IDI Gazeley UK Ltd

Magna Park Extension: Hybrid Application

ES Chapter No. 10 Air Quality

Environmental Statement – Final Report: September 2015

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10 Air Quality

10.1 Introduction

10.1.1 This report describes the potential air quality impacts 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).

10.1.2 The proposed development comprises two zones. Full descriptions of the proposals are set out in Chapter 2 of this ES, and are not repeated here. 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 DHL Supply Chain that is the subject of Application Reference 15/00919/FUL);
- 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).

10.1.3 The proposed development lies close to an Air Quality Management Area (AQMA) declared by Harborough District Council (HDC) for exceedences 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 $PM_{2.5}$).

10.1.4 There is also the potential for the construction activities to impact upon both existing and new properties. The main pollutants of concern related to construction activities are dust and PM_{10}.

10.1.5 This report describes existing local air quality conditions (2014), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2016, which is the anticipated opening year of the proposed development, as well as the design year (2031) when the proposed development will be complete and fully occupied. In addition, a sensitivity test has been carried out for 2021 (based on the 2031 traffic forecasts), which is the anticipated opening year of the second phase (post-DHL Supply Chain) of the proposed development; this is to take account of the fact that vehicle emission are forecast to reduce in future years, and provides a worst-case assessment. The assessment of construction dust impacts focuses on the anticipated duration of the works.

10.1.6 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) – see Hybrid Application: EIA Scoping Information (Appendix I).

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 announced the launch of the Planning Practice Guidance (PPG) website (DCLG, 2014). 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 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 Plan

10.2.11 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

10.2.12 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).

10.2.13 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, 2009). Therefore, 1-hour nitrogen dioxide concentrations need only be considered if the annual mean concentration is above this level.

10.2.14 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, 2009). 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.

10.2.15 The European Union has also set limit values for nitrogen dioxide, PM_{10} and $PM_{2.5}$. 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). The limit values for nitrogen dioxide are the same levels as the UK objectives, but applied from 2010 (The Air Quality Standards Regulations (No. 1001), 2010). The limit values for PM_{10} and $PM_{2.5}$ are also the same level as the UK statutory objectives, but applied from 2005 for PM_{10} and from 2015 for $PM_{2.5}$. In the UK, only monitoring and modelling carried out by the UK Government meets the specification required to determine compliance with the limit values. The UK Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the limit values being exceed, and these data are not included in reporting to the European Commission.

10.2.16 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 µg/m^3 not to be exceeded more than 18 times a year
	Annual Mean	40 µg/m^3
Fine Particles (PM_{10})	24-hour Mean	50 µg/m^3 not to be exceeded more than 35 times a year
	Annual Mean	40 µg/m^3
Fine Particles ($PM_{2.5}$) [a]	Annual Mean	25 µg/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.

Construction Dust Criteria

10.2.17 The construction dust assessment considers the potential for impacts within 350m of the Site boundary; or within 50m of roads used by construction vehicles. The assessment methodology is in line with that provided by the IAQM (Institute of Air Quality Management, 2014). The assessment takes into account the construction phasing information and details of groundworks and other construction activity provided in Chapter 2 of this ES.

10.2.18 The assessment of dust impacts is based around a sequence of steps. Step 1 is a basic screening stage, to determine whether the more detailed assessment provided in Step 2 is required. Step 2a determines the potential for dust to be raised from on-Site works and by vehicles leaving the Site. Step 2b defines the sensitivity of the area to any dust that may be raised. Step 2c combines the information from Steps 2a and 2b to determine the risk of dust impacts without appropriate mitigation. Step 3 uses this information to determine the appropriate level of mitigation required to ensure that there should be no significant impacts. Full details of this approach are provided in Appendix G1.

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, 2015b) and the Environment Agency's website 'what's in your backyard' (Environment Agency, 2015). 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) has been undertaken at sites along the A5 and A4303; the results of this survey are included within the assessment.

10.3.3 The background concentrations across the study area have been defined using the national pollution maps published by Defra (Defra, 2015a). These cover the whole country on a 1x1 km grid. Current exceedences of the annual mean EU limit value for nitrogen dioxide have been identified using the maps of roadside concentrations published by Defra (2015c). These are the maps, currently based on 2012 data, used by the UK Government, together with the results from national AURN monitoring sites that operate to EU data quality standards, to report exceedences of the limit value to the EU.

Descriptors for Air Quality Impacts and Assessment of Significance

Construction Dust Significance

10.3.4 Guidance from the IAQM (IAQM, 2014) is that, with appropriate mitigation in place, the impacts of construction dust will not be significant. The assessment thus focuses on determining the appropriate level of mitigation so as to ensure that impacts will normally not be significant.

Operational Significance

10.3.5 Guidance on Land-use Planning and Development Control: Planning for Air Quality was developed by the Institute of Air Quality Management (IAQM) and Environmental Protection UK in May 2015 (Moorcroft and Barrowcliffe et al, 2015). The approach to the guidance involves a two-stage approach:

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

10.3.6 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.

10.3.7 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 G2.

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)'.

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

- the existing and future air quality conditions without the Development;
- the extent of current and future population exposure to the impacts; and
- the influence and validity of any assumptions adopted in undertaking the prediction of impacts.

Assessment of Road Traffic Impacts

Sensitive Receptors

10.3.9 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations close to the proposed development. The receptors have been located on the façades of the properties closest to the road sources. Sixteen 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 G3 for verification method).

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.
6	Residential property at Emmanuel Cottages, 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

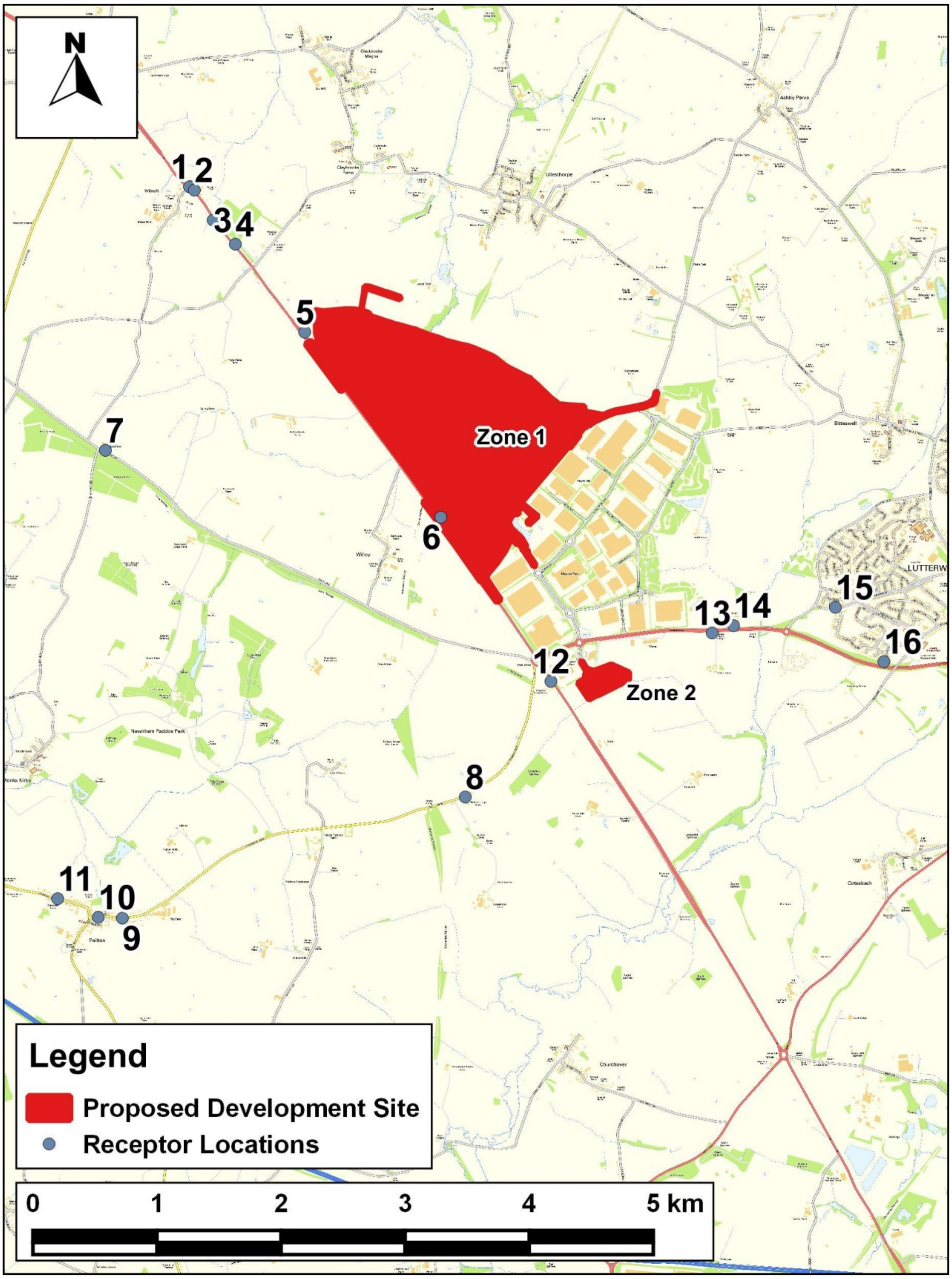

Figure 10.1 Receptor Locations and Proposed Development Site

Assessment Scenarios

10.3.10 Predictions of nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for a base year (2014), and the future years of 2016, 2021 and 2031. For 2016, 2021 and 2031, predictions have been made assuming both that the development does proceed (With Development), and does not proceed (Without Development). A further 2016 sensitivity test has been carried out for nitrogen dioxide that involves assuming no reduction in emission factors for road traffic from the baseline year. This is to address the issue identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011) that road traffic emissions have not been declining as expected (see later section on Uncertainty). Nitrogen dioxide concentrations in 2016 with and without the Proposed DEvelopment are thus presented for two scenarios: 'With Emissions Reduction' and 'Without Emissions Reduction'. It was not considered appropriate to include a sensitivity test to emissions in 2021 and 2031; justification for this is provided in the section on Uncertainty.

Modelling Methodology

10.3.11 Concentrations have been predicted using the ADMS-Roads dispersion model. Details of the model inputs and the model verification are provided in Appendix G3, together with the method used to derive current and future year background nitrogen dioxide concentrations.

Uncertainty in Road Traffic Modelling Predictions

10.3.12 There are many components that contribute to the uncertainty of modelling predictions. The 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 the model is required to simplify real-world conditions into a series of algorithms. An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix G4). Because the model has been verified and adjusted, there can be reasonable confidence in the prediction of current year (2014) concentrations.

10.3.13 Predicting pollutant concentrations in a future year will always be subject to greater uncertainty. For obvious reasons, the model cannot be verified in the future, and it is necessary to rely on a series of projections provided by DfT and Defra as to what will happen to traffic volumes, background pollutant concentrations, and vehicle emissions. A disparity between the road transport emission projections and measured annual mean concentrations of nitrogen oxides and nitrogen dioxide has been identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011). This is evident across the UK, although the effect appears to be greatest in inner London; there is also considerable inter-site variation. Whilst the emission projections suggested that both annual mean nitrogen oxides and nitrogen dioxide concentrations should have fallen by around 15-25% over the 6 to 8 years prior to 2009, at many monitoring sites levels remained relatively stable, or even showed a slight increase.

10.3.14 The reason for the disparity is thought to relate to the on-road performance of modern diesel vehicles. New vehicles registered in the UK have 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 is often no better than that of earlier models (Carslaw et al., 2011). There is a widespread consensus that the Euro VI emissions standard for Heavy Duty Vehicles is delivering as expected. The emissions standard for Euro 6 Light Duty Vehicles is being delivered in two stages (often referred to as "Euro 6a/b" and "Euro 6c"). Euro 6a/b vehicles are currently on the road, and Euro 6c is expected to be introduced from about 2018 onwards. The Euro 6 emissions standard is unchanged between Euro 6a/b and Euro 6c, but the test procedure is different – the latter is based on Portable Emissions Measurement Systems (PEMS) to ensure that emissions during real-world driving conditions are fully considered.

10.3.15 The emission factors for Euro 6a/b are incorporated into Defra's Emission Factor Toolkit (EFT v6.0.2) which has been used for this assessment (and which are based on COPERT4v10). COPERT4v10 assumes Euro 6 diesel cars and Light Goods Vehicles to have NOx emissions 65% lower than Euro 5, and with a Conformity Factor of 2.8. The COPERT4v11 report was published in September 2014 and contains updated emissions factors for both Euro 5/V and Euro 6/VI vehicles, and confirms that the current assumption in EFTv6.0.2 for Euro 6a/b is correct. It also confirms that NOx emissions from Euro 6c vehicles are expected to be lower with a Conformity Factor of about 1.5.

10.3.16 The implications for this assessment are that the absolute nitrogen dioxide concentrations predicted in 2016 may be higher than shown, when based on the revised emissions reduction forecasts. Despite the belief that the emissions factors are now more realistic, there remains some uncertainty in the short term. To account for this uncertainty in the projections, sensitivity checks have been conducted assuming that the future (2016) road traffic emissions per vehicle are unchanged from 2014 values. The predictions within this sensitivity check are likely to be over-pessimistic, as new vehicles meeting more stringent standards (Euro 6a/b) came into service from 2013/14. The Defra forecast figures indicate by 2016 there will be a roughly 50% penetration of Euro VI HDVs (the most polluting vehicles), and a roughly 20% penetration of Euro 6 LDVs. These new vehicles are expected to deliver real on-road reductions in nitrogen oxides emissions.

10.3.17 By 2021, Defra forecast that there will be a >90% penetration of Euro VI HDVs, and an 67% penetration of Euro 6 LDVs. In addition, by 2021 there will be an increasing proportion of Euro 6c vehicles in the fleet, and the reduced NOx emissions associated with these vehicles have not been taken into account (as the COPERT4v11 emissions are not in EFTv6.0.2). It is therefore not considered appropriate to include sensitivity checks for the 2021 or 2031 assessment year.

10.3.18 It must also be borne in mind that the predictions in 2016 are based on worst-case assumptions regarding the change in traffic flows, such that all committed developments are assumed to be fully operational. In 2021, the traffic flows associated with all committed developments and a fully completed and operational Development assumed. These assumptions will have overestimated the traffic emissions, which will, in part, offset any potential underestimation in future concentrations using the official emission factors as described above.

10.4 Baseline Conditions

Air Quality Management Areas

10.4.1 In July 2006, HDC declared an Air Quality Management Area (AQMA) for exceedences of the annual mean nitrogen dioxide objective in Lutterworth town centre. The AQMA encompasses properties along the High Street in Lutterworth, extending from the junction with George Street to the north, to just below the junction with Stoney Hollow to the south.

10.4.2 Subsequent review and assessment reports confirmed the exceedence of the objective, and that an area to the south of the AQMA may also be exceeding the annual mean objective for nitrogen dioxide. The Further Assessment (HDC, 2012) has also identified that car and HGV traffic had the greatest impact on air quality in the AQMA, contributing over 80% of NOx emissions. While HGVs comprise only 6% of total movements, they were estimated to contribute over 40% of NOx.

10.4.3 Rugby Borough Council (RBC) has also declared an AQMA for exceedences 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

10.4.4 A search of the UK Pollutant Release and Transfer Register (Defra, 2015b) and Environment Agency's 'what's in your backyard' (Environment Agency, 2015) 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

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

Air Quality Monitoring

Monitoring Carried Out By Local Authorities

10.4.6 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.

10.4.7 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. Annual mean nitrogen dioxide concentrations at roadside sites within the Lutterworth AQMA have consistently exceeded the objective, and there is little evidence of any downward trend in levels. Outside the AQMA, concentrations are below the objective. A summary of the measured concentrations over the period 2010 to 2014 is shown in Table 10.4.

10.4.8 Diffusion tube monitoring is also carried out by Hinckley & Bosworth Borough Council, including four sites located along the A5, to the west of the M69. A summary of the measured concentrations over the period 2010 to 2013 is also shown in Table 10.3; levels at both kerbside (1 m from the road) and building facade sites have all been well below the objective.

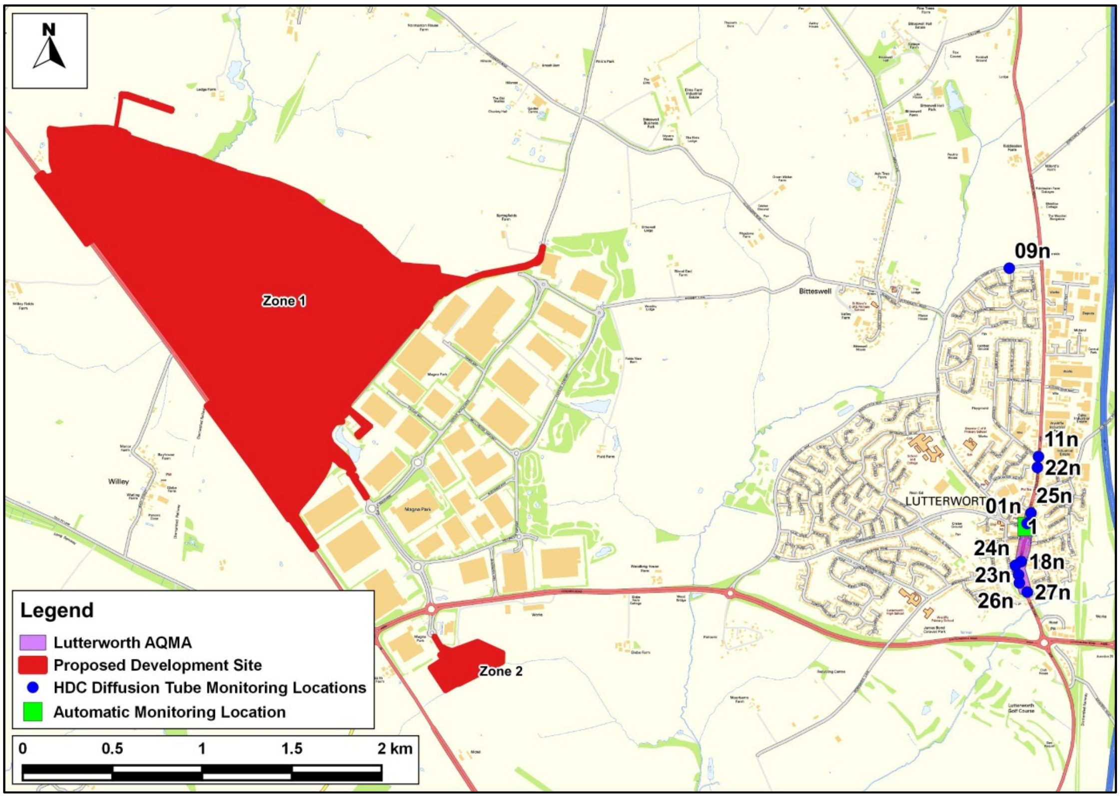

Figure 10.2 HDC Monitoring Locations and Lutterworth AQMA

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Table 10.4 Summary of Annual Mean Nitrogen Dioxide (NO_2) Monitoring (2010-2014) [a b]

Site No.	Site Type	Location	2010	2011	2012	2013	2014
Harborough DC - Lutterworth							
01n	R	Lutterworth Service Shop	**58.0**	**49.5**	**48.7**	**45.5**	39.8
09n	R	Maxwell Way	32.2	25.5	25.6	25.5	23.9
11n	R	Day Nursery	28.8	26.2	34.8	36.2	35.8
18n	R	Jazz Hair	**52.3**	**45.2**	**43.3**	42.2	39.2
22n	R	77 Leicester Road	28.8	26.2	22.3	21.0	19.9
23n	R	6 The Terrace, Rugby Road	**41.2**	37.5	31.5	34.2	27.6
24n	R	4-9 Regent Road	29.5	26.6	**51.4**	**47.5**	38.8
25n	R	26 Market Street	**43.4**	35.8	31.1	37.8	34.9
26n	R	24 Rugby Road	**48.1**	**49.5**	**41.8**	**41.0**	**40.7**
27n	R	17 Rugby Road	**43.3**	36.8	33.9	32.9	29.8
Harborough DC - Walcote							
16n	R	Walcote	32.0	29.0	24.5	23.8	21.4
Harborough DC - Theddingworth							
28n	R	Spencerdene Main St	n/a	22.0	23.3	19.3	21.1
29n	R	Homeside Main St	n/a	30.3	31.1	31.4	27.5
Hinckley & Bosworth BC							
20	K	Weldon A5	33.2	32.6	n/a	n/a	n/a
22	K	Lester House – A5	32.5	32.1	n/a	n/a	n/a
30	F	Lester House (Façade)	24.8	24.7	28.0	24.4	n/a
31	F	Weldon (Façade)	24.4	24.6	28.0	23.6	n/a

Notes

K – Kerbside Site

R – Roadside Site

F – Building Façade Site

a Exceedences 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 2014 Air Quality Progress Report (Hinckley & Bosworth BC, 2014).

Monitoring Carried Out for IDI-G

10.4.9 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 are provided in Appendix G4, G5 and G6. Measured concentrations at these monitoring locations have been used to verify the model predictions, as set in Appendix G3. Monitoring location 3 has been excluded from the model verification (see Appendix G3).

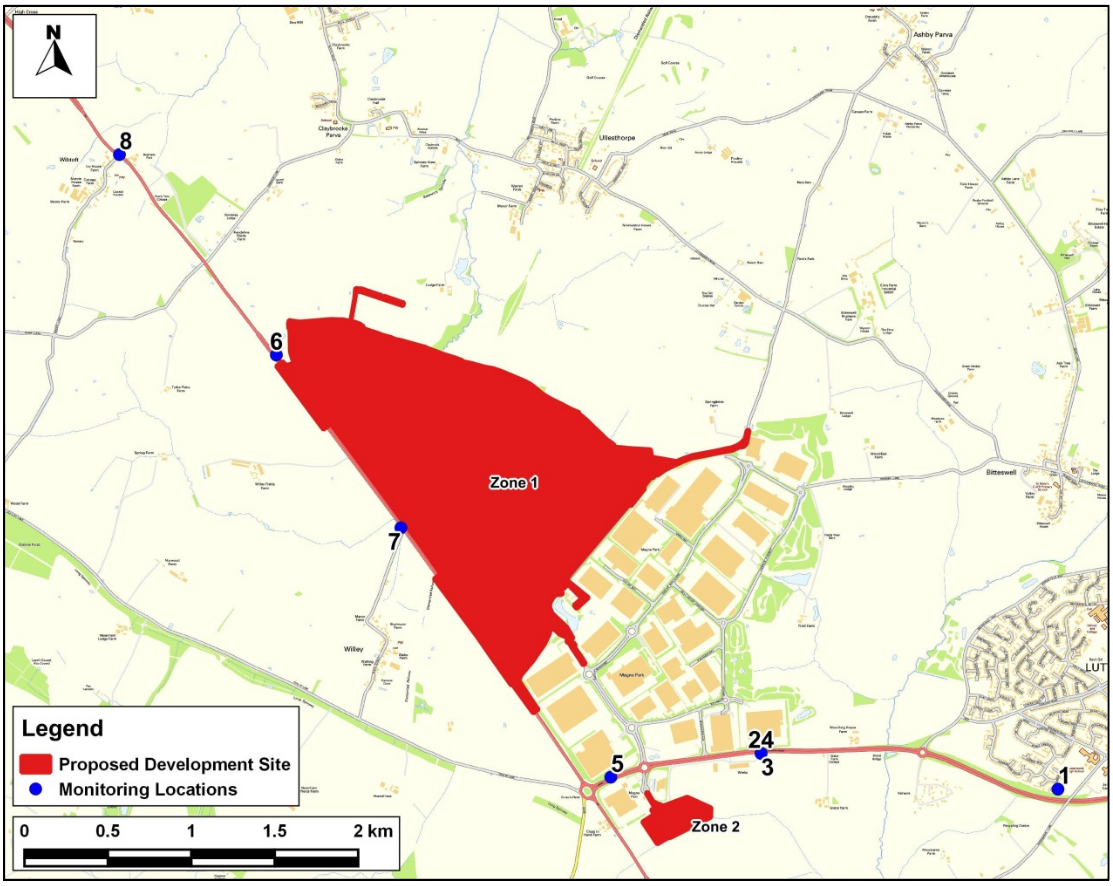

Figure 10.3 IDI-G Diffusion Tube Monitoring Locations

Table 10.5 Monitored Nitrogen Dioxide Concentrations (µg/m³)

Monitoring Location	Location	Annualised Concentration [a]
1	Alexander Drive, Near A4303	20.6
2	A4303, Near TT Electronics	**41.2** [b]
3	A4303, Near MPL	**94.0** [c]
4	A5, Near White House Farm	30.4
5	A5, Near Main Street	19.1
6	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; Further details are provided in Appendix G7.

10.4.10 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

10.4.11 In addition to these locally measured concentrations, estimated background concentrations across the study area have been determined for 2014 and the future years of 2016 and 2031 (Table 10.6). In the case of nitrogen dioxide, two sets of 2016 backgrounds are presented to take into account uncertainty in future year vehicle emission factors. The derivation of background concentrations is described in Appendix G4. The background concentrations are all well below the objectives.

Table 10.6 Estimated Annual Mean Background Pollutant Concentrations in 2014, 2016, 2021 and 2031 (µg/m3)

Year	NO_2	PM_{10}	$PM_{2.5}$
2014 [a]	13.6 – 16.9	16.6 – 17.7	10.9 – 11.3
2016 – Without Reductions in Traffic Emissions [b]	13.1 – 16.3	n/a	n/a
2016 – With Reductions in Traffic Emissions [c]	12.5 – 15.3	16.2 – 17.4	10.6 – 11.0
2021 – With Reductions in Traffic Emissions [d]	10.0 – 12.3	15.6 – 16.8	10.1 – 10.4
2031 – With Reductions in Traffic Emissions [d]	11.4 – 14.7	15.4 – 16.6	9.9 – 10.2
Objectives	**40**	**40**	**25**

n/a = not applicable

a This assumes that road vehicle emission factors in 2014 remain the same as in 2011 (See Appendix G4).

b This assumes that road vehicle emission factors in 2016 remain the same as in 2011.

c This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

d This assumes that road vehicle emission factors reduce between 2014 and 2012/2030 at the current 'official' rates. The background concentrations in 2031 have been assumed to be the same as those for 2030.

National Compliance

10.4.12 There are no national network (AURN) monitoring sites within the study area where exceedences of the EU limit values have been identified. The national map of roadside annual mean concentrations identifies no exceedences (in 2012) of the limit value for nitrogen dioxide along the nearby sections M1, M6, A4303, A426 or A5. There are also no exceedences of the limit values for PM_{10} or $PM_{2.5}$.

Baseline Dispersion Model Results

10.4.13 Baseline concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been modelled at each of the existing receptor locations (see Table 10.2 and Figure 10.1). The results, which cover both the existing (2014) and future years (2016, 2021 and 2031) baselines (Without Development), are set out in Table 10.7, Table 10.8 and Table 10.9. The future 2016 baseline for nitrogen dioxide covers the two scenarios: with the official reductions in vehicle emission factors and without these reductions. The modelled road components of nitrogen oxides concentrations have been adjusted by a factor of 2.9465, which was derived during the model verification process, and the total NO_2 has been adjusted by a secondary verification factor of 0.9910 (see Appendix G4 for details of the model verification).

2014 Baseline

10.4.14 The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations, apart from at Receptor 1 (located alongside the A5 north of Magna Park) where concentrations are above the objective. All of the predictions for annual mean PM_{10} and $PM_{2.5}$ are well below the objectives in 2014. All annual mean PM_{10} concentrations are well below the threshold (32 µg/m^3) at which an exceedence of the daily mean objective is likely.

2016 Baseline With 'Official' Emission Reduction

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 µg/m^3) at which an exceedence of the daily mean objective is likely.

2016 Baseline Without Emission Reduction

10.4.16 The predicted annual mean concentrations of nitrogen dioxide are below the objective at all receptor locations, apart from at Receptors 1 and 2 (both are located alongside the A5 north of Magna Park) where concentrations are above the objective.

2021 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 µg/m^3) at which an exceedence of the daily mean objective is likely.

2031 Baseline

10.4.18 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 µg/m^3) at which an exceedence of the daily mean objective is likely.

Table 10.7 Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m³) [a]

Receptor	2014	2016		2021 [d]	2031 [d]
		With 'Official' Emissions Reduction [b]	Without Emissions Reduction [c]		
1	**42.1**	36.9	**43.7**	28.0	23.2
2	39.4	34.5	**40.8**	26.2	22.0
3	33.6	29.5	34.6	22.4	19.6
4	37.7	33.1	39.0	25.1	21.4
5	28.8	25.3	29.5	19.3	17.4
6	31.2	27.3	32.1	20.8	18.0
7	18.9	17.1	18.4	14.0	13.7
8	16.7	15.0	16.2	11.8	12.5
9	22.5	20.2	22.1	15.6	16.8
10	31.2	27.6	30.9	21.1	20.3
11	26.3	23.4	25.9	18.0	18.0
12	31.2	26.9	32.1	19.7	17.7
13	26.7	23.2	27.2	16.7	16.2
14	28.3	24.5	29.0	17.5	16.8
15	23.1	21.2	23.0	17.7	17.2
16	25.5	22.2	25.9	15.9	16.0

a Exceedences of the objective are shown in bold.
b This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.
c This assumes that road vehicle emission factors in 2016 remain the same as in 2014.
d This assumes that road vehicle emission factors reduce between 2014 and 2021/2031 at the current 'official' rates.

Table 10.2 Modelled Baseline Annual Mean Concentrations of PM_{10} ($\mu g/m^3$)

Receptor	2014	2016	2021	2031
1	21.6	21.2	21.3	21.0
2	21.1	20.7	20.8	20.5
3	20.2	19.8	19.7	19.4
4	20.8	20.4	20.5	20.2
5	19.7	19.4	19.1	18.9
6	19.8	19.4	19.3	19.0
7	17.9	17.5	17.0	16.8
8	17.2	16.9	16.3	16.1
9	18.0	17.6	17.0	16.8
10	19.1	18.6	18.1	17.8
11	18.0	17.6	17.0	16.8
12	19.1	18.8	18.5	18.3
13	18.8	18.5	18.0	17.8
14	19.1	18.7	18.2	18.0
15	17.6	17.2	16.8	16.5
16	19.0	18.6	18.1	17.9

While the annual mean PM_{10} objective is 40 $\mu g/m^3$, 32 $\mu g/m^3$ is the annual mean concentration above which an exceedence of the 24-hour mean PM_{10} concentration is possible, as outlined in LAQM.TG(09) (Defra, 2009). A value of 32 $\mu g/m^3$ is thus used as a proxy to determine the likelihood of exceedence of the 24-hour mean PM_{10} objective, as recommended in EPUK & IAQM guidance (EPUK & IAQM, 2015).

Table 10.9 Modelled Baseline Annual Mean Concentrations of $PM_{2.5}$ (µg/m^3)

Receptor	2014	2016	2021	2031
1	13.8	13.4	13.1	12.8
2	13.5	13.1	12.8	12.5
3	12.9	12.5	12.2	11.9
4	13.4	12.9	12.6	12.3
5	12.5	12.1	11.7	11.4
6	12.6	12.2	11.8	11.5
7	11.4	11.1	10.6	10.4
8	11.2	10.8	10.3	10.1
9	11.7	11.3	10.8	10.6
10	12.4	12.0	11.4	11.1
11	11.9	11.5	10.9	10.7
12	12.4	12.0	11.6	11.4
13	12.2	11.9	11.3	11.1
14	12.4	12.0	11.5	11.2
15	11.7	11.4	10.9	10.7
16	12.2	11.8	11.3	11.0

10.5 Construction Effects and Mitigation

10.5.1 The construction works will give rise to an increased number of HGV movements on the local road network. The outline construction programme identifies a number of discrete (non-overlapping) parcels of development, each extending over a period of about 60 weeks, although the actual period of construction works within each programme will be less (and approximately 37 weeks). The daily peak number of HGV movements is about 220, but averaged over the period of a year, this reduces to just over 100 movements per day. These movements will be divided across the local road network (i.e. the A4303 and the A5 north and south); in addition, access through the existing Magna Park will available once Agrossy Way is linked up. Guidance issued by EPUK/IAQM suggests that a detailed assessment of changes to HGV traffic flows is only required where there is an increase of more than 100 AADT. This is unlikely to occur on any individual road link, and the impacts of construction traffic HGVs have been scoped out of any further assessment.

10.5.2 The construction works will give rise to a risk of dust impacts during demolition, earthworks and construction, as well as from trackout of dust and dirt by vehicles onto the public highway. The Proposed Development will be constructed in essentially two phases; 2016 to 2020 (hereinafter referred to as Phase 1) and 2020 to 2026 (hereinafter referred to as Phase 2). Phase 1 will comprise of parcels E, F, G, H and I of Zone 1 (the new distribution park) and Zone 2 (the rail freight facility with HGV parking). Phase 2 will comprise of parcels J, K, L and M of Zone 1 (the new distribution park).

Potential Dust Emission Magnitude

Demolition

10.5.3 There will be a requirement to demolish Emmanuel and Lodge cottages with an approximate total volume of 10,000 m^3. These cottages will be demolished during Phase 1 and based on the example definitions set out in Table G1.1 in Appendix G1, the dust emission class for demolition is considered to be small for Phase 1. There will be no demolition necessary for Phase 2.

Earthworks

10.5.4 The characteristics of the soil at the development site have been defined using the British Geological Survey's UK Soil Observatory website (British Geological Survey, 2015), as set out in Table 10.10.

Table 10.10 Summary of Soil Characteristics

Category	Record
Soil layer thickness	Deep
Grain Size (and Soil Parent Material)	Mixed (Argillic[a], Arenaceous[b] and Rudaceous[c])
European Soil Bureau Description	Glacial Till, River Terrace Sand/Gravel, Riverine Clay, Floodplain Sands and Gravel
Soil Group	All
Soil Texture	Loam[d] to Clayey Loam, Clay to Sandy Loam and Sand to Sandy Loam

a grain size < 0.06 mm.
b grain size 0.06 – 2.0 mm.
c grain size > 2.0 mm.
d a loam is composed mostly of sand and silt.

10.5.5 Overall, it is considered that, when dry, this soil has the potential to be slightly dusty.

10.5.6 The site covers some 2,325,000 m^2 and about half of this will be subject to earthworks. This will mainly involve the removal of topsoil and the excavation of sub soil which is usually damp and not prone to dust re-suspension. Dust will arise mainly from vehicles travelling over unpaved ground and from the handling of dusty materials. Phase 1 covers approximately 575,000 m^2 and based on the example definitions set out in Table G1.1 in Appendix G1, the dust emission class for earthworks is considered to be large. Phase 2 covers about 415,000 m^2 and based on the example definitions set out in Table G1.1 in Appendix G1, the dust emission class for earthworks is considered to be large.

Construction

10.5.7 Construction will involve a total building volume of around 125,000,000 m^3. The buildings will comprise primarily of steel frames, which will not create any dust. Dust will arise from vehicles travelling over unpaved ground, the handling and storage of dusty materials. Based on the example definitions set out in Table G1.1 in Appendix G1, the dust emission class for construction is considered to be large for both phases.

Trackout

10.5.8 The number of vehicles accessing the site, which may track out dust and dirt will vary during the construction phase, but for the majority of the works there will be between about 100 to 200 outward heavy vehicle movements per day. Construction traffic will enter and exit via Mere Road off the A5. Based on the example definitions set out in Table G1.1 in Appendix G1, the dust emission class for trackout is considered to be large for both phases.

10.5.9 Table 10.11 summarises the dust emission magnitude for the proposed development.

Table 10.11 Summary of Dust Emission Magnitude

Source	Dust Emission Magnitude	
	Phase 1	Phase 2
Demolition	Small	N/A
Earthworks	Large	Large
Construction	Large	Large
Trackout	Large	Large

Sensitivity of the Area

10.5.10 This assessment step combines the sensitivity of individual receptors to dust effects with the number of receptors in the area and their proximity to the site. It also considers additional site-specific factors such as topography and screening, and in the case of sensitivity to human health effects, baseline PM_{10} concentrations.

Sensitivity of the Area to Effects from Dust Soiling

10.5.11 The IAQM guidance explains that residential properties and car parks are ‘high’ sensitivity receptors to dust soiling, while commercial/industrial warehouses and agricultural fields are ‘low’ sensitivity receptors (Table G1.2 in Appendix G1). There is one residential property within 50 m of the Site. The nearest sensitive receptors are three car parks within 20 m of the Site (see Figure 10.4). Using the matrix set out in Table G1.3 in Appendix G1, the area surrounding the onsite works is of ‘medium’ sensitivity to dust soiling. Table 10.10 shows that dust emission magnitude for trackout is ‘large’ and Table G1.2 in Appendix G1 thus explains that there is a risk of material being tracked 500 m from the site exit. Since it is not known which roads construction vehicles will use, it has been assumed that vehicles may travel along all local roads within 500 m. There are three residential properties and two car parks within 50 m of the roads along which material could be tracked (see Figure 10.5). Table G1.3 in Appendix G1 thus indicates that the area is of ‘low’ sensitivity to dust soiling due to trackout (Table 10.12).

10.5.12 The SemeLAB facility is located to the south of the A4303, approximately 50 metres from the carriageway. The facility manufactures high performance components for the communications industry, and the processes are susceptible to dust. The operators of the facility have expressed concerns regarding dust emissions, particularly during the construction of Zone 2, which is adjacent to the A4303, but approximately 255 metres to the southwest of SemeLAB. At this distance the sensitivity to dust soiling is described as low, based on Table G1.3 in Appendix G1, and the risk of any impacts will be low. In considering this risk, it should be taken into account that there will be minimal construction works within Zone 2. SemeLAB is also over 200 m away from roads where dust may be tracked out, and will thus not be affected by dust tracked out from the Proposed Development Site. Overall, the risk of dust effects at SemeLAB is judged to be low.

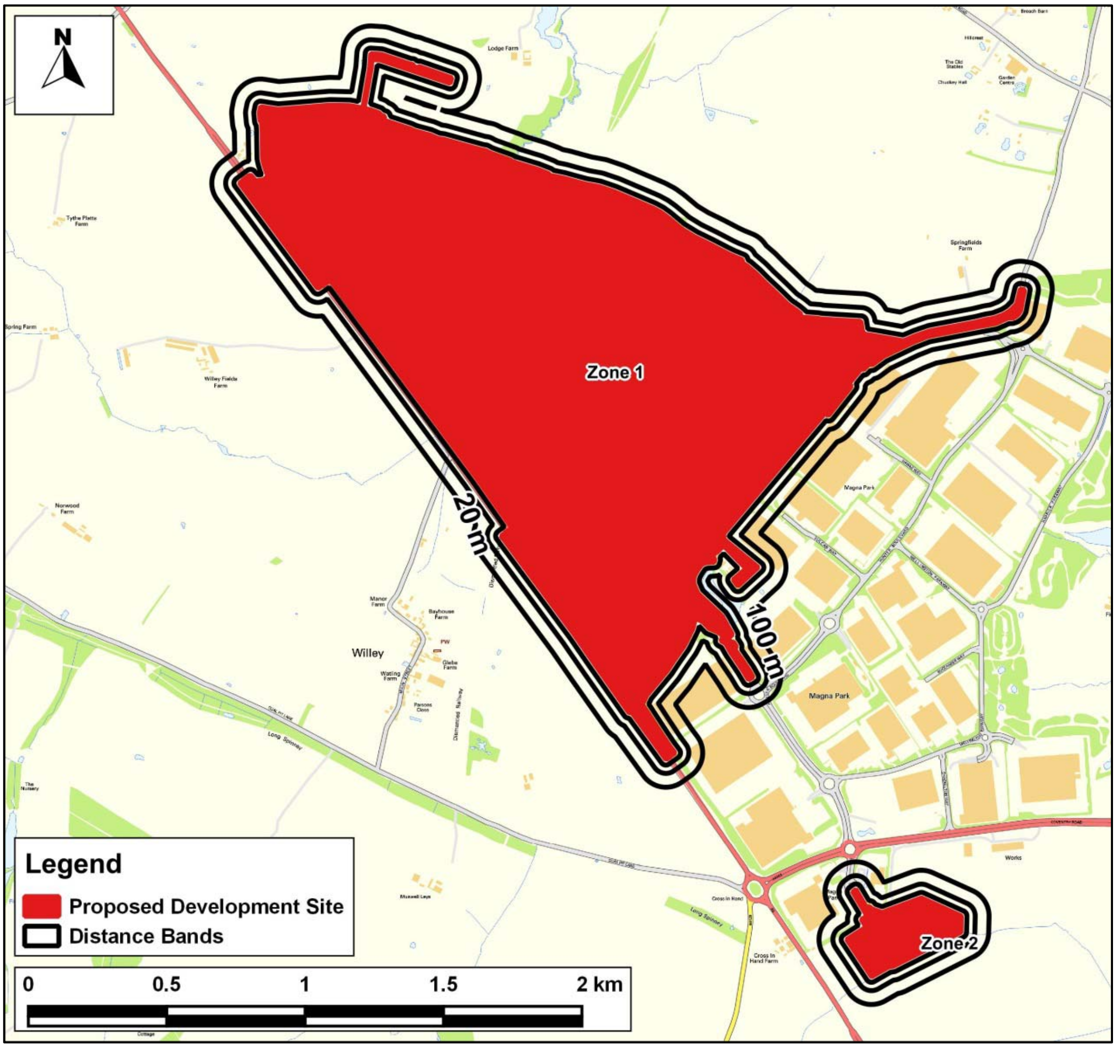

Figure 10.1 Distance Bands (20 m, 50 m and 100 m) from the Site Boundary

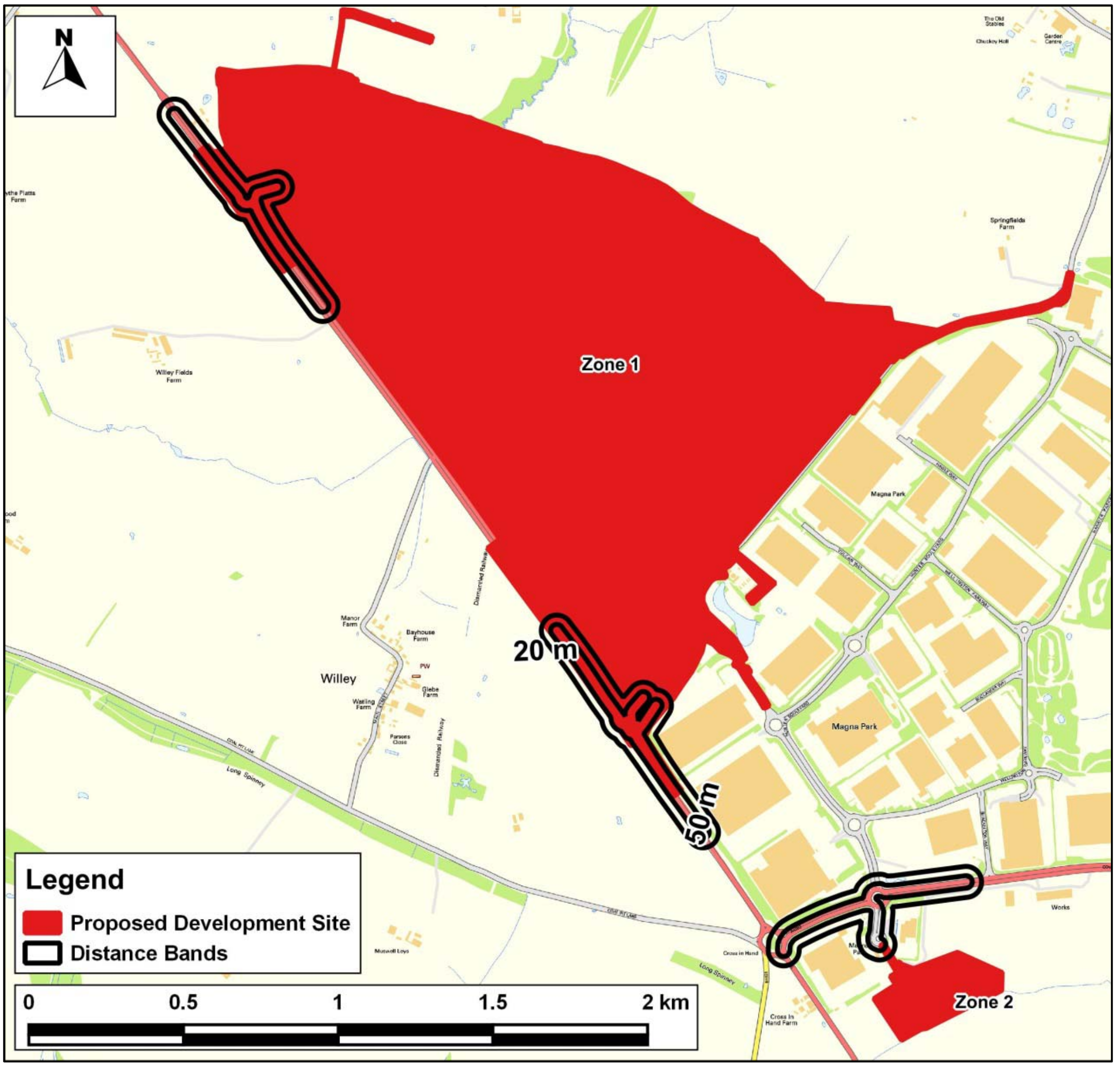

Figure 10.2 Distance Bands (Black) around Roads Used by Construction Traffic Within 500 m of the Site Boundary (Red)

Sensitivity of the Area to any Human Health Effects

10.5.13 Residential properties are also classified as being of ‘high’ sensitivity to human health effects. The matrix in Table G1.4 in Appendix G1 requires information on the baseline annual mean PM_{10} concentration in the area. The maximum predicted baseline PM_{10} concentration at the receptors is 22.8 $\mu g/m^3$ (Table 10.7), and this value has been used. Using the matrix in Table G1.4 in Appendix G1, the area surrounding the onsite works and the area surrounding roads along which material may be tracked from the site are of ‘low’ sensitivity to human health effects (Table 10.12).

Sensitivity of the Area to any Ecological Effects

10.5.14 The guidance considers SSSIs with dust-sensitive features to be of ‘medium sensitivity’. The nearest designated ecological site is the Misterton Marshes SSSI, which is located over 4 km away from the Site and will thus not be effected by the construction works. There are however, a number of agricultural fields within 20 m of the Site boundary and within 20 m along roads which material may be tracked, that may contain dust-sensitive features. These are considered to be of ‘low sensitivity’. Table G1.5 in Appendix G1 thus shows that the area is of low sensitivity to ecological effects (Table 10.12).

Table 10.12 Summary of the Area Sensitivity

Effects Associated With:	Sensitivity of the Surrounding Area	
	On-site Works	Trackout
Dust Soiling	Medium Sensitivity	Low Sensitivity
Human Health	Low Sensitivity	Low Sensitivity
Ecological	Low Sensitivity	Low Sensitivity

Significance of Predicted Effects

10.5.15 The dust emission magnitudes in Table 10.11 have been combined with the sensitivities of the area in Table 10.12 using the matrix in Table G1.6 in Appendix G1, in order to assign a risk category to each activity. The resulting risk categories for the four construction activities, without mitigation, are set out in Table 10.13. These risk categories have been used to determine the appropriate level of mitigation as set out in paragraph 10.73.

Table 10.13 Summary of Risk of Impacts Without Mitigation

Source	Dust Soiling	Human Health	Ecology
Phase 1			
Demolition	Low Risk	Negligible	Negligible
Earthworks	Medium Risk	Low Risk	Low Risk
Construction	Medium Risk	Low Risk	Low Risk
Trackout	Low Risk	Low Risk	Low Risk
Phase 2			
Demolition	N/A	N/A	N/A
Earthworks	Medium Risk	Low Risk	Low Risk
Construction	Medium Risk	Low Risk	Low Risk
Trackout	Low Risk	Low Risk	Low Risk

Significance of Predicted Effects

10.5.16 The IAQM does not provide a method for assessing the significance of effects before mitigation, and advises that pre-mitigation significance should not be determined. With appropriate mitigation in place, the IAQM guidance is clear that the residual effect will normally not be significant (IAQM, 2014).

Proposed Mitigation

10.5.17 Measures to mitigate dust emissions will be required during the construction phase of the development in order to reduce impacts upon nearby sensitive receptors.

10.5.18 The Site has been identified as a Medium Risk site during earthworks and construction for dust soiling effects, and as a Low Risk site during demolition and trackout for dust soiling effects. For human health and ecology effects, the Site has been identified as a Low Risk site during earthworks, construction and trackout, and as a Negligible Risk site during demolition, as set out in Table 10.13. Comprehensive guidance has been published by IAQM (IAQM, 2014) that describes measures that should be employed, as appropriate, to reduce the impact of a low and medium risk site, along with guidance on monitoring during demolition and construction (Institute of Air Quality Management, 2012b). This reflects best practice experience and has been used, together with the professional experience of the consultant and the findings of the dust impact assessment, to draw up a set of measures that should be incorporated into the specification for the works. These measures are described in Appendix G7.

10.5.19 The mitigation measures should be written into a dust management plan (DMP). The DMP may be integrated into a Code of Construction Practice or the Construction Environmental Management Plan, and may require monitoring.

10.5.20 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

10.6 Operational Effects and Mitigation

Potential Impacts

10.6.1 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ are set out in Table 10.14, Table 10.15, Table 10.16 and Table 10.17 for both the “Without Development” and “With Development” scenarios, for 2016, 2021 and 2031. 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 in 2016 to reflect current uncertainty in Defra’s future-year vehicle emission factors.

Nitrogen Dioxide With ‘Official’ Emissions Reduction

10.6.2 In 2016, 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.

10.6.3 In 2021, 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 most receptors, but slight adverse at Receptors 2, 3, 4, 6 and 10, and moderate adverse at Receptor 1.

10.6.4 In 2031, annual mean concentrations of nitrogen dioxide are well below the objective, with or without the proposed development.

Nitrogen Dioxide Without Emissions Reduction – 2016 Only

10.6.5 Assuming no reduction in emissions, the annual mean nitrogen dioxide concentrations are below the objective at all receptors in 2016, apart from at Receptors 1 and 2, with and without the proposed development. These receptors are at locations where concentrations have been measured above the objective level in 2014. The impacts are negligible at most receptors, but slight adverse at Receptor 10, moderate adverse at Receptors 2 and 4, and substantial adverse at Receptor 1.

PM_{10} and $PM_{2.5}$

10.6.6 The annual mean PM_{10} and $PM_{2.5}$ concentrations in both 2016 and 2031 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 µg/m^3, and thus there is no likelihood that the daily mean objective will be exceeded.

10.6.7 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 10.14 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2016 (µg/m^3) a

Receptor	2016					
	With 'Official' Emissions Reduction [b]			Without Emissions Reduction [c]		
	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor
1	36.9	37.5	Negligible	**43.7**	**44.4**	Substantial Adverse
2	34.5	35.1	Negligible	**40.8**	**41.4**	Moderate Adverse
3	29.5	29.9	Negligible	34.6	35.1	Negligible
4	33.1	33.6	Negligible	39.0	39.6	Moderate Adverse
5	25.3	25.7	Negligible	29.5	29.9	Negligible
6	27.3	27.7	Negligible	32.1	32.6	Negligible
7	17.1	17.4	Negligible	18.4	18.7	Negligible
8	15.0	15.2	Negligible	16.2	16.4	Negligible
9	20.2	20.5	Negligible	22.1	22.5	Negligible
10	27.6	28.4	Negligible	30.9	31.8	Slight Adverse
11	23.4	23.9	Negligible	25.9	26.6	Negligible
12	26.9	27.3	Negligible	32.1	32.5	Negligible
13	23.2	23.8	Negligible	27.2	28.1	Negligible
14	24.5	25.2	Negligible	29.0	29.9	Negligible
15	21.2	21.5	Negligible	23.0	23.3	Negligible
16	22.2	22.8	Negligible	25.9	26.7	Negligible
Objective	**40**		-	**40**		-

a Exceedences of the objective as shown in bold.

b This assumes that road vehicle emission factors reduce between 2014 and 2016 at the current 'official' rates.

c This assumes that road vehicle emission factors in 2016 remain the same as in 2014.

d This assumes that road vehicle emission factors reduce between 2014 and 2031 at the current 'official' rates

Table 10.15 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations in 2021 and 2031 (µg/m³) a

Receptor	2021			2031		
	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor
1	28.0	31.7	Moderate Adverse	23.2	23.3	Negligible
2	26.2	29.5	Slight Adverse	22.0	22.1	Negligible
3	22.4	25.0	Slight Adverse	19.6	19.6	Negligible
4	25.1	28.3	Slight Adverse	21.4	21.4	Negligible
5	19.3	21.4	Negligible	17.4	17.4	Negligible
6	20.8	23.2	Slight Adverse	18.0	18.0	Negligible
7	14.0	14.7	Negligible	13.7	13.8	Negligible
8	11.8	12.3	Negligible	12.5	12.6	Negligible
9	15.6	16.5	Negligible	16.8	16.9	Negligible
10	21.1	23.4	Slight Adverse	20.3	20.7	Negligible
11	18.0	19.6	Negligible	18.0	18.3	Negligible
12	19.7	20.6	Negligible	17.7	17.8	Negligible
13	16.7	18.0	Negligible	16.2	16.3	Negligible
14	17.5	19.0	Negligible	16.8	16.8	Negligible
15	17.7	18.5	Negligible	17.2	17.2	Negligible
16	15.9	17.1	Negligible	16.0	16.1	Negligible
Objective	**40**		-	**40**		-

a Exceedences of the objective as shown in bold.

Table 10.16 Predicted Annual Mean PM_{10} Impacts (µg/m³)

Receptor	2016			2021			2031		
	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor
1	21.2	21.3	Negligible	21.3	22.6	Negligible	21.0	21.1	Negligible
2	20.7	20.8	Negligible	20.8	21.9	Negligible	20.5	20.6	Negligible
3	19.8	19.9	Negligible	19.7	20.5	Negligible	19.4	19.5	Negligible
4	20.4	20.5	Negligible	20.5	21.5	Negligible	20.2	20.3	Negligible
5	19.4	19.4	Negligible	19.1	19.7	Negligible	18.9	18.9	Negligible
6	19.4	19.5	Negligible	19.3	20.0	Negligible	19.0	19.0	Negligible
7	17.5	17.5	Negligible	17.0	17.1	Negligible	16.8	16.8	Negligible
8	16.9	16.9	Negligible	16.3	16.4	Negligible	16.1	16.1	Negligible
9	17.6	17.7	Negligible	17.0	17.2	Negligible	16.8	16.9	Negligible
10	18.6	18.7	Negligible	18.1	18.5	Negligible	17.8	17.9	Negligible
11	17.6	17.6	Negligible	17.0	17.3	Negligible	16.8	16.9	Negligible
12	18.8	18.8	Negligible	18.5	18.8	Negligible	18.3	18.3	Negligible
13	18.5	18.6	Negligible	18.0	18.4	Negligible	17.8	17.8	Negligible
14	18.7	18.8	Negligible	18.2	18.7	Negligible	18.0	18.1	Negligible
15	17.2	17.2	Negligible	16.8	16.9	Negligible	16.5	16.5	Negligible
16	18.6	18.7	Negligible	18.1	18.5	Negligible	17.9	18.0	Negligible
Objective	**40**		-	**40**		-	**40**		-

Table 10.17 Predicted Annual Mean $PM_{2.5}$ Impacts (µg/m³)

Receptor	2016			2021			2031		
	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor	Without Dev	With Dev	Impact Descriptor
1	13.4	13.4	Negligible	13.1	13.8	Negligible	12.8	12.8	Negligible
2	13.1	13.1	Negligible	12.8	13.4	Negligible	12.5	12.5	Negligible
3	12.5	12.6	Negligible	12.2	12.6	Negligible	11.9	11.9	Negligible
4	12.9	13.0	Negligible	12.6	13.2	Negligible	12.3	12.3	Negligible
5	12.1	12.1	Negligible	11.7	12.0	Negligible	11.4	11.4	Negligible
6	12.2	12.2	Negligible	11.8	12.2	Negligible	11.5	11.6	Negligible
7	11.1	11.1	Negligible	10.6	10.6	Negligible	10.4	10.4	Negligible
8	10.8	10.9	Negligible	10.3	10.4	Negligible	10.1	10.1	Negligible
9	11.3	11.4	Negligible	10.8	10.9	Negligible	10.6	10.6	Negligible
10	12.0	12.0	Negligible	11.4	11.6	Negligible	11.1	11.2	Negligible
11	11.5	11.5	Negligible	10.9	11.1	Negligible	10.7	10.7	Negligible
12	12.0	12.1	Negligible	11.6	11.7	Negligible	11.4	11.4	Negligible
13	11.9	11.9	Negligible	11.3	11.6	Negligible	11.1	11.1	Negligible
14	12.0	12.1	Negligible	11.5	11.7	Negligible	11.2	11.3	Negligible
15	11.4	11.4	Negligible	10.9	11.0	Negligible	10.7	10.7	Negligible
16	11.8	11.8	Negligible	11.3	11.5	Negligible	11.0	11.1	Negligible
Objective	**25**		-	**25**		-	**25**		-

Significance of Predicted Effects

10.6.8 The operational air quality effects in 2016 are judged to be minor adverse. This professional judgement is made in accordance with the methodology set out in Paragraph 10.3.8, taking into account the factors set out in Table 10.18, and also taking into account the uncertainty over future projections of traffic-related nitrogen dioxide concentrations, which may not decline as rapidly as expected. The latter has been addressed by giving consideration to both sets of modelled results for nitrogen dioxide; those with and without reductions in traffic emissions. It is expected that concentrations will fall in the range between the two sets of results, but given the confidence in Euro VI performance, the incremental change in concentrations is expected to be closer to the "with emissions reduction" scenario[1]..

10.6.9 More specifically, the judgement that the air quality effects will be minor adverse in 2016 takes account of the assessment that concentrations will be below the nitrogen dioxide annual mean objective in 2016 at all receptors, with or without the proposed development, assuming vehicle emissions reduce as forecast by Government. If vehicle emissions do not decline as expected, concentrations are below the objective at most receptors, but above the objective at two receptors (1 and 2), with or without the proposed development; most of the impacts are predicted to be negligible, with slight to substantial adverse impacts at six isolated properties (Receptors 1, 2, 3, 4, 6 and 10). It is important to note that the proposed development does not cause any new exceedences.

10.6.10 In 2021, there are slight to moderate adverse impacts at six receptors, but all predicted concentrations are well below the objective. It must also be borne in mind that this assessment is founded on a worst-case assumption that all traffic associated with the completed and fully-operational Development is on the road in 2021, when, in reality, only half of the Scheme will have been completed. The effects in 2021 are therefore judged to be not significant

10.6.11 In 2031, all concentrations are predicted to be below the objective and all impacts are predicted to be negligible. The effects in 2031 are therefore judged to be not significant.

[1] The incremental change to traffic associated with the Proposed Development is principally related to HGV movements which are governed by the Euro VI emissions standards.

Table 10.18 Factors Taken into Account in Determining the Overall Significance of the Scheme on Local Air Quality

Factors	Outcome of Assessment
The descriptions of the impacts at the receptors.	Assuming no reduction in emissions, the impacts at the receptors range from *negligible* to *substantial adverse*.
Number of people affected by increases and/or decreases in concentrations and a judgement on the overall balance.	All of the modelled receptors will experience an increase in concentrations.
Whether or not an exceedence of an objective is predicted to arise in the study area where none existed before or an exceedence area is substantially increased.	No new areas of exceedence of the objective are predicted.
Whether or not the study area exceeds an objective and this exceedence is removed or the exceedence area is reduced.	The study area currently includes predicted exceedences of the nitrogen dioxide annual mean objective level, which remain with the proposed development in 2016. In 2021 and beyond, there are no predicted exceedences.
Uncertainty, including the extent to which worst-case assumptions have been made.	The inclusion of the two scenarios for nitrogen dioxide in 2016 covers the uncertainty over vehicle emission factors. The actual concentrations in 2016 are likely to be between the two scenarios.
The extent to which an objective is exceeded.	The annual mean nitrogen dioxide objective is exceeded at two receptors in 2016 by a small margin in the 'without emission reductions' scenario, but is not exceeded at any receptor in the 'with emission reductions' scenario.

Proposed Mitigation

10.6.12 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.

10.6.13 Additionally, the existing routing arrangement which requires all HGVs to use the strategic and primary road networks only (thus prohibiting all HGVs from driving through the Lutterworth AQMA) will continue to be rigorously enforced.

10.7 Residual Effects

Construction

10.7.1 The IAQM guidance is clear that, with appropriate mitigation in place, the residual effect will normally be 'not significant'. The mitigation measures set out in paragraph 10.5.17 and Appendix G7 are based on the IAQM guidance. With these measures in place and effectively implemented the residual effects are judged to be insignificant.

10.7.2 The IAQM guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. During these events, short-term dust annoyance may occur, however, the scale of this would not normally be considered sufficient to change the conclusion that overall the effects will be insignificant.

Operational

10.7.3 The residual impacts will be the same as those identified above in section 10.6.

10.8 Cumulative Effects

10.8.1 There are no major developments near to the proposed development. There are, however, a small number of permitted developments in Monks Kirby, but none of these are close to the proposed development or expected to generate any significant HGV movements during construction. Thus, there will be no significant cumulative effects during the construction phase.

10.8.2 The predicted operational air quality effects are based on traffic data that includes all local committed developments (as described in Chapter 6: Traffic and Transport). Therefore, the predicted concentrations presented in this assessment include all cumulative effects.

Other Developments Accounted

10.8.3 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 expansion of MPL and Symmetry Park. Traffic data associated with Symmetry Park have been provided by URS and have been added to the 2031 With Scheme scenario in order to predict the impacts. The results are shown in Table 10.19 to Table 10.21.

10.8.4 All predicted impacts are negligible, and the operational effects are unchanged from those described in section 10.6

Table 10.19 Predicted Impacts on Annual Mean Nitrogen Dioxide Concentrations (µg/m³) – With Symmetry Park

Receptor	2031		
	With 'Official' Emissions Reduction [a]		
	Without Scheme	With Scheme + Symmetry Park	Impact Descriptor
1	23.2	23.9	Negligible
2	22.0	22.7	Negligible
3	19.6	20.1	Negligible
4	21.4	22.0	Negligible
5	17.4	17.8	Negligible
6	18.0	18.5	Negligible
7	13.7	14.1	Negligible
8	12.5	12.6	Negligible
9	16.8	17.1	Negligible
10	20.3	21.1	Negligible
11	18.0	18.5	Negligible
12	17.7	18.2	Negligible
13	16.2	17.0	Negligible
14	16.8	17.6	Negligible
15	17.2	17.7	Negligible
16	16.0	16.7	Negligible
Objective	40		-

a This assumes that road vehicle emission factors reduce between 2014 and 2031 at the current 'official' rates.

Table 10.20 Predicted Annual Mean PM10 Impacts (µg/m³) – With Symmetry Park

Receptor	2031		
	Annual Mean $PM_{2.5}$ (µg/m³)		
	Without Development	With Dev + Symmetry Park	Impact Descriptor
1	21.0	21.5	Negligible
2	20.5	20.9	Negligible
3	19.4	19.7	Negligible
4	20.2	20.6	Negligible
5	18.9	19.1	Negligible
6	19.0	19.2	Negligible
7	16.8	16.9	Negligible
8	16.1	16.1	Negligible
9	16.8	16.9	Negligible
10	17.8	18.1	Negligible
11	16.8	17.0	Negligible
12	18.3	18.6	Negligible
13	17.8	18.2	Negligible
14	18.0	18.5	Negligible
15	16.5	16.7	Negligible
16	17.9	18.3	Negligible
Objective	40		-

Table 10.21 Predicted Annual Mean $PM_{2.5}$ Impacts (µg/m³) – With Symmetry Park

Receptor	2031		
	Annual Mean $PM_{2.5}$ (µg/m³)		
	Without Development	With Dev + Symmetry Park	Impact Descriptor
1	12.8	13.0	Negligible
2	12.5	12.7	Negligible
3	11.9	12.0	Negligible
4	12.3	12.5	Negligible
5	11.4	11.5	Negligible
6	11.5	11.7	Negligible
7	10.4	10.5	Negligible
8	10.1	10.1	Negligible
9	10.6	10.6	Negligible
10	11.1	11.3	Negligible
11	10.7	10.8	Negligible
12	11.4	11.5	Negligible
13	11.1	11.3	Negligible
14	11.2	11.5	Negligible
15	10.7	10.8	Negligible
16	11.0	11.2	Negligible
Objective	25		-

10.9 Summary

10.9.1 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. With these measures in place, it is expected that any residual effects will be 'not significant'. However, the guidance recognises that, even with a rigorous dust management plan in place, it is not possible to guarantee that the dust mitigation measures will be effective all of the time, for instance under adverse weather conditions. The local community may therefore experience occasional, short-term dust annoyance. The scale of this would not normally be considered sufficient to change the conclusion that the effects will not be significant.

10.9.2 The operational impacts of increased traffic emissions arising from the additional traffic on local roads, due to the development, have been assessed. Concentrations have been modelled for 16 worst-case receptors, representing existing properties where impacts are expected to be greatest. In the case of nitrogen dioxide, the modelling for the year of 2016 has been carried out assuming both that vehicle emissions decrease (using 'official' emission factors), and that they do not decrease in future years. This is to allow for uncertainty over emission factors for nitrogen oxides identified by Defra (Carslaw, Beevers, Westmoreland, & Williams, 2011).

10.9.3 The proposed 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, and the impacts will all be negligible. In the case of nitrogen dioxide, assuming that vehicle emissions reduce between 2014 and 2016, the impacts will be negligible at all receptors. Without a reduction in vehicle emissions over this period, the impacts will remain negligible at most receptors, but slight adverse at Receptor 10, moderate adverse at Receptors 2 and 4, and substantial adverse at Receptor 1. In 2021, the impacts will be negligible at most receptors, but slight adverse at Receptors 2, 3, 4, 6 and 10, and moderate adverse at Receptor 1. In 2031, the impacts will all be negligible.

10.9.4 The overall operational air quality effects of the development are judged to be minor adverse in 2016. 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 2016 at most receptors, but above the objective at two receptors (1 and 2) assuming no reduction in emissions; the proposed development does not cause any new exceedences. In 2021 and 2031 the effects of the scheme are judged to be not significant.

10.10 References

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List of Technical Appendices in ES Volume 3

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.

[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.

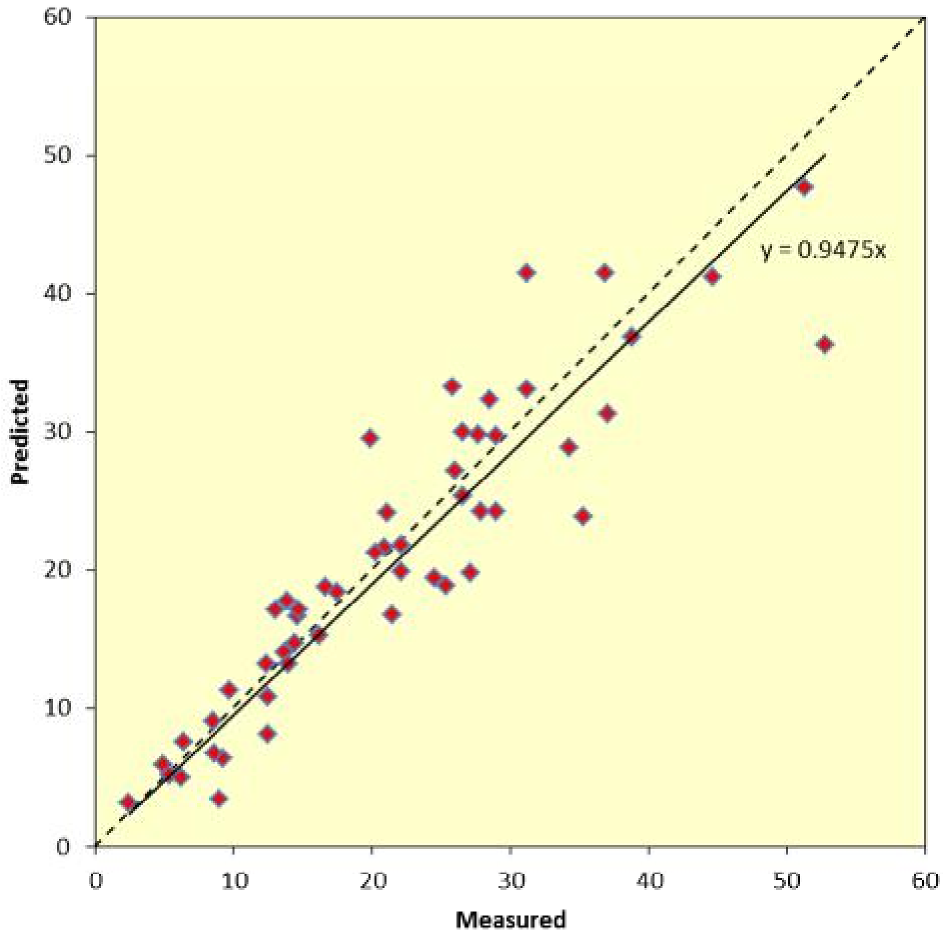

Figure G3.1: Predicted Mapped versus Measured Concentrations at AURN Background Sites in 2013

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.

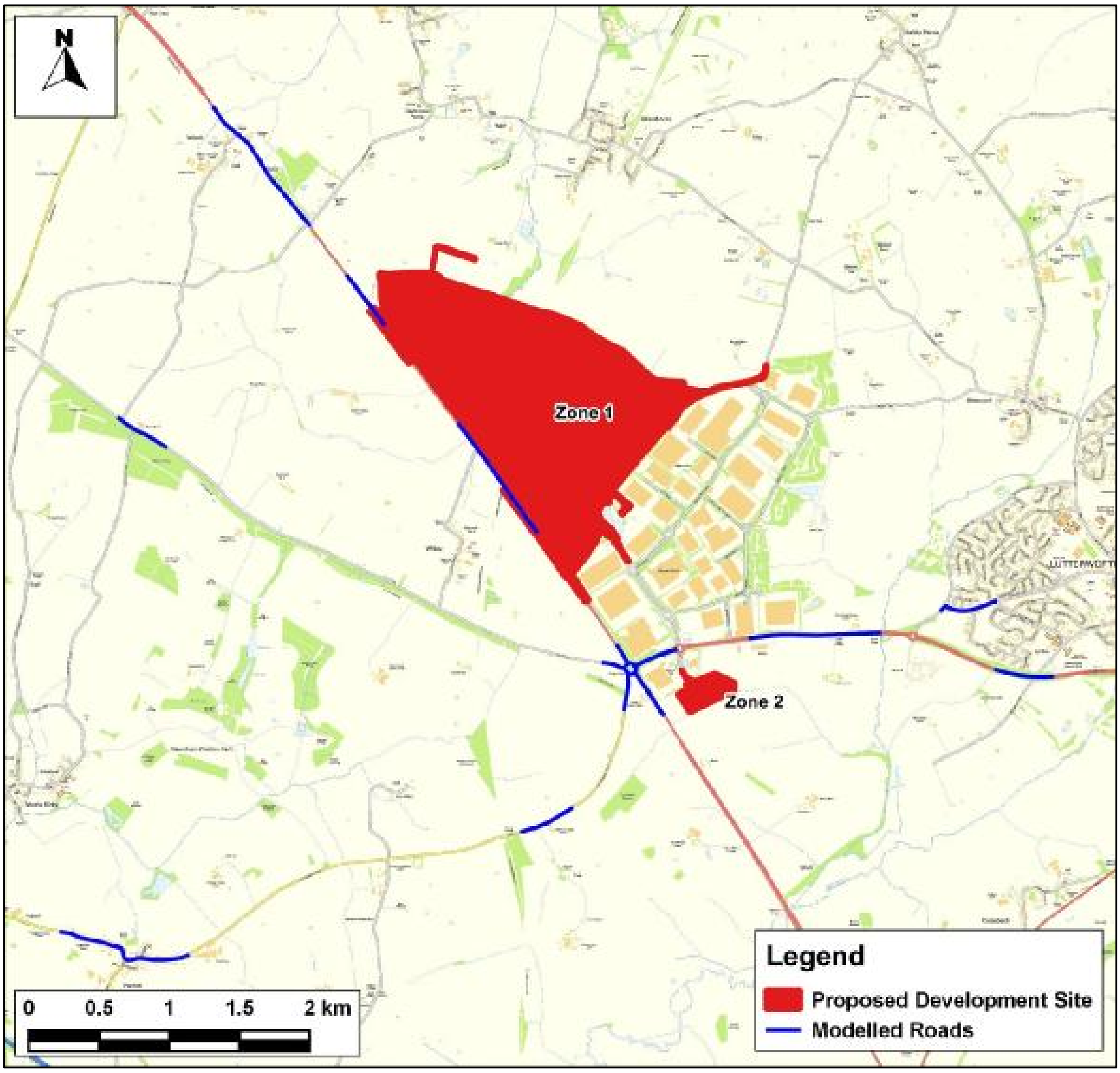

Figure G3.2: Modelled Road Network

Contains Ordnance Survey data © Crown copyright and database right 2015

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.

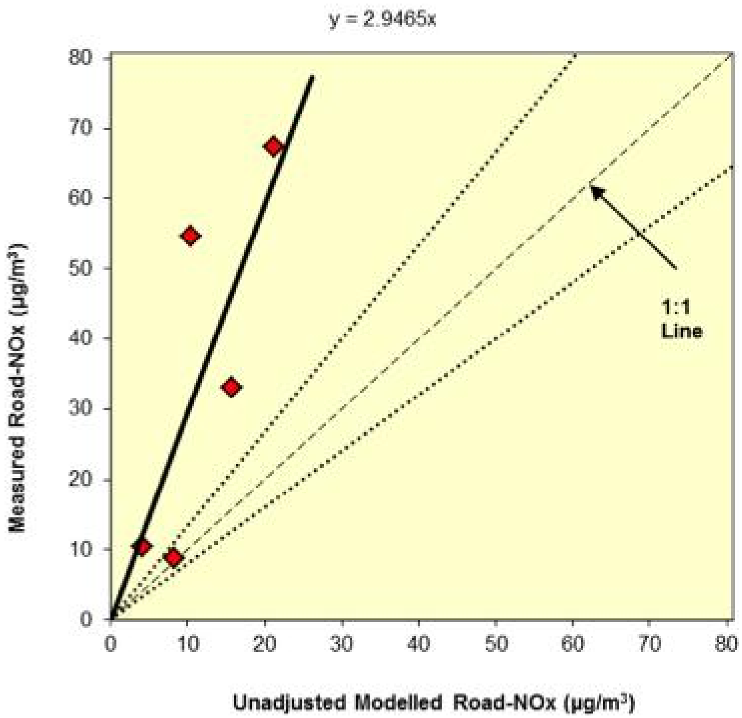

Figure G3.3: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.

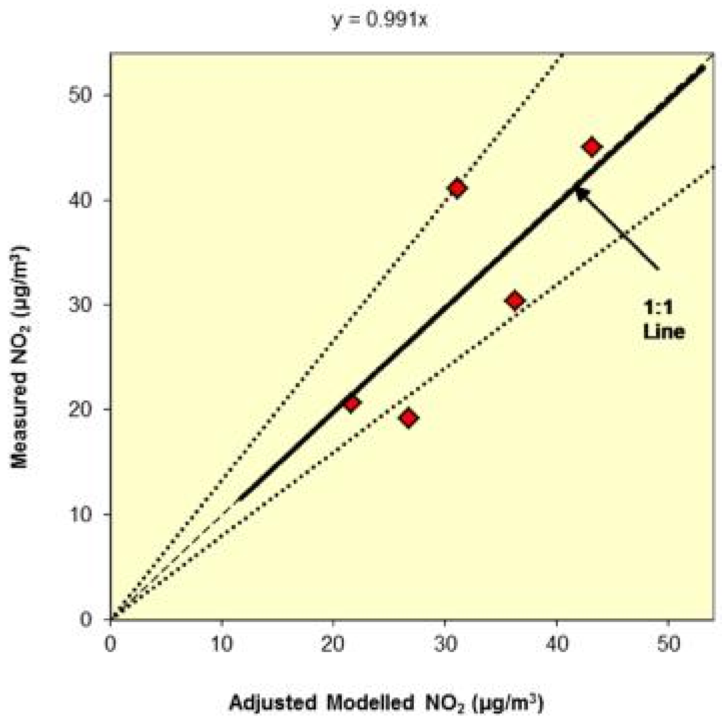

Figure G3.4: Comparison of Measured Total NO_2 to Primary Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

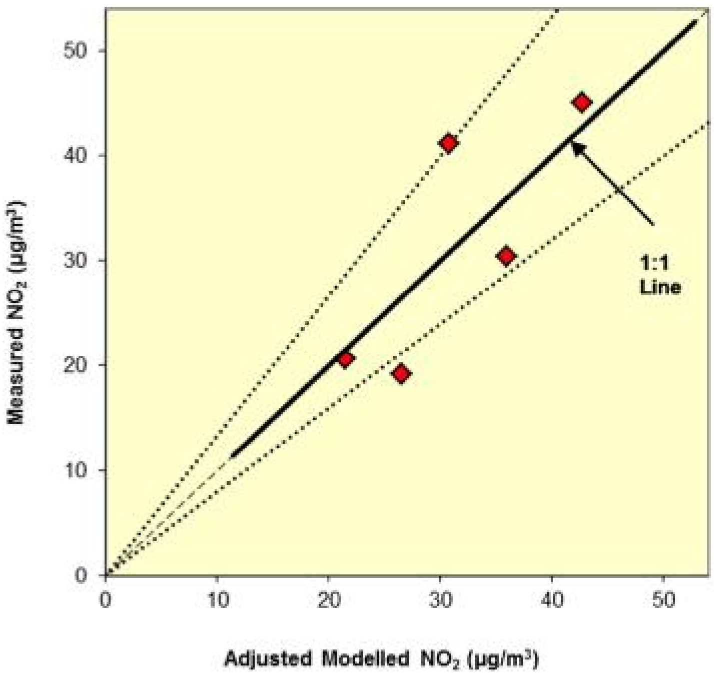

Figure G3.5: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.

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).