.7
7	10.9	10.6	10.6
8	10.5	10.2	10.2
9	11.0	10.6	10.6
10	11.6	11.0	11.2
11	11.0	10.5	10.7
12	11.7	11.0	11.4
13	11.5	10.9	11.2
14	11.7	11.0	11.3
15	11.0	10.6	10.7
16	11.6	11.0	11.2

10.5 Operational Effects and Mitigation

Potential Impacts

10.5.1 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are set out in Table 10.10, Table 10.11 and Table 10.12 for both the “Without Development” and “With Development” scenarios, for 2019, 2022 and 2025. These tables also describe the impacts at each receptor using the impact descriptors given in Table 10.2. For nitrogen dioxide, results are presented for two scenarios, so as to include a worst-case sensitivity test.

Nitrogen Dioxide

10.5.2 In 2019, the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the proposed development. The impacts are *negligible* at all receptors.

10.5.3 In 2022, the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the proposed development. The impacts are *negligible* at all receptors.

10.5.4 In 2025, annual mean concentrations of nitrogen dioxide are predicted to be well below the objective, with or without the proposed development. Based on the “official” emissions forecasts, the impacts are *negligible* at 11 receptors, and *slight adverse* at four receptors (all of which are located adjacent to the A5).

Nitrogen Dioxide Worst-case Sensitivity Test

10.5.5 Based on the worst-case sensitivity test, the annual mean nitrogen dioxide concentrations are below the objective at all receptors in 2019, 2022 and 2025, with and without the Proposed Development. In both 2019 and 2022, the impacts are *negligible* at all receptors, and the results are not materially different from the results based on the "official" emissions forecasts. In 2025, the impacts are predicted to be *moderate adverse* at one receptor (Watling House) and *slight adverse* at three other receptors (all adjacent to the A5).

PM_{10} and $PM_{2.5}$

10.5.6 The annual mean PM_{10} and $PM_{2.5}$ concentrations in 2019, 2022 and 2025 are well below the objectives at all receptors, with or without the Proposed Development. All predicted annual mean PM_{10} concentrations are below the threshold of 32 $\mu g/m^3$, and thus there is no likelihood that the daily mean objective will be exceeded.

10.5.7 The magnitudes of change are imperceptible at all receptors. Coupled with the concentrations all being well below the objective, the impacts are thus described as *negligible*.

Table 10.10 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2019 ($\mu g/m^3$)

Receptor	2019 Opening Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	30.7	31.2	Negligible	32.9	33.5	Negligible
2	28.6	29.2	Negligible	30.7	31.2	Negligible
3	24.5	24.9	Negligible	26.3	26.7	Negligible
4	27.5	27.9	Negligible	29.4	29.9	Negligible
5	21.0	21.3	Negligible	22.4	22.7	Negligible
7	14.9	15.1	Negligible	15.0	15.2	Negligible
8	12.9	13.0	Negligible	13.1	13.3	Negligible
9	16.2	16.5	Negligible	16.4	16.6	Negligible
10	22.3	23.1	Negligible	21.9	22.6	Negligible
11	18.8	19.3	Negligible	18.7	19.1	Negligible
12	22.0	22.4	Negligible	23.6	24.0	Negligible
13	19.3	19.8	Negligible	20.8	21.4	Negligible
14	20.3	20.9	Negligible	22.0	22.7	Negligible
15	18.5	18.8	Negligible	18.3	18.5	Negligible
16	18.4	18.8	Negligible	19.9	20.4	Negligible
Objective	**40**		-	**40**		-

a In line with Defra's "official" forecasts on emissions

b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool

c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.11 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2022 ($\mu g/m^3$)

Receptor	2022 Interim Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	25.3	26.2	Negligible	28.8	29.8	Negligible
2	23.7	24.5	Negligible	26.9	27.8	Negligible
3	20.4	21.1	Negligible	23.1	23.8	Negligible
4	22.8	23.5	Negligible	25.8	26.6	Negligible
5	17.7	18.2	Negligible	19.8	20.4	Negligible
7	13.1	13.5	Negligible	13.9	14.3	Negligible
8	11.3	11.6	Negligible	12.0	12.3	Negligible
9	14.0	14.5	Negligible	15.0	15.5	Negligible
10	18.8	20.0	Negligible	19.9	21.1	Negligible
11	16.0	16.9	Negligible	17.0	17.8	Negligible
12	18.1	18.6	Negligible	20.4	21.0	Negligible
13	16.1	16.8	Negligible	18.2	19.1	Negligible
14	16.9	17.8	Negligible	19.2	20.3	Negligible
15	16.2	16.7	Negligible	17.1	17.6	Negligible
16	15.4	16.1	Negligible	17.4	18.2	Negligible
Objective	**40**		-	**40**		-

a In line with Defra’s “official” forecasts on emissions

b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool

c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.12 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2025 ($\mu g/m^3$)

Receptor	2025 Completion Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	22.2	25.5	Slight Adverse	26.6	30.6	Moderate Adverse
2	20.9	23.8	Slight Adverse	24.8	28.5	Slight Adverse
3	18.1	20.3	Slight Adverse	21.4	24.2	Slight Adverse
4	20.1	22.8	Slight Adverse	23.8	27.2	Slight Adverse
5	15.7	17.4	Negligible	18.4	20.5	Negligible
7	11.9	12.3	Negligible	13.1	13.6	Negligible
8	10.3	10.6	Negligible	11.3	11.6	Negligible
9	12.5	13.1	Negligible	14.1	14.7	Negligible
10	16.5	17.9	Negligible	18.6	20.2	Negligible
11	14.2	15.2	Negligible	15.9	17.0	Negligible
12	15.9	16.4	Negligible	18.8	19.5	Negligible
13	14.3	15.2	Negligible	16.8	17.9	Negligible
14	15.0	16.0	Negligible	17.6	19.0	Negligible
15	14.5	15.1	Negligible	16.2	16.8	Negligible
16	13.7	14.5	Negligible	16.0	17.1	Negligible
Objective	**40**		-	**40**		-

a In line with Defra's "official" forecasts on emissions

b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool

c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.13 Predicted Annual Mean PM$_{10}$ Impacts (µg/m^3)

Receptor	2019			2022			2025		
	Without Dev	With Dev	Impact Descriptor[a]	Without Dev	With Dev	Impact Descriptor[a]	Without Dev	With Dev	Impact Descriptor[a]
1	19.9	20.1	Negligible	19.8	20.1	Negligible	19.8	21.0	Negligible
2	19.4	19.6	Negligible	19.3	19.5	Negligible	19.2	20.4	Negligible
3	18.5	18.6	Negligible	18.3	18.5	Negligible	18.2	19.1	Negligible
4	19.2	19.3	Negligible	19.0	19.2	Negligible	18.9	20.0	Negligible
5	17.9	18.0	Negligible	17.7	17.9	Negligible	17.7	18.3	Negligible
7	15.9	16.0	Negligible	15.7	15.8	Negligible	15.6	15.7	Negligible
8	15.2	15.2	Negligible	15.0	15.1	Negligible	14.9	15.0	Negligible
9	16.0	16.1	Negligible	15.8	15.9	Negligible	15.7	15.8	Negligible
10	17.1	17.3	Negligible	16.9	17.1	Negligible	16.7	17.1	Negligible
11	16.0	16.1	Negligible	15.7	15.9	Negligible	15.6	15.9	Negligible
12	17.3	17.4	Negligible	17.2	17.3	Negligible	17.1	17.3	Negligible
13	17.0	17.1	Negligible	16.8	17.0	Negligible	16.7	17.0	Negligible
14	17.3	17.4	Negligible	17.1	17.3	Negligible	16.9	17.3	Negligible
15	15.9	15.9	Negligible	15.7	15.8	Negligible	15.5	15.7	Negligible
16	17.1	17.3	Negligible	16.9	17.2	Negligible	16.8	17.1	Negligible
Objective	**40**		**-**	**40**		**-**	**40**		**-**

a The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.14 Predicted Annual Mean $PM_{2.5}$ Impacts (µg/m^3)

Receptor	2019			2022			2025		
	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor
1	13.3	13.3	Negligible	12.2	13.2	Negligible	12.9	13.6	Negligible
2	13.0	13.0	Negligible	12.0	12.9	Negligible	12.6	13.3	Negligible
3	12.4	12.4	Negligible	11.6	12.3	Negligible	12.1	12.5	Negligible
4	12.8	12.9	Negligible	11.9	12.7	Negligible	12.5	13.1	Negligible
5	12.0	12.0	Negligible	11.4	11.9	Negligible	11.7	12.1	Negligible
7	10.9	10.9	Negligible	10.6	10.7	Negligible	10.6	10.7	Negligible
8	10.5	10.5	Negligible	10.2	10.3	Negligible	10.2	10.2	Negligible
9	11.0	11.0	Negligible	10.6	10.8	Negligible	10.6	10.7	Negligible
10	11.6	11.7	Negligible	11.0	11.5	Negligible	11.2	11.5	Negligible
11	11.0	11.1	Negligible	10.5	10.9	Negligible	10.7	10.8	Negligible
12	11.7	11.7	Negligible	11.0	11.6	Negligible	11.4	11.5	Negligible
13	11.5	11.6	Negligible	10.9	11.4	Negligible	11.2	11.4	Negligible
14	11.7	11.7	Negligible	11.0	11.6	Negligible	11.3	11.5	Negligible
15	11.0	11.1	Negligible	10.6	10.9	Negligible	10.7	10.8	Negligible
16	11.6	11.6	Negligible	11.0	11.5	Negligible	11.2	11.4	Negligible
Objective	**25**		-	**25**		-	**25**		-

a The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Significance of Predicted Effects

10.5.8 The operational air quality effects in 2019, 2022 and 2025 are judged to be not significant. This professional judgement is made in accordance with the methodology set out in Paragraph 10.3.9, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. 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.

10.5.9 More specifically, the judgement that the air quality effects will be *not significant* takes account of the conclusions that:

- concentrations are predicted to be below the objectives in 2019, 2022 and 2025 at all receptors, with or without the Proposed Development;
- impacts associated with both PM_{10} and $PM_{2.5}$ are negligible at all receptor locations;
- impacts associated with nitrogen dioxide are *negligible* at all receptor locations in both 2019 and 2022. In 2025, for the worst-case sensitivity test, a *moderate adverse* impact is predicted at one receptor (Watling House) and *slight adverse* at three other receptors (all adjacent to the A5). However, concentrations are predicted to be well below the objective, and the assessment is founded on the assumption that the traffic associated with all committed developments is on the road in 2025, and an accelerated phasing of the Proposed Development; this, together with the worst-case sensitivity test is likely to have overstated the impacts.

Proposed Mitigation

10.5.10 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. The Council's Air Quality Action Plan will also be helping to deliver improved air quality.

10.5.11 The agreed routing arrangement for the DHL scheme, which requires all HGVs to use the strategic and primary road networks only (thus prohibiting all HGVs from driving through the Lutterworth AQMA) will be enforced for all elements of the Hybrid scheme. This enforcement will be based on the use of ANPR cameras, and financial penalties imposed on both HGV drivers and operating companies in breach of the agreement (subject to final approval by HDC).

10.5.12 The A426/A4303 improvement scheme, which will be delivered under the consented DHL scheme, is expected to reduce congestion at this junction. This will be beneficial in increasing vehicle speeds and reducing emissions, further reducing pollutant concentrations along the arms of this junction.

10.5.13 The Framework Travel Plan (FTP) that has been submitted in support of the planning application for the Hybrid scheme, sets out a number of measures that will encourage employees to make sustainable transport choices; this is expected to result in a reduction in single occupancy car use, and play a major role in reducing both total vehicle kilometres and total emissions. The benefits of the FTP have not been accounted for within this assessment.

10.6 Residual Effects

Operational

10.6.1 The residual impacts will be the same as those identified above in Section 10.5.

10.7 Cumulative Effects

10.7.1 The predicted operational air quality effects are based on traffic data that includes all local committed developments. Therefore, the predicted concentrations presented in this assessment include all cumulative effects.

Other Developments Accounted

10.7.2 On 5 June 2015, a planning application was submitted by db symmetry for the development of a strategic logistics park (Symmetry Park) on land to the south of Magna Park. The application has not yet been determined, and as such, this development was not included in the list of committed developments. However, for completeness, a sensitivity test has been carried out which considers the potential combined effects of the proposed Hybrid scheme and Symmetry Park. Traffic data associated with Symmetry Park have been provided by Aecom and have been added to the 2019, 2022 and 2025 With Development scenarios. In addition, the proposed new roundabout on the A4303, which would link the access road to the Symmetry Park site, has also been included. The results are shown in Table 10.15 to Table 10.19.

Nitrogen Dioxide

10.7.3 In 2019, the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the Proposed Development (including Symmetry Park). The impacts are *negligible* at most receptors, but *slight adverse* at two receptors; R1 adjacent to the A5 and at Woodbrigg House Farm (R14) adjacent to the A4303; the latter is close to the new roundabout/access road to Symmetry Park, with the impact driven by this new junction.

10.7.4 In 2022, the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the Proposed Development (including Symmetry Park). *Slight adverse* impacts are predicted at Woodbrigg Farm (R14) and Glebe Farm (R13).

10.7.5 In 2025, annual mean concentrations of nitrogen dioxide are predicted to be well below the objective, with or without the Proposed Development (including Symmetry Park). *Slight adverse* impacts are predicted at four receptors adjacent to the A5 (R1, R2, R3 and R4) and at Woodbrigg Farm (R14).

Nitrogen Dioxide Worst-case Sensitivity Test

10.7.6 For the worst-case sensitivity test, the annual mean nitrogen dioxide concentrations are below the objective at all receptors in 2019, 2022 and 2025, with and without the Proposed Development (including Symmetry Park). In both 2019 and 2022, the results are not materially different from the results based on the “official” emissions forecasts. In 2025, the impacts are predicted to be *moderate adverse* at three receptors, all adjacent to the A5, and *slight adverse* at four other receptors.

PM_{10} and $PM_{2.5}$

10.7.7 The annual mean PM_{10} and $PM_{2.5}$ concentrations in 2019, 2022 and 2025 are well below the objectives at all receptors, with or without the Proposed Development (including Symmetry

Park). All predicted annual mean PM_{10} concentrations are below the threshold of 32 µg/m^3, and thus there is no likelihood that the daily mean objective will be exceeded.

Table 10-15 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m³) – With Development + Symmetry Park - 2019

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	30.7	31.9	Slight Adverse	32.9	34.2	Slight Adverse
2	28.6	29.7	Negligible	30.7	31.9	Slight Adverse
3	24.5	25.4	Negligible	26.3	27.2	Negligible
4	27.5	28.5	Negligible	29.4	30.5	Slight Adverse
5	21.0	21.7	Negligible	22.4	23.2	Negligible
7	14.9	15.5	Negligible	15.0	15.6	Negligible
8	12.9	13.1	Negligible	13.1	13.4	Negligible
9	16.2	16.6	Negligible	16.4	16.8	Negligible
10	22.3	23.5	Negligible	21.9	23.0	Negligible
11	18.8	19.6	Negligible	18.7	19.4	Negligible
12	22.0	22.9	Negligible	23.6	24.7	Negligible
13	19.3	21.3	Negligible	20.8	22.9	Negligible
14	20.3	24.4	Slight Adverse	22.0	24.5	Slight Adverse
15	18.5	19.3	Negligible	18.3	19.0	Negligible
16	18.4	19.5	Negligible	19.9	21.2	Negligible
Objective	**40**			**40**		-

[a] In line with Defra's "official emissions" forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described within the CURED tool.

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10-16 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m^3) – With Development + Symmetry Park - 2022

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	25.3	27.1	Negligible	28.8	31.0	Slight Adverse
2	23.7	25.3	Negligible	26.9	28.9	Negligible
3	20.4	21.7	Negligible	23.1	24.6	Negligible
4	22.8	24.3	Negligible	25.8	27.6	Negligible
5	17.7	18.6	Negligible	19.8	21.0	Negligible
7	13.1	13.9	Negligible	13.9	14.9	Negligible
8	11.3	11.7	Negligible	12.0	12.4	Negligible
9	14.0	14.7	Negligible	15.0	15.7	Negligible
10	18.8	20.5	Negligible	19.9	21.7	Negligible
11	16.0	17.2	Negligible	17.0	18.2	Negligible
12	18.1	19.3	Negligible	20.4	22.0	Negligible
13	16.1	18.3	Slight Adverse	18.2	20.8	Slight Adverse
14	16.9	20.3	Slight Adverse	19.2	22.3	Slight Adverse
15	16.2	17.3	Negligible	17.1	18.3	Negligible
16	15.4	16.9	Negligible	17.4	19.3	Negligible
Objective	**40**			**40**		-

[a] In line with Defra's "official emissions" forecasts.

[b] Assuming higher emissions from modern diesel vehicles with the CURED tool.

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10-17 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m³) – With Development + Symmetry Park - 2025

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	22.2	26.2	Slight Adverse	26.6	31.5	Moderate Adverse
2	20.9	24.4	Slight Adverse	24.8	29.3	Moderate Adverse
3	18.1	20.8	Slight Adverse	21.4	24.9	Slight Adverse
4	20.1	23.4	Slight Adverse	23.8	28.0	Moderate Adverse
5	15.7	17.8	Negligible	18.4	21.1	Slight Adverse
7	11.9	12.7	Negligible	13.1	14.2	Negligible
8	10.3	10.7	Negligible	11.3	11.8	Negligible
9	12.5	13.2	Negligible	14.1	14.9	Negligible
10	16.5	18.3	Negligible	18.6	20.7	Negligible
11	14.2	15.4	Negligible	15.9	17.3	Negligible
12	15.9	17.0	Negligible	18.8	20.3	Negligible
13	14.3	16.2	Negligible	16.8	19.3	Slight Adverse
14	15.0	17.3	Slight Adverse	17.6	20.3	Slight Adverse
15	14.5	15.5	Negligible	16.2	17.4	Negligible
16	13.7	15.2	Negligible	16.0	18.0	Negligible
Objective	**40**			**40**		-

[a] In line with Defra's "official emissions" forecasts.

[b] Assuming higher emissions from modern diesel vehicles with the CURED tool

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.13 Predicted Annual Mean PM_{10} Impacts ($\mu g/m^3$) – With Development + Symmetry Park

Receptor	2019			2022			2025		
	Without Dev	With Dev + symmetry park	Impact Descriptor	Without Dev	With Dev + symmetry park	Impact Descriptor	Without Dev	With Dev + symmetry park	Impact Descriptor
1	19.9	20.2	Negligible	19.8	20.4	Negligible	19.8	21.3	Negligible
2	19.4	19.7	Negligible	19.3	19.8	Negligible	19.2	20.6	Negligible
3	18.5	18.7	Negligible	18.3	18.7	Negligible	18.2	19.3	Negligible
4	19.2	19.4	Negligible	19.0	19.5	Negligible	18.9	20.2	Negligible
5	17.9	18.1	Negligible	17.7	18.0	Negligible	17.7	18.4	Negligible
7	15.9	16.0	Negligible	15.7	16.0	Negligible	15.6	15.9	Negligible
8	15.2	15.3	Negligible	15.0	15.1	Negligible	14.9	15.0	Negligible
9	16.0	16.1	Negligible	15.8	16.0	Negligible	15.7	15.9	Negligible
10	17.1	17.3	Negligible	16.9	17.3	Negligible	16.7	17.3	Negligible
11	16.0	16.1	Negligible	15.7	16.0	Negligible	15.6	16.0	Negligible
12	17.3	17.5	Negligible	17.2	17.6	Negligible	17.1	17.5	Negligible
13	17.0	17.4	Negligible	16.8	17.4	Negligible	16.7	17.4	Negligible
14	17.3	17.2	Negligible	17.1	17.3	Negligible	16.9	17.2	Negligible
15	15.9	16.0	Negligible	15.7	15.9	Negligible	15.5	15.9	Negligible
16	17.1	17.4	Negligible	16.9	17.4	Negligible	16.8	17.4	Negligible
Objective	**40**		-	**40**		-	**40**		-

Table 10.14 Predicted Annual Mean $PM_{2.5}$ Impacts ($\mu g/m^3$)

Receptor	2019			2022			2025		
	Without Dev	With Dev + symmetry park	Impact Descriptor	Without Dev	With Dev + symmetry park	Impact Descriptor	Without Dev	With Dev + symmetry park	Impact Descriptor
1	13.3	13.4	Negligible	12.2	13.4	Negligible	12.9	13.8	Negligible
2	13.0	13.1	Negligible	12.0	13.0	Negligible	12.6	13.4	Negligible
3	12.4	12.5	Negligible	11.6	12.4	Negligible	12.1	12.7	Negligible
4	12.8	12.9	Negligible	11.9	12.9	Negligible	12.5	13.2	Negligible
5	12.0	12.1	Negligible	11.4	12.0	Negligible	11.7	12.1	Negligible
7	10.9	10.9	Negligible	10.6	10.8	Negligible	10.6	10.7	Negligible
8	10.5	10.5	Negligible	10.2	10.3	Negligible	10.2	10.2	Negligible
9	11.0	11.0	Negligible	10.6	10.8	Negligible	10.6	10.7	Negligible
10	11.6	11.7	Negligible	11.0	11.6	Negligible	11.2	11.5	Negligible
11	11.0	11.1	Negligible	10.5	10.9	Negligible	10.7	10.9	Negligible
12	11.7	11.8	Negligible	11.0	11.7	Negligible	11.4	11.6	Negligible
13	11.5	11.7	Negligible	10.9	11.7	Negligible	11.2	11.6	Negligible
14	11.7	11.6	Negligible	11.0	11.6	Negligible	11.3	11.5	Negligible
15	11.0	11.1	Negligible	10.6	11.0	Negligible	10.7	10.9	Negligible
16	11.6	11.7	Negligible	11.0	11.6	Negligible	11.2	11.5	Negligible
Objective	**25**		-	**25**		-	**25**		-

Significance of Predicted Effects With Symmetry Park

10.7.8 The operational air quality effects in 2019, 2022 and 2025 are judged to be not significant. This professional judgement is made in accordance with the methodology set out in Paragraph 10.3.9, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. 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.

10.7.9 More specifically, the judgement that the air quality effects will be *not significant* takes account of the conclusions that:

- concentrations are predicted to be below the objectives in 2019, 2022 and 2025 at all receptors, with or without the Proposed Development (including Symmetry Park);
- impacts associated with both PM_{10} and $PM_{2.5}$ are negligible at all receptor locations;
- in 2025, for the worst-case sensitivity test, *moderate adverse* impacts are predicted at three receptors adjacent to the A5. However, concentrations are predicted to be well below the objective, and the assessment is founded on the assumption that the traffic associated with all committed developments and an accelerated phasing of the Proposed Development and Symmetry Park is on the road in 2025; this, together with the worst-case sensitivity test is likely to have overstated the impacts.

10.8 Conclusions

10.8.1 The operational impacts arising from the additional traffic on local roads, due to the Hybrid scheme, have been assessed. Concentrations have been modelled for 15 worst-case receptors, representing existing properties where impacts are expected to be greatest. In the case of nitrogen dioxide, a sensitivity test has been applied to all scenarios; this is to allow for uncertainty over emission factors for nitrogen oxides identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011).

10.8.2 The proposed Hybrid scheme will increase traffic volumes on local roads. These changes will lead to an increase in concentrations of PM_{10} and $PM_{2.5}$ at all existing receptors, but all levels are predicted to be well below the objectives, and the impacts will all be *negligible*.

10.8.3 In the case of nitrogen dioxide, annual mean concentrations are predicted to be well below the air quality objective, with or without the Proposed Development in all scenarios that have been assessed. Assuming the worst-case sensitivity test, the impacts are predicted to be *negligible* at all receptors in both 2019 (Opening Year) and 2022 (Interim Year). In 2025 (Completion Year) there is a *moderate adverse* impact predicted at one receptor (Watling House) and *slight adverse* impacts predicted at three other receptors adjacent to the A5, based on the worst-case sensitivity test.

10.8.4 The overall operational air quality effects of the Hybrid scheme 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 nitrogen dioxide concentrations being below the annual mean objective in 2019, 2022 and 2025 at all receptors. Whilst *slight* to *moderate adverse* impacts are identified in 2025, these are limited to a small number of locations, and the assessment is founded on conservative assumptions regarding traffic generation, such that all committed schemes are fully operational, and there is an accelerated phasing of the Hybrid scheme.

10.8.5 It is concluded that there are no air quality constraints to the Hybrid scheme, and that it is consistent with all relevant national and local policies.

10.8.6 An additional sensitivity test has been carried out which considers the potential combined effects of the proposed Hybrid scheme and symmetry park, which will generate higher volumes of traffic on the local road network. These changes will lead to an increase in concentrations of PM_{10} and $PM_{2.5}$ at all existing receptors, but all levels are predicted to be well below the objectives, and the impacts will all be *negligible*.

10.8.7 In the case of nitrogen dioxide, annual mean concentrations are predicted to be well below the air quality objective, with or without the Hybrid scheme + Symmetry Park, in all scenarios that have been assessed. In 2019 (Opening Year), *slight adverse* impacts are predicted at a small number of receptors close to the A5, and close to the new access junction to Symmetry Park, on the A4303. In 2025 (Completion Year) there is a *moderate adverse* impact predicted at three receptors adjacent to the A5, and *slight adverse* impacts predicted at four other receptors, based on the worst-case sensitivity test.

10.8.8 The overall operational effects of the combined schemes are judged to be not significant, for the reasons identified in Paragraph 10.8.4 above.

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List of Technical Appendices

Appendix 10.1: Professional Experience
Appendix 10.2: Modelling Methodology

APPENDIX 10.1

PROFESSIONAL EXPERIENCE

Stephen Moorcroft, BSc (Hons) MSc DIC MIEnvSc MIAQM CEnv

Mr Moorcroft is a Director of Air Quality Consultants, and has worked for the company since 2004. He has over thirty-five years' postgraduate experience in environmental sciences. Prior to joining Air Quality Consultants, he was the Managing Director of Casella Stanger, with responsibility for a business employing over 100 staff and a turnover of £12 million. He also acted as the Business Director for Air Quality services, with direct responsibility for a number of major Government projects. He has considerable project management experience associated with Environmental Assessments in relation to a variety of development projects, including power stations, incinerators, road developments and airports, with particular experience related to air quality assessment, monitoring and analysis. He has contributed to the development of air quality management in the UK, and has been closely involved with the LAQM process since its inception. He has given expert evidence to numerous public inquiries, and is frequently invited to present to conferences and seminars. He is a Member of the Institute of Air Quality Management.

Dr Austin Cogan, MPhys (Hons) PhD MIEnvSc MIAQM

Dr Cogan has over eight years' experience in environmental sciences, is a Senior Consultant with AQC and has over four years' experience in the fields of air quality modelling, monitoring and assessment, having been involved in over 200 projects. Prior to this he studied at the University of Leicester, gaining 2 years' experience of scientific instrument design and spent 4 years' pioneering research in satellite observations of carbon dioxide, including data validation, model comparisons, bias correction and software development. He has since been involved in air quality, odour and climate change assessments of residential and commercial developments, road schemes, airports, waste management processes, and industrial processes. Dr Cogan has also been involved in the analysis and interpretation of air quality data and the preparation of review and assessment reports for local authorities. He has also undertaken a number of large scale modelling projects for local authorities investigating the impacts of action plan measures and Local Plan development, using the outputs from microsimulation models to assess the air quality impacts at relevant locations. Dr Cogan has published seven scientific papers and given numerous presentations at conferences. He is also a Member of the Institute of Air Quality Management.

Dr Frances Marshall, MSci PhD

Dr Marshall is an Assistant Consultant with AQC, having joined the company in September 2016. She is currently gaining experience of undertaking air quality assessments, including the use of dispersion modelling. Prior to joining AQC, Frances spent four years carrying out postgraduate research into atmospheric aerosols at the University of Bristol.

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

APPENDIX 10.2

MODELLING METHODOLOGY

Background Concentrations

1. The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2017b). These cover the whole country on a 1x1 km grid and are published for each year from 2013 until 2030. The background maps for 2014 have been calibrated against concurrent measurements from national monitoring. The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment years than those derived from the Defra maps (AQC, 2016c).

Background NO_2 Concentrations for Sensitivity Test

2. 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 Inputs

Road Traffic

3. 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 and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 7.0) published by Defra (2017b).
4. The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2014). The meteorological data has been taken from the monitoring station located at Church Lawford, which is considered suitable for this area.
5. AADT flows, speeds and the proportions of HDVs, for roads affected by the proposed development have been provided by Aecom. Traffic speeds have been based on those provided, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table 10.2.1 and Table G3.2[3].
6. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (2015).
7. Figure 10.2.1 shows the road network, including the additional roundabout planned for access to Symmetry Park, included within the model and defines the study area.

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[3] In each scenario, the Without Scheme flows include all committed developments (including DHL), the With Scheme flows include the Hybrid scheme operational and construction traffic flows, and the Sensitivity Test scenario includes traffic associated with both the Hybrid Scheme and Symmetry Park.

Table 10.2.1: Summary of AADT Traffic Data used in the Assessment

Road Link	2014	2019 (Without Scheme)	2019 (With Scheme)	2019 (Sensitivity Test)	2022 (Without Scheme)	2022 (With Scheme)	2022 (Sensitivity Test)	2025 (Without Scheme)	2025 (With Scheme)	2025 (Sensitivity Test)
A4303 East of Symmetry Park	16,975	22,511	23,991	25,850	23,737	26,869	30,587	24,239	28,696	32,414
A4303 West of Symmetry Park	16,975	22,511	23,991	25,779	23,737	26,869	30,445	24,239	28,696	32,272
Coventry Road	6,653	9,066	9,458	9,866	9,563	10,389	11,204	9,722	10,904	11,719
A5 North of A4303	14,964	19,224	19,860	20,465	20,510	21,859	23,069	21,202	26,953	28,163
A5 South of A4303	14,599	18,741	19,198	19,883	20,202	21,177	22,546	20,992	22,296	23,665
Coal Pit Lane	3,764	4,690	4,975	5,292	4,954	5,553	6,186	5,130	5,990	6,623
B4027	4,136	5,029	5,436	5,559	5,163	6,026	6,271	6,237	6,477	6,722

Table G3.2: Summary of %HDV Traffic Data used in the Assessment

Road Link	2014	2019 (Without Scheme)	2019 (With Scheme)	2019 (Sensitivity Test)	2022 (Without Scheme)	2022 (With Scheme)	2022 (Sensitivity Test)	2025 (Without Scheme)	2025 (With Scheme)	2025 (Sensitivity Test)
A4303 East of Symmetry Park	19.7%	20.0%	20.2%	20.9%	19.9%	20.4%	21.5%	19.9%	20.5%	21.5%
A4303 West of Symmetry Park	19.7%	20.0%	20.2%	21.2%	19.9%	20.4%	22.0%	19.9%	20.5%	22.0%
Coventry Road	1.3%	1.1%	1.0%	1.8%	1.0%	1.0%	2.4%	1.0%	0.9%	2.3%
A5 North of A4303	16.4%	16.3%	16.2%	16.6%	16.2%	16.1%	16.8%	16.2%	16.7%	17.2%
A5 South of A4303	19.0%	19.8%	19.9%	20.8%	19.5%	20.0%	21.6%	19.4%	19.7%	21.2%
Coal Pit Lane	4.5%	4.5%	4.2%	5.6%	4.8%	4.3%	6.6%	5.0%	4.3%	6.4%
B4027	4.7%	4.5%	4.4%	5.0%	4.5%	4.3%	5.3%	4.5%	4.3%	5.2%

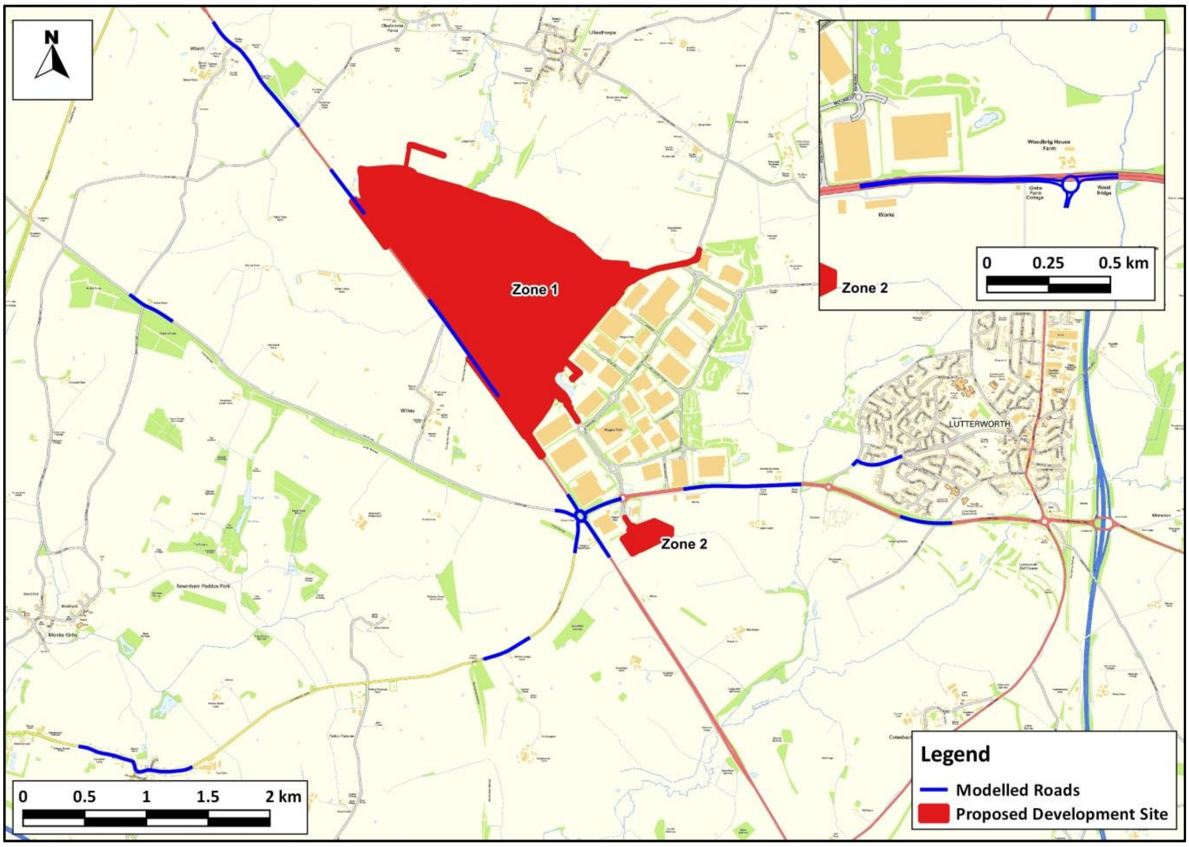

Figure 10.2.1:Modelled Road Network with the Inset Showing the Access Roundabout for Symmetry Park Included in the Sensitivity Test

Contains Ordnance Survey data © Crown copyright and database right 2017

Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

8. 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 G3.3 to the emission factors used within the EFT4, 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 adjustments set out in Table 10.2.4. The results from this sensitivity test are likely

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

to over-predict emissions from vehicles in the future and thus provide a reasonable worst-case upper-bound to the assessment.

Table 10.2.5: 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).

Model Verification

9. In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The verification methodology is described below.

Nitrogen Dioxide

10. Most nitrogen dioxide (NO_2) 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 ($NOx = NO + NO_2$). The model has been run to predict the annual mean NOx concentrations during 2014 at the locations where Air Quality Consultants carried out diffusion tube monitoring. Monitoring Location 5 was excluded from the verification process due to a number of reasons; only two months of monitoring data was collected at this location, and the measured concentrations are significantly higher than all other monitoring locations which suggest the data may be erroneous. In addition, the diffusion tubes for this location had to be diluted by the laboratory in order to calibrate the concentrations which will lead to some additional uncertainty. It was observed that there are large numbers of HGVs accelerating along the road adjacent to this monitoring location, which cannot be accurately represented in the model.

11. The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2017b).

12. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure 10.2.2). This calculated factor of 3.0999 has then been applied to the

modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

13. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure 10.2.3 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.
14. The results imply that the model has under-predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

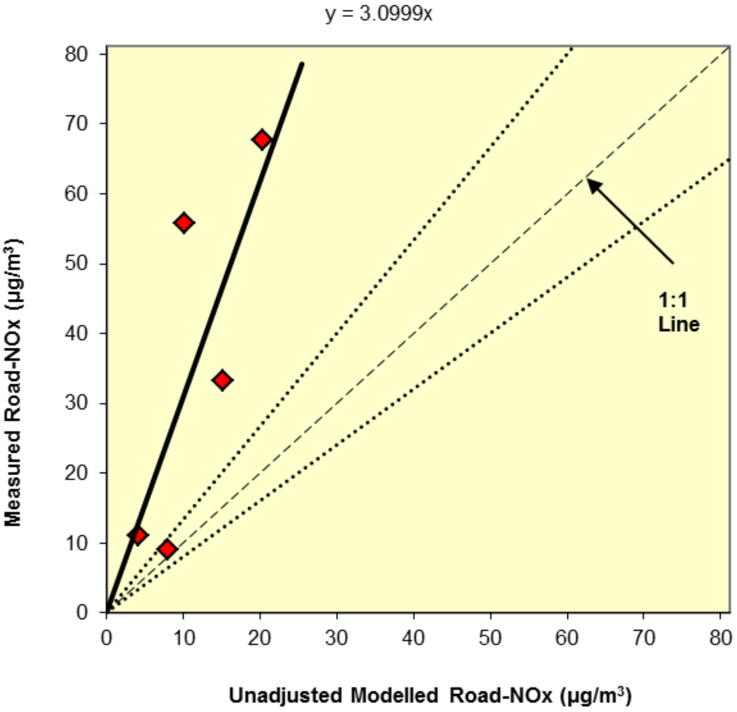

Figure 10.2.2:Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

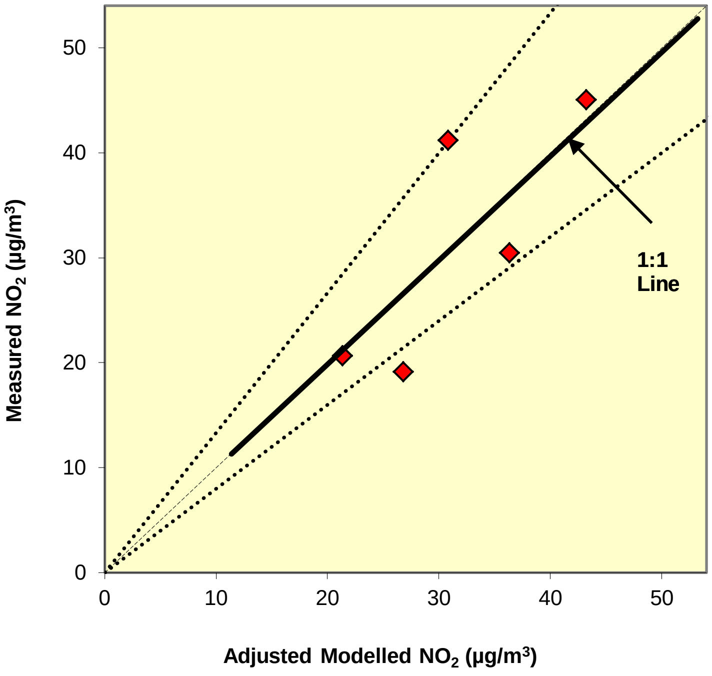

Figure 10.2.3:Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Model Verification for NOx and NO_2 Sensitivity Test

15. The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 2.0509 which has been applied to all modelled road-NOx concentrations within the sensitivity test.

PM_{10} and $PM_{2.5}$

16. There are no nearby PM_{10} or $PM_{2.5}$ monitors. It has therefore not been possible to verify the model for PM_{10} or $PM_{2.5}$. The model outputs of road-PM_{10} and road-$PM_{2.5}$ have therefore been adjusted by applying the adjustment factor (3.0999) calculated for road NOx.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

17. The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the adjustment factor set out above, which, along with the background NO_2, is processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2017b). The traffic mix within the calculator has been set to “All non-urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

APPENDIX 10.3

LUTTERWORTH AQMA ASSESSMENT

Introduction

1. The ES Chapter 10 Update (July 2017) has focussed on the assessment of traffic-related impacts on the major road network (A5/A4303) that will be affected by the Hybrid scheme. As stated in the Chapter 10 Update, a restriction on scheme-related HGVs through the Lutterworth AQMA (A426) will be strictly enforced via an ANPR camera system, with an associated penalty system applied to both the HGV driver and operator (subject to agreement with HDC). The Hybrid scheme will, however, generate a small number of additional car trips through the AQMA. For completeness, this Technical Appendix provides an assessment of the air quality impacts of those additional trips.
2. The assessment focuses on annual mean concentrations of nitrogen dioxide (as this is the basis for the AQMA declaration).

Sensitive Locations

3. Concentrations of nitrogen dioxide have been predicted at a number of locations adjacent to the A426 which passes through the centre of Lutterworth. Receptors have been identified to represent worst-case exposure, located at the facades of the properties closest to the road.
4. Six existing properties have been identified as receptors for the assessment. These locations are described in

5. Table 10.3.1 and shown in Figure 10.3.1. In addition, concentrations have been modelled at the diffusion tube monitoring sites operated by Harborough District Council (HDC), in order to verify the model outputs[1]. Sites for the verification were selected based on similarity to the modelled road network, and the availability of traffic data.

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[1] The A426 as it passes through Lutterworth has very different characteristics from the A5/A4303 that was used in the Chapter 10 Update model verification. A separate model verification has therefore been carried out.

Table 10.3.1: Existing Receptor Locations and Verification Sites

Receptor	Description
1	Property at 23 Riverside Road
2	Property at 1 Misterton Way
3	Property at 19 Market Street
4	Property at 26 Market Street
5	Property at 18 Lower Leicester Road
6	Property at 29 Leicester Road
Verification Sites	
18n	Jazz Hair
25n	26 Market Street
26n	24 Rugby Road
27n	17 Rugby Road

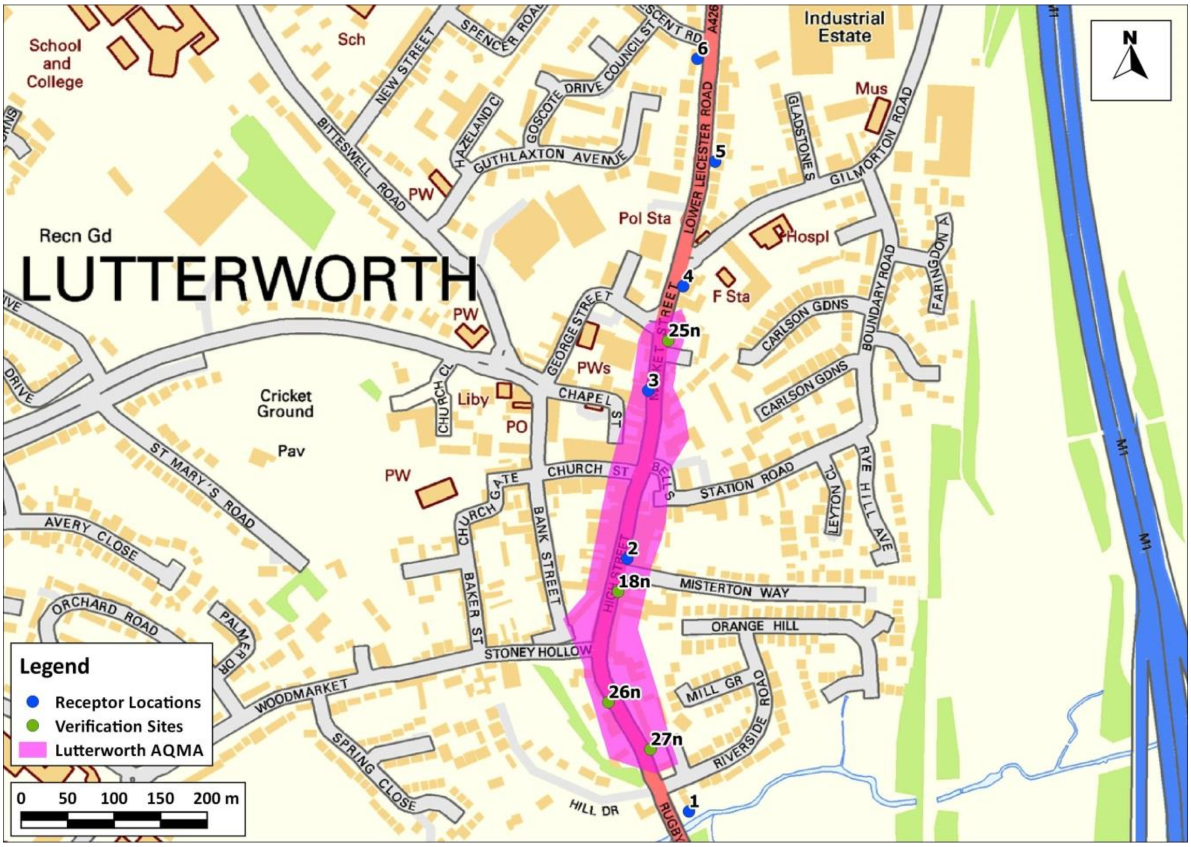

Figure 10.3.1: Existing Receptor Locations and Verification Sites and Lutterworth AQMA

Assessment Scenarios

6. Predictions of annual mean nitrogen dioxide concentrations have been carried out 2019, 2022 and 2025. For each scenario, predictions have been made assuming both that the development does proceed (With Development), and does not proceed (Without Development). In addition to the set of 'official' predictions, a sensitivity test has been carried out 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). This sensitivity test is fully described in the ES Chapter 10 Update and Technical Appendix 10.2 Modelling Methodology.

Background Concentrations

7. The background pollutant concentrations across the study area have been defined using the national pollution maps published by Defra (2015). 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 (verification year) have been calibrated against concurrent measurements from national monitoring. The calibration factor calculated has also been applied to future year backgrounds. This has resulted in slightly higher predicted concentrations for the future assessment years than those derived from the Defra maps (AQC, 2016c). Estimated background concentrations across the study area have also been determined for the future years of 2019, 2022 and 2025 and are shown in Table 10.3.2.

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

Table 10.3.2: Estimated Annual Mean Background Pollutant Concentrations in 2015, 2019, 2022 and 2025 (µg/m^3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2015 (Verification Year)	17.9	17.0	11.8
2019 [a]	14.5	16.4	11.2
2019 Worst-case Sensitivity Test [b]	*15.3*	*N/A*	*N/A*
2022 [a]	13.0	16.2	11.0
2022 Worst-case Sensitivity Test [b]	*14.3*	*N/A*	*N/A*
2025 [a]	12.0	16.1	10.9
2025 Worst-case Sensitivity Test [b]	*13.7*	*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 the CURED emissions tool

Model Inputs

Road Traffic

9. 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 and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 7.0) published by Defra (2017b).

10. The model has been run using the full year of meteorological data that corresponds to the traffic and monitoring data (2015). The meteorological data have been taken from the monitoring station located at Church Lawford, which is considered suitable for this area.

11. AADT flows, speeds and the proportions of HDVs, for roads affected by the Proposed Development have been provided by Aecom. Traffic speeds have been based on those provided, taking account of the road layout, speed limits and the proximity to a junction. An additional sensitivity test has also been carried out to consider the combined effects of the proposed Symmetry Park development (as described in ES Chapter 10 Update). The traffic data used in this assessment are summarised in

12.

13. Table 10.3.3**Error! Reference source not found.** and **Error! Reference source not found.**[2].

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

15. Figure 10.3.2 shows the road network included within the model and defines the study area.

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[2] In each scenario, the Without Scheme flows include all committed developments (including DHL), the With Scheme flows include the Hybrid scheme operational and construction traffic flows, and the Sensitivity Test scenario includes traffic associated with both the Hybrid Scheme and Symmetry Park.

Table 10.3.3: Summary of AADT Traffic Data used in the Assessment

Road Link	2015	2019 (Without Scheme)	2019 (With Scheme)	2019 (Sensitivity Test)	2022 (Without Scheme)	2022 (With Scheme)	2022 (Sensitivity Test)	2025 (Without Scheme)	2025 (With Scheme)	2025 (Sensitivity Test)
A426	14,669	16,635	16,797	16,913	17,345	17,684	17,916	17,689	18,172	18,404

Table 10.3.4: Summary of %HDV Traffic Data used in the Assessment

Road Link	2015	2019 (Without Scheme)	2019 (With Scheme)	2019 (Sensitivity Test)	2022 (Without Scheme)	2022 (With Scheme)	2022 (Sensitivity Test)	2025 (Without Scheme)	2025 (With Scheme)	2025 (Sensitivity Test)
A426	6.1%	5.9%	5.8%	5.8%	5.9%	5.8%	5.7%	5.9%	5.9%	5.6%

Note: The LLITM traffic model assigns some HGV movements, associated with the operation of the Hybrid Scheme and Symmetry Park, to the A426 and Lutterworth. The LLITM model takes no account of the restriction on HGV movements that will be imposed. The HGV movements assigned to the A426 for both "With Scheme" (Hybrid Scheme) and "Sensitivity Test" (Hybrid Scheme + Symmetry Park) have therefore been removed.

Figure 10.3.2: Modelled Road Network for Lutterworth

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Sensitivity Test for Nitrogen Oxides and Nitrogen Dioxide

16. A worst-case sensitivity test has been carried out by applying the adjustments set out in Table 10.3.5 to the emission factors used within the EFT3, 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 adjustments set out in Table 10.3.5. 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 10.3.5: Summary of Adjustments Made to Defra's EFT (v7.0)

Vehicle Type		Adjustment Applied to Emission Factors
All Petrol Vehicles		No adjustment
Light Duty	**Euro 5 and earlier**	No adjustment

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

Diesel Vehicles	**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).

Model Verification

17. In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The verification methodology is described below.

18. Most nitrogen dioxide (NO_2) 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 ($NOx = NO + NO_2$). The model has been run to predict the annual mean NOx concentrations during 2015 at the diffusion tubes operated by the Council. Verification sites were chosen to reflect the extent of the AQMA.

19. The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the ‘measured’ road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 5.1) available on the Defra LAQM Support website (Defra, 2017b).

20. An adjustment factor has been determined as the slope of the best-fit line between the ‘measured’ road contribution and the model derived road contribution, forced through zero (Figure 10.3.3). This calculated factor of 2.8606 has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

21. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure 10.3.4 compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2, and shows a close agreement.

22. The results imply that the model has under-predicted the road-NOx contribution. This is a common experience with this and most other road traffic emissions dispersion models.

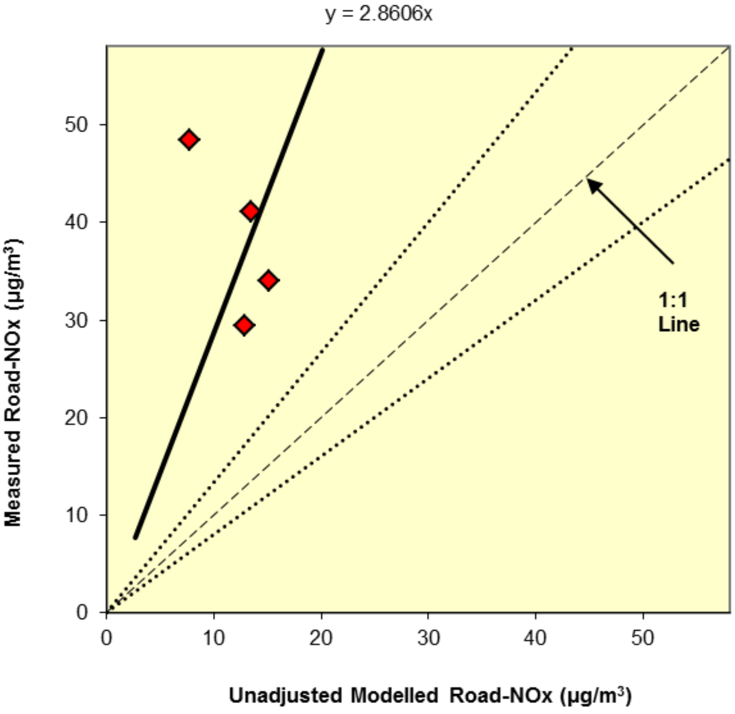

Figure 10.3.3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

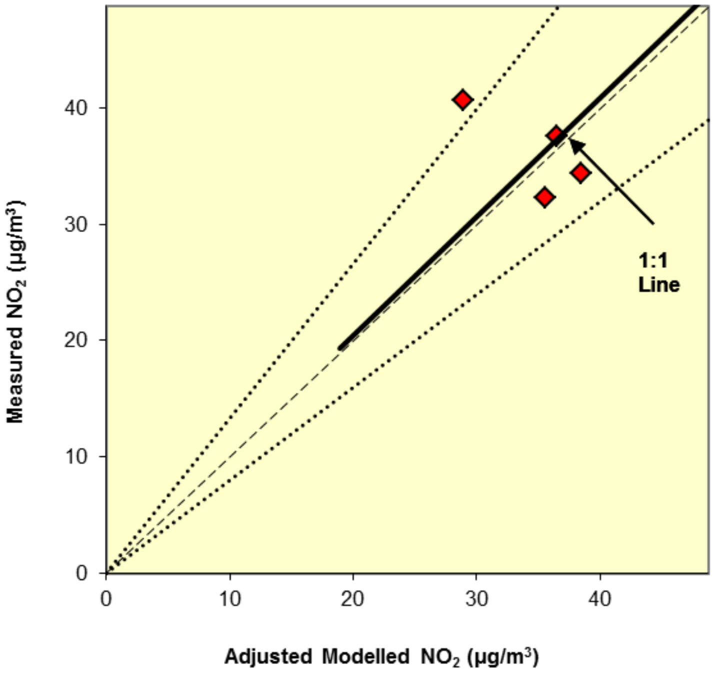

Figure 10.3.4: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

Model Verification for NOx and NO_2 Sensitivity Test

23. The approach set out above has been repeated using the predicted road-NOx and background concentrations specific to the sensitivity test. This has resulted in an adjustment factor of 2.4057 which has been applied to all modelled road-NOx concentrations within the sensitivity test.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

24. The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the adjustment factor set out above, which, along with the background NO_2, is processed through the NOx to NO_2 calculator available on the Defra LAQM Support website (Defra, 2017b). The traffic mix within the calculator has been set to “All non-urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

Baseline Results

25. Baseline concentrations of nitrogen dioxide have been modelled at each of the existing receptor locations (see

26. Table 10.3.1 and Figure 10.3.1). The results, which cover the future year (2019, 2022 and 2025) baselines (Without Development), are set out in Table 10.3.6. The predictions for nitrogen dioxide include the 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 (as described in Paragraph 17 to Paragraph 22).

27. The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations in 2019, 2022 and 2025.

28. The results from the upper-bound sensitivity test are not materially different from those derived using the “official” emissions forecasts, and all concentrations are below the objective.

Table 10.3.6: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m^3)

Receptor	2019[a]	2022[a]	2025[a]	Worst-case Sensitivity Test[b]		
				2019	2022	2025
1	21.8	18.7	16.7	23.9	21.9	20.7
2	28.7	24.2	21.2	31.8	29.0	27.1
3	27.1	22.7	19.9	29.5	26.8	25.1
4	28.9	24.1	21.0	31.6	28.6	26.7
5	25.4	21.4	18.9	27.8	25.3	23.8
6	20.7	17.8	15.9	22.5	20.7	19.5

a In line with Defra’s forecasts

b Assumes higher emissions from diesel vehicles based on CURED emissions tool

Operational Effects

29. Predicted annual mean concentrations of nitrogen dioxide are set out in Table 10.3.7,

30. Table 10.3.8 and Table 10.3.9 for both the “Without Development” and “With Development” scenarios, for 2019, 2022 and 2025. These tables also describe the impacts at each receptor using the impact descriptors given in Table 10.2 of ES Chapter 10 Update. Results are presented for two scenarios, so as to include a worst-case sensitivity test.

31. In 2019, 2022 and 2025 the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the proposed development. The impacts are negligible at all receptors.

32. Based on the worst-case sensitivity test, the annual mean nitrogen dioxide concentrations are below the objective at all receptors in 2019, 2022 and 2025, with and without the proposed development. The predicted impacts are negligible at all receptors, and the results are not materially different from the results based on the “official” emissions forecasts.

Table 10.3.7: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2019 (μg/m^3)

Receptor	2019 Opening Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	21.8	21.9	Negligible	23.9	24.0	Negligible
2	28.7	28.9	Negligible	31.8	31.9	Negligible
3	27.1	27.2	Negligible	29.5	29.6	Negligible
4	28.9	29.0	Negligible	31.6	31.7	Negligible
5	25.4	25.5	Negligible	27.8	27.9	Negligible
6	20.7	20.7	Negligible	22.5	22.6	Negligible
Objective	**40**		-	**40**		-

a In line with Defra’s “official” forecasts on emissions

b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool

c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.3.8: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2022 ($\mu g/m^3$)

Receptor	2022 Opening Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	18.7	18.8	Negligible	21.9	22.0	Negligible
2	24.2	24.4	Negligible	29.0	29.2	Negligible
3	22.7	22.8	Negligible	26.8	27.0	Negligible
4	24.1	24.3	Negligible	28.6	28.8	Negligible
5	21.4	21.6	Negligible	25.3	25.5	Negligible
6	17.8	17.8	Negligible	20.7	20.8	Negligible
Objective	**40**		-	**40**		-

a In line with Defra's "official" forecasts on emissions
b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool
c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.3.9: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2025 ($\mu g/m^3$)

Receptor	2025 Opening Year					
				Worst-case sensitivity test [b]		
	Without Dev[a]	With Dev[a]	Impact Descriptor[c]	Without Dev	With Dev	Impact Descriptor[c]
1	16.7	16.8	Negligible	20.7	20.8	Negligible
2	21.2	21.4	Negligible	27.1	27.4	Negligible
3	19.9	20.1	Negligible	25.1	25.3	Negligible
4	21.0	21.2	Negligible	26.7	27.0	Negligible
5	18.9	19.1	Negligible	23.8	24.0	Negligible
6	15.9	16.0	Negligible	19.5	19.7	Negligible
Objective	**40**		-	**40**		-

a In line with Defra's "official" forecasts on emissions
b Assuming higher emissions from modern diesel vehicles based on CURED emissions tool
c The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Significance of Predicted Effects

33. The operational air quality effects in 2019, 2022 and 2025 are judged to be not significant. This professional judgement is made in accordance with the methodology set out in Paragraph **Error! Reference source not found.** of ES Chapter 10 Update, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. 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.

34. More specifically, the judgement that the air quality effects will be not significant takes account of the conclusions that concentrations are predicted to be below the objectives in 2019, 2022

and 2025 at all receptors, with or without the Proposed Development. Additionally, impacts associated with nitrogen dioxide are negligible at all receptor locations in all assessment years. It is also of note that the assessment is founded on the assumption that the traffic associated with all committed developments and an accelerated phasing of the proposed development is on the road for each assessment year; which will provide a conservative assessment.

Cumulative Effects

35. The predicted operational air quality effects are based on traffic data that includes all local committed developments. Therefore, the predicted concentrations presented in this assessment include all cumulative effects.

Combined Effects With Symmetry Park

36. The combined effects of the Hybrid Scheme together with the proposed Symmetry Park development on land to the south of Magna Park has been considered. Traffic data associated with Symmetry Park have been obtained from Aecom, and have been added to the 2019, 2022 and 2025 With Development scenarios. Predicted impacts are presented in Table 10.3.10, Table 10.3.11 and Table 10.3.12 for 2019, 2022 and 2025 respectively.

37. In 2019, 2022 and 2025 the annual mean nitrogen dioxide concentrations are predicted to be below the objective at all receptors, with and without the Proposed Development (including Symmetry Park). The impacts are negligible at all receptors.

38. For the worst-case sensitivity test, the annual mean nitrogen dioxide concentrations are below the objective at all receptors in 2019, 2022 and 2025, with and without the Proposed Development (including Symmetry Park). In all years, the results are not materially different from the results based on the “official” emissions forecasts.

Table 10.3.10: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations ($\mu g/m^3$) – With Development + Symmetry Park – 2019

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	21.8	21.9	Negligible	23.9	24.0	Negligible
2	28.7	28.9	Negligible	31.8	32.0	Negligible
3	27.1	27.2	Negligible	29.5	29.7	Negligible
4	28.9	29.1	Negligible	31.6	31.8	Negligible
5	25.4	25.5	Negligible	27.8	28.0	Negligible
6	20.7	20.7	Negligible	22.5	22.6	Negligible
Objective	40			40		-

[a] In line with Defra’s “official emissions” forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described within the CURED tool.

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.3.11: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations ($\mu g/m^3$) – With Development + Symmetry Park – 2022

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	18.7	18.9	Negligible	21.9	22.1	Negligible
2	24.2	24.5	Negligible	29.0	29.3	Negligible
3	22.7	23.0	Negligible	26.8	27.1	Negligible
4	24.1	24.4	Negligible	28.6	29.0	Negligible
5	21.4	21.7	Negligible	25.3	25.6	Negligible
6	17.8	17.9	Negligible	20.7	20.9	Negligible
Objective	**40**			**40**		-

[a] In line with Defra's "official emissions" forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described within the CURED tool.

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Table 10.3.12: Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations ($\mu g/m^3$) – With Development + Symmetry Park – 2025

Receptor				Worst-case Sensitivity Test [b]		
	Without Development[a]	With Development + Symmetry Park[a]	Impact Descriptor[c]	Without Development	With Development + Symmetry Park	Impact Descriptor[c]
1	16.7	16.9	Negligible	20.7	20.9	Negligible
2	21.2	21.5	Negligible	27.1	27.6	Negligible
3	19.9	20.1	Negligible	25.1	25.5	Negligible
4	21.0	21.3	Negligible	26.7	27.1	Negligible
5	18.9	19.1	Negligible	23.8	24.1	Negligible
6	15.9	16.0	Negligible	19.5	19.7	Negligible
Objective	**40**			**40**		-

[a] In line with Defra's "official emissions" forecasts.

[b] Assuming higher emissions from modern diesel vehicles as described within the CURED tool.

[c] The percentage changes used to generate the impact descriptors are relative to the objective and have been rounded to the nearest whole number

Significance of Predicted Effects with Symmetry Park

39. The operational air quality effects in 2019, 2022 and 2025 are judged to be not significant. This professional judgement is made in accordance with the methodology set out in Paragraph 10.3.9 of Chapter 10, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. 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.

40. More specifically, the judgement that the air quality effects will be not significant takes account of the conclusions that concentrations are predicted to be below the objectives in 2019, 2022 and 2025 at all receptors, with or without the Proposed Development (and Symmetry Park). Additionally, impacts associated with nitrogen dioxide are negligible at all receptor locations in all three assessment years. It is also of note that the assessment is founded on the assumption that the traffic associated with all committed developments and an accelerated phasing of the proposed development and Symmetry Park is on the road for each assessment year; which will provide a conservative assessment.

Conclusions

41. The operational impacts arising from the additional traffic through Lutterworth, due to the Hybrid scheme, have been assessed. Concentrations have been modelled for six receptors, representing existing properties where impacts are expected to be greatest. In the case of nitrogen dioxide, a sensitivity test has been applied to all scenarios; this is to allow for uncertainty over emission factors for nitrogen oxides identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011).

42. The proposed Hybrid scheme will increase traffic volumes through Lutterworth town centre. These changes will lead to an increase in concentrations of nitrogen dioxide, but all concentrations are predicted to be below the air quality objective, with or without the Proposed Development. Assuming the worst-case sensitivity test, the impacts are all predicted to be negligible at all receptors in 2019 (Opening Year), 2022 (Interim Year) and 2025 (Completion Year).

43. The overall operational air quality effects of the Hybrid scheme are judged to be not significant. This conclusion, which takes account of the uncertainties in future projections for nitrogen dioxide, is based on nitrogen dioxide concentrations being below the annual mean objective in 2019, 2022 and 2025 at all receptors.

44. It is concluded there are no air quality constraints to the Hybrid scheme, and that it is consistent with all relevant national and local policies.

45. An additional sensitivity test has been carried out which considers the potential combined effects of the proposed Hybrid scheme and Symmetry Park, which will generate higher volumes of traffic through Lutterworth town centre. These changes will lead to an increase in concentrations of nitrogen dioxide, but all levels are predicted to be below the objective, with or without the Hybrid scheme and Symmetry Park, and the impacts will all be negligible in all scenarios that have been assessed.

46. The overall operational effects of the combined schemes are judged to be not significant, for the same reasons identified in Paragraph 43.

About IDI Gazeley

IDI Gazeley is one of the world's leading investors and developers of logistics warehouses and distribution parks with 60 million square feet of premier assets under management and additional prime land sites to develop another 45 million square feet of distribution facilities near major markets and transport routes in North America, Europe and China.

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APPENDIX G3

MODELLING METHODOLOGY

Background Concentrations

1. The background concentrations across the study area have been defined using the national pollution maps published by Defra (2015a). These cover the whole country on a 1x1 km grid and are published for each year from 2011 until 2030. The maps include the influence of emissions from a range of different sources; one of which is road traffic. As noted in Paragraph **Error! Reference source not found.**, there is evidence that the current 'official' emissions factors published by Defra may over-predicted the rate at which road traffic emissions of nitrogen oxides will fall in the future. The maps currently in use were verified against measurements made during 2011 at a large number of automatic monitoring stations and so there can be reasonable confidence that the maps are representative of conditions during 2011. Similarly, there is reasonable confidence that the reductions which Defra predicts from other sectors (e.g. rail) will be achieved.

2. In order to calculate background nitrogen dioxide and nitrogen oxides concentrations in 2014, it is assumed that there was no reduction in the road traffic component of backgrounds between 2011[1] and 2014. This has been done using the source-specific background nitrogen oxides maps provided by Defra (2015a). For each grid square, the road traffic component has been held constant at 2011 levels, while 2014 values have been taken for the other components. Nitrogen dioxide concentrations have then been calculated using the background nitrogen dioxide calculator which Defra (2015a) publishes to accompany the maps. The result is a set of 'adjusted 2014 background' concentrations.

3. As an additional step, a set of 'adjusted 2013 background' mapped values have been derived following the same approach defined in paragraph A1.5. These have been calibrated against national background measurements made as part of the AURN during 2013 (see Figure G3.1). Based on the 52 sites with more than 90% data capture for 2013, the maps under-predict the background concentrations by 5.5%, on average. In the absence of fully ratified 2014 AURN data, the 'adjusted 2014 background' mapped values have been uplifted by this percentage to provide a worst-case approach.

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[1] This approach assumes that there has been no reduction in emissions per vehicle, but that traffic volumes have remained constant. This is not the same as the assumption made for dispersion modelling, in which emissions per vehicle are held constant while traffic volumes are assumed to change year on year. This discrepancy is unlikely to influence the overall conclusions of the assessment.

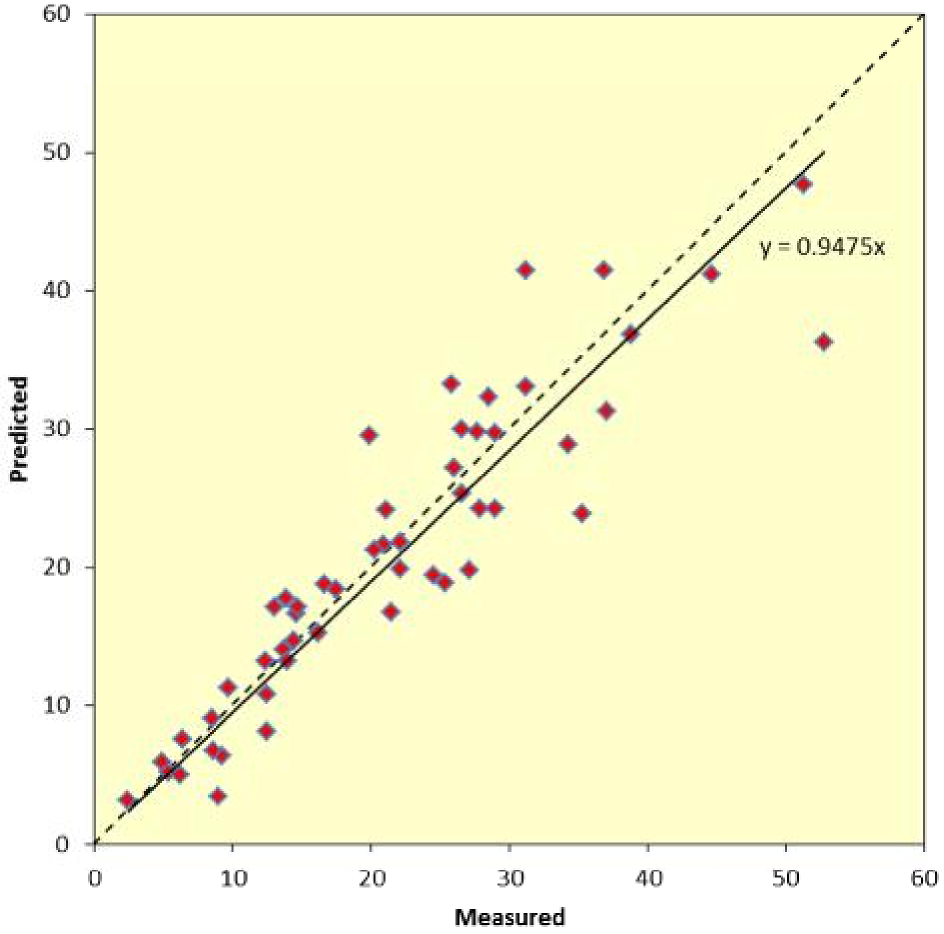

Figure G3.1: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2013

4. Two separate sets of 2016 background nitrogen dioxide and nitrogen oxides concentrations have been used for the future-year assessment. The 2016 background ‘without emissions reduction’ has been calculated using the same approach as described for the 2014 data: the road traffic component of background nitrogen oxides has been held constant at 2011 values, while 2016 data are taken for the other components. Nitrogen dioxide has then been calculated using Defra’s background nitrogen dioxide calculator. This has been adjusted by a national factor of 1.0554 for the background calibration, as described in Paragraph 3. The 2016 background ‘with emissions reduction’ assumes that Defra’s revised predicted reductions occur from 2014 onward. This dataset has been derived first by calculating the ratio of the unadjusted mapped value for 2016 to the unadjusted mapped value for 2014. This ratio has then been applied to the calibrated 2014 value (as derived in Paragraph 2). The background values for 2021 have been derived following the same methodology as the 2014 background ‘with emissions reduction’. The background values for 2031 have also been derived following the same methodology as the 2014 background ‘with emissions reduction’, but using the mapped values for the future year of 2030, as values for 2031 are currently unavailable.

5. For PM_{10} and $PM_{2.5}$, there is no strong evidence that Defra's predictions are unrealistic and so the year-specific mapped concentrations have been used in this assessment.

Model Inputs

Road Traffic

6. Predictions have been carried out using the ADMS-Roads dispersion model (v3.4). The model requires the user to provide various input data, including emissions from each section of road, and the road characteristics (including road width and street canyon height, where applicable). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the Emission Factor Toolkit (Version 6.0.1) published by Defra (2015a). For nitrogen dioxide, future-year concentrations have been predicted once using year-specific emission factors from the EFT, and once using emission factors for 2014[2], which is the year for which the model has been verified.
7. The model has been run using the full year of meteorological data that corresponds to the most recent set of nitrogen dioxide monitoring data (2014). The meteorological data has been taken from the monitoring station located at Church Lawford, which is considered suitable for this area.
8. AADT flows, speeds and the proportions of HDVs, for roads affected by the proposed development have been provided by AECOM. Traffic speeds have been based on those provided, taking account of the road layout, speed limits and the proximity to a junction. The traffic data used in this assessment are summarised in Table G3.1 and Table G4.2.

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[2] i.e. combining current-year emission factors with future-year traffic data.

Table G3.1: Summary of AADT Traffic Data used in the Assessment

Road Link	2014	2016 (Without Scheme)	2016 (With Scheme)	2031 (Without Scheme)	2031 (With Scheme)
A4303	16,975	18,515	19,648	23,461	28,672
Coventry Road	6,653	7,080	7,369	9,544	10,897
A5 North of A4303	14,964	16,519	16,995	22,995	28,534
A5 South of A4303	14,599	15,735	16,062	22,151	23,671
Coal Pit Lane	3,764	3,828	4,039	5,090	6,078
B4027	4,136	4,206	4,510	5,130	6,542

Table G4.2: Summary of %HDV Traffic Data used in the Assessment

Road Link	2014	2016 (Without Scheme)	2016 (With Scheme)	2031 (Without Scheme)	2031 (With Scheme)
A4303	19.7%	19.9%	20.3%	19.1%	20.3%
Coventry Road	1.3%	1.2%	1.2%	1.1%	1.0%
A5 North of A4303	16.4%	15.8%	15.8%	15.0%	15.8%
A5 South of A4303	19.0%	19.4%	19.5%	18.1%	18.6%
Coal Pit Lane	4.5%	4.5%	4.3%	4.8%	4.0%
B4027	4.7%	4.7%	4.7%	4.7%	4.3%

9. Diurnal flow profiles for the traffic have been derived from the national diurnal profiles published by DfT (DfT, 2011).
10. Figure G3.2 shows the road network included within the model and defines the study area.

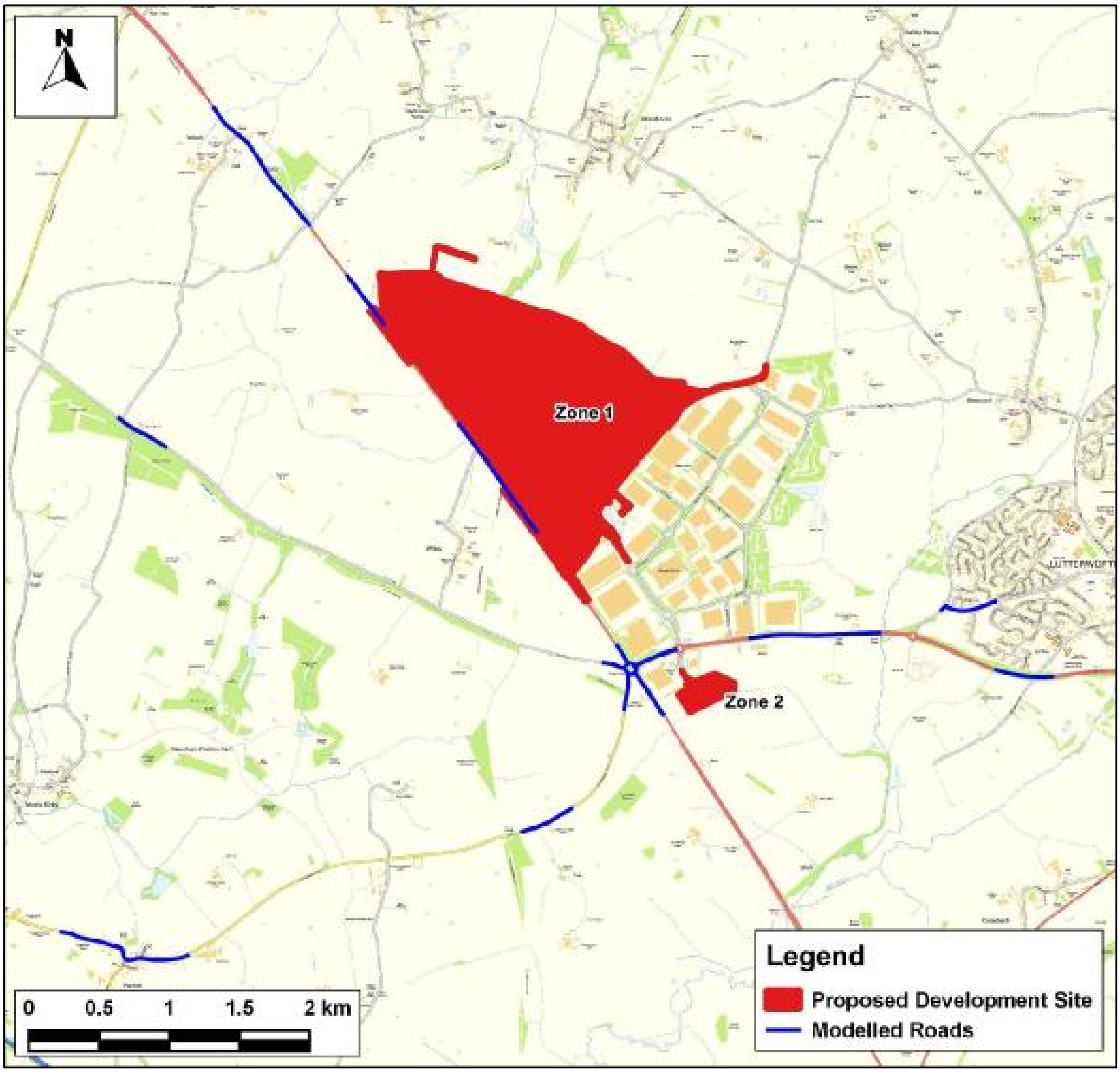

Figure G3.2: Modelled Road Network

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Model Verification

11. In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The verification methodology is described below.

Nitrogen Dioxide

12. Most nitrogen dioxide (NO_2) 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 ($NOx = NO + NO_2$). The model has been run to predict the annual mean NOx concentrations during 2014 at the locations where Air Quality Consultants carried out diffusion tube monitoring. Monitoring Location 3 was excluded from the verification process due to a number of reasons; only two months of

monitoring data was collected at this location, and the measured concentrations are significantly higher than all other monitoring locations which suggests the data may be erroneous. In addition, the diffusion tubes for this location had to be diluted by the laboratory in order to calibrate the concentrations which will lead to some additional uncertainty. It was observed that there are large numbers of HGVs accelerating along the road adjacent to this monitoring location, and which cannot be accurately represented in the model.

13. The model output of road-NOx (i.e. the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 4.1) available on the Defra LAQM Support website (Defra, 2015a).

14. A primary adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure G3.3). This factor has then been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations. The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. A secondary adjustment factor has finally been calculated as the slope of the best-fit line applied to the adjusted data and forced through zero (Figure G3.4).

15. The following primary and secondary adjustment factors have been applied to all modelled nitrogen dioxide data:

Primary adjustment factor :	2.9465
Secondary adjustment factor:	0.9910

16. The results imply that the model has under predicted the road-NOx contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

17. Figure G3.5 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows a 1:1 relationship.

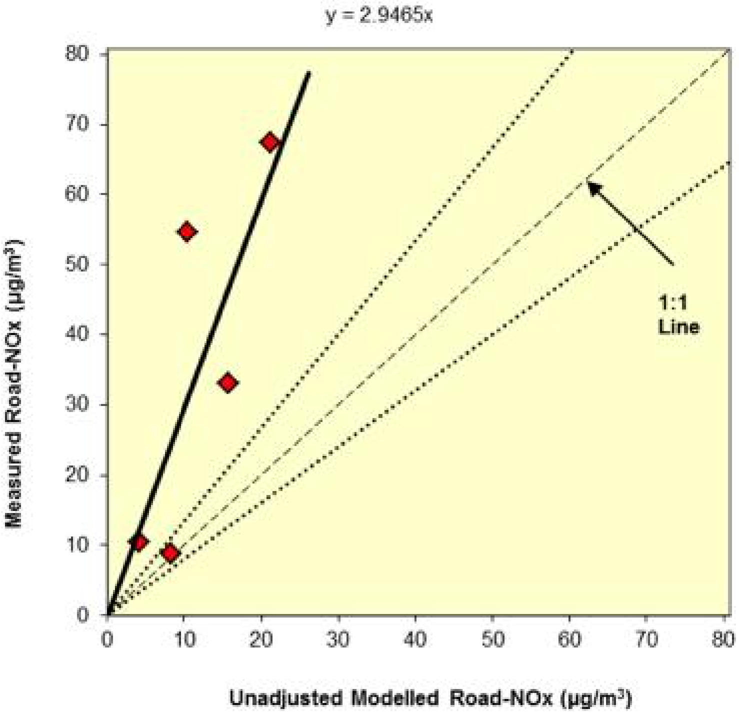

Figure G3.3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

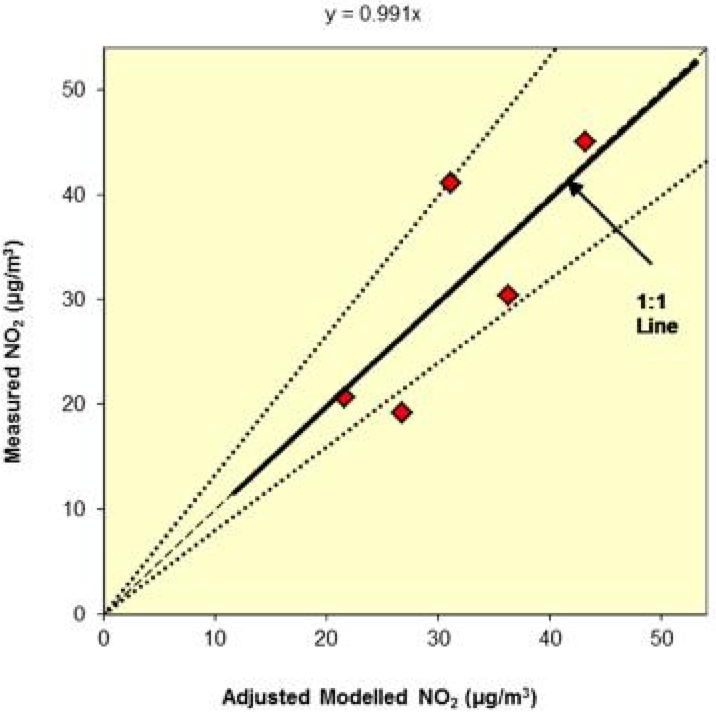

Figure G3.4: Comparison of Measured Total NO_2 to Primary Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

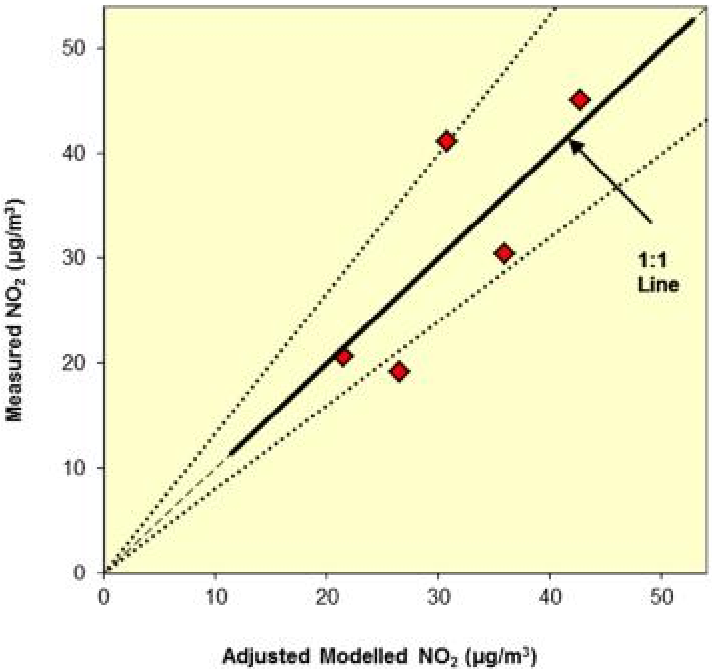

Figure G3.5: Comparison of Measured Total NO$_2$ to Final Adjusted Modelled Total NO$_2$ Concentrations. The dashed lines show ± 25%.

PM$_{10}$ and PM$_{2.5}$

18. There are no nearby PM$_{10}$ or PM$_{2.5}$ monitors. It has therefore not been possible to verify the model for PM$_{10}$ or PM$_{2.5}$. The model outputs of road-PM$_{10}$ and road-PM$_{2.5}$ have therefore been adjusted by applying the primary adjustment factor calculated for road NOx.

Model Post-processing

Nitrogen oxides and nitrogen dioxide

19. The model predicts road-NOx concentrations at each receptor location. These concentrations have then been adjusted using the primary adjustment factor, which, along with the background NO$_2$, is processed through the NOx to NO$_2$ calculator available on the Defra LAQM Support website (Defra, 2015a). The traffic mix within the calculator has been set to “All non-urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO$_2$ based on the adjusted road-NOx and the background NO$_2$. This is then adjusted by the secondary adjustment factor to provide the final predicted concentrations.

APPENDIX G4

DIFFUSION TUBE MONITORING LOCATIONS

1. Photographs of the diffusion tube monitoring locations are presented in Figure G4.1 to Figure G4.6.

Figure G4.1: Monitoring Location 1 – On Lamppost, Outside No. 5 Alexander Drive, Near the A4303

Figure G4.2: Monitoring Location 2 – A4303, On Lamppost, Near Entrance to TT Electronics

Figure G4.3: Monitoring Location 3 – A4303, On Bicycle Warning Signpost, Near Entrance to MPL

Figure G4.4: Monitoring Location 4 – A5, On Parking Signpost, Near White House Farm

Figure G4.5: Monitoring Location 5 – A5, On Telephone Pole, Near Main Street

Figure G4.6: Monitoring Location 6 – A5, On Lamppost, Near Green Lane

APPENDIX G5

RAW DIFFUSION TUBE RESULTS

Table G5.1: Raw Diffusion Tube Results

Tube ID	Height (m)	Distance From Kerb (m)	30 Jun – 28 Jul	28 Jul – 26 Aug	26 Aug – 22 Sep
			NO_2 (µg/m^3)	NO_2 (µg/m^3)	NO_2 (µg/m^3)
1	2.60	1.58	17.33	20.53	20.23
2	2.40	3.15	36.16	34.36	45.14
3	2.40	3.15	36.11	34.73	46.36
4	2.40	3.15	36.18	32.03	46.65
5	2.10	1.15	82.10	79.40	-
6	2.00	1.60	29.75	26.61	29.30
7	2.00	4.55	17.61	12.74	23.51
8	2.00	1.40	44.47	43.40	38.93

APPENDIX G6

DIFFUSION TUBE DATA ADJUSTMENTS

1. The diffusion tube results do not represent a full calendar year. Therefore, in accordance with the guidance set out in Box 3.2 of LAQM.TG(09), the data have been adjusted to an annual mean, based on the ratio of concentrations during the short-term monitoring period (3 months; Jul 2014 – Sep 2014) to those over a calendar year (Jan 2014 – Dec 2014) at three background sites operated as part of the Automatic Urban and Rural Network (AURN) where long-term data are available.
2. The annual mean nitrogen dioxide concentrations and the period means for each of the four monitoring sites from which adjustment factors have been calculated are presented in Table G6.1, along with the Overall Factor.

Table G6.1: Data used to Adjust Short-term Monitoring Data at the Diffusion Tubes to 2014 Annual Mean Concentrations

AURN Station	Period Mean Concentration (µg/m^3)	Annual Mean Concentration (µg/m^3)	Adjustment Factor
Birmingham Acocks Green	41.5	43.1	1.04
Birmingham Tyburn	23.9	29.8	1.25
Leamington Spa	16.7	19.6	1.17
Leicester University	22.0	26.9	1.22
Overall Factor	**-**	**-**	**1.17**

3. The diffusion tubes were prepared and analysed by Gradko International (20% TEA in water). The latest national bias adjustment factor for this type of diffusion tube is 0.91 and the annualised concentrations have thus been bias adjusted by this factor.

Table G6.2: Adjustment of Raw Monitoring Data to Annual Mean Concentrations

Tube ID	Monitoring Location	Raw Monitored Concentration	Annualised Concentration	Bias Adjusted Concentration [a]
1	1	19.4	22.7	20.6
2, 3 & 4	2	38.6[b]	45.2	**41.2**
5	3	80.8	103.3	**94.0**
6	4	28.6	33.4	30.4
7	5	18.0	21.0	19.1
8	6	42.3	49.5	**45.0**
Objective		**-**	**-**	**40**

[a] Exceedences of the objective are shown in bold.

[b] Average of triplicate diffusion tube concentrations.

APPENDIX G7

CONSTRUCTION MITIGATION

1. The following is a set of measures that should be incorporated into the specification for the works:

Communications

- develop and implement a stakeholder communications plan that includes community engagement before and during work on site;
- display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environmental manager/engineer or the site manager; and
- display the head or regional office contact information.

Dust Management Plan

- Develop and implement a Dust Management Plan (DMP) approved by the Local Authority which documents the mitigation measures to be applied, and the procedures for their implementation and management.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken;
- make the complaints log available to the local authority when asked; and
- record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

Monitoring

- Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust. Record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning to be provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the Local Authority when asked;
- increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and
- agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction (Institute of Air Quality Management, 2012b).

Preparing and Maintaining the Site

- Plan the site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible;

- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- fully enclose specific operations where there is a high potential for dust production and the site is active for an extensive period;
- avoid site runoff of water or mud;
- keep site fencing, barriers and scaffolding clean using wet methods;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below; and
- cover, seed, or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off their engines when stationary – no idling vehicles;
- avoid the use of diesel- or petrol-powered generators and use mains electricity or battery-powered equipment where practicable;
- impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate);
- produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- implement a Travel Plan that supports and encourages sustainable staff travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes, conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- only remove the cover from small areas during work, not all at once.

Measures Specific to Construction

- Avoid scabbling (roughening of concrete surfaces), if possible;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.

Measures Specific to Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport; and
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).