Plot SGR1

Air Quality Assessment

On behalf of **SGR (Bicester 1) Limited**

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1 Introduction

1.1 Proposed Development

1.1.1 Peter Brett Associates LLP (PBA) has been commissioned to prepare an air quality assessment in support of an outline planning application for a proposed residential development for up to 75 units (the Proposed Development).

1.1.2 The application site, known as Plot SGR1 (hereafter the Site), is adjacent to the Elmsbrook Exemplar site on the North West Bicester Eco Town development. The Site is within the administrative boundary of Cherwell District Council (CDC). The location of the Site is shown by the red line boundary on **Figure 1** included in **Appendix F.**

1.2 Scope of Assessment

1.2.1 This report describes existing air quality within the study area, considers the suitability of the site for residential development, and assesses the impact of the construction and operation of the development on air quality in the surrounding area. The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), and for road traffic are nitrogen dioxide (NO_2), PM_{10} and $PM_{2.5}$.

1.2.2 The proposed development will not include an energy centre. Therefore, an assessment of the effect of potential energy centre emissions has been scoped out.

1.2.3 The assessment has been prepared taking into account relevant local and national guidance and regulations.

2 Legislation and Policy

2.1 The Air Quality Strategy

2.1.1 The Air Quality Strategy (2007) establishes the policy framework for ambient air quality management and assessment in the UK (DETR, 2007). The primary objective is to ensure that everyone can enjoy a level of ambient air quality which poses no significant risk to health or quality of life. The Strategy sets out the National Air Quality Objectives (NAQOs) and Government policy on achieving these objectives.

2.1.2 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments. The relevant NAQOs for LAQM are prescribed in the Air Quality (England) Regulations 2000 (Statutory Instrument, 2000) and the Air Quality (Amendment) (England) Regulations 2002 (Statutory Instrument, 2002).

2.1.3 Where an objective is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA.

2.1.4 The Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16); Defra, 2016), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year). Thus, for example, annual mean objectives apply at the façades of residential properties, whilst the 24-hour objective (for PM_{10}) would also apply within the garden. They do not apply to occupational, indoor or in-vehicle exposure.

2.2 EU Limit Values

2.2.1 The Air Quality Standards Regulations 2010 (Statutory Instrument, 2010) implements the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC), and includes limit values for NO_2. These limit values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and the legal responsibility for ensuring that they are complied with. The compliance date for the NO_2 EU Limit Value was 1 January 2010, five years later than the date for the NAQO.

2.2.2 Directive 2008/50/EC consolidated the previous framework directive on ambient air quality assessment and management and its first three daughter directives. The limit values remained unchanged, but it now allows Member States a time extension for compliance, subject to European Commission (EC) approval.

2.2.3 The Directive limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply; and
- On the carriageway of roads; and on the central reservations of roads except where there is normally pedestrian access.

Air Quality Objectives

Human Health

2.2.4 The NAQOs for NO_2 and PM_{10} set out in the Air Quality Regulations (England) 2000 and the Air Quality (England) (Amendment) Regulations 2002, are shown in **Table 2.1**.

Table 2.1: NO_2 and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen Dioxide (NO_2)	1-hour mean	200 µg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40 µg/m^3
Particulate Matter (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

2.2.5 The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and 2004, respectively, but also continue to apply in all future years thereafter. Analysis of long-term monitoring data suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment this concentration has been used to screen whether the one-hour mean objective is likely to be achieved (Defra 2009).

2.2.6 The Air Quality Strategy 2007 (DETR, 2007) includes an exposure reduction target for smaller particles known as $PM_{2.5}$. These are an annual mean target of 25 µg/m^3 by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

2.2.7 The Ambient Air Quality and Cleaner Air for Europe directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for $PM_{2.5}$, shown in **Table 2.2**. The UK Government transposed this new directive into national legislation in June 2010.

Table 2.2: $PM_{2.5}$ Objectives

	Time Period	Objective	To be Achieved by
UK Objectives	Annual mean	25 µg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background Sites	Between 2010 and 2020
European Obligations	Annual mean	Target value of 25 µg/m^3	2010
	Annual mean	Limit value of 25 µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20 µg/m^3	2020

	Time Period	Objective	To be Achieved by
	3 year Average Exposure Indicator (AEI) (a)	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20 µg/m^3	2015

Note: (a) The 3 year annual or AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

2.3 Planning Policy

National Policy

2.3.1 The National Planning Policy Framework (NPPF) was published in March 2012 (Department for Communities and Local Government, 2012). This sets out the Government's planning policies for England and how they are expected to be applied. In relation to conserving and enhancing the natural environment, 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 soil, air, water or noise pollution or land instability."*

2.3.2 Paragraph 124, also 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 the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

2.3.3 Paragraph 203 goes on to say;

"Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."

2.3.4 A draft revised NPPF proposals were published on 5 March 2018. The draft implements the Government's reforms to planning policy. Subject to consultation, the Government intends to publish a final Framework before the summer of 2018. The draft NPPF includes additional policy taking air quality fully into account (paragraph 178):

"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

Planning Practice Guidance

2.3.5 Planning Practice Guidance (PPG) (Planning Practice Guidance, 2014) was published in March 2014 to support the National Planning Policy Framework. Paragraph 001, Reference 32-001-20140306 of the PPG provides a summary as to why air quality is a consideration for planning;

"… Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values. It is important that the potential impact of new development on air quality is taken into account in planning where the national assessment indicates that relevant limits have been exceeded or are near the limit… The local air quality management (LAQM) regime requires every district and unitary authority to regularly review and assess air quality in their area. These reviews identify whether national objectives have been, or will be, achieved at relevant locations, by an applicable date… If national objectives are not met, or at risk of not being met, the local authority concerned must declare an air quality management area and prepare an air quality action plan… Air quality can also affect biodiversity and may therefore impact on our international obligations under the Habitats Directive… Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

2.3.6 Paragraph 002, Reference 32-002-20140306, of the PPG concerns the role of Local Plans with regard to air quality;

"… Drawing on the review of air quality carried out for the local air quality management regime, the Local Plan may need to consider;

- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments;*
- *the impact of point sources of air pollution…; and*
- *ways in which new development would be appropriate in locations where air quality is or likely to be a concern and not give rise to unacceptable risks from pollution. This could be through, for example, identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable."*

2.3.7 Paragraph 005, Reference 32-005-20140306, of the PPG identifies when air quality could be relevant for a planning decision;

"… When deciding whether air quality is relevant to a planning application, considerations could include whether the development would;

- *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*

- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Areas;*

- *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality;*

- *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations; and*

- *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites."*

2.3.8 Paragraph 007, Reference 32-007-20140306, of the PPG provides guidance on how detailed an assessment needs to be;

"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 locationally specific."

2.3.9 Paragraph 008, Reference 32-008-20140306, of the PPG provides guidance on how an impact on air quality can be mitigated;

"Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact… Examples of mitigation include;

- *the design and layout of development to increase separation distances from sources of air pollution;*

- *using green infrastructure, in particular trees, to absorb dust and other pollutants;*

- *means of ventilation;*

- *promoting infrastructure to promote modes of transport with low impact on air quality;*

- *controlling dust and emissions from construction, operation and demolition; and*

- *contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."*

2.3.10 Paragraph 009, Reference 32-009-20140306, of the PPG provides guidance on how considerations about air quality fit into the development management process by means of a flowchart. The final two stages in the process deal with the results of the assessment;

"Will the proposed development (including mitigation) lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or national objectives for pollutants or fail to comply with the requirements of the Habitats Regulations." If Yes:

"Consider how the proposal could be amended to make it acceptable or, where not practicable, consider whether planning permission should be refused."

Local Policy

Cherwell District Council (CDC) Local Plan Part 1

2.3.11 The Cherwell Local Plan 2011-2031 Part 1 sets out how Cherwell will grow and change in the period up to 2031. It identifies the long term spatial vision for Cherwell and includes policies to help deliver that vision.

2.3.12 Policy ESD 10 'Protection and Enhancement of Biodiversity and the Natural Environment', states:

"Protection and enhancement of biodiversity and the natural environment will be achieved by the following:

… Air quality assessments will also be required for development proposals that would significantly adversely impact on biodiversity by generating an increase in air pollution"

Cherwell Design Guide SPD (Emerging)

2.3.13 CDC is currently preparing a new Cherwell Design Guide SPD, consultation was undertaken between 23 November and 21 December 2017, with a targeted adoption date of February 2018 (CDC, 2017). The SPD states regarding air quality:

"*All new development within or immediately adjacent to Local AQMAs may be subject to section 106 agreements which require the implementation of measures to offset increases in local pollutant emissions, and /or make an appropriate financial contribution towards improvement measures or air quality monitoring*."

North West Bicester SPD (February 2016)

2.3.14 This SPD expands upon Policy Bicester 1 of the adopted Cherwell Local Plan 2011-2031 Part 1, and provides further detail on the policy and a means of implementing the strategic allocation at North West Bicester.

Cherwell District Council Air Quality Action Plan

2.3.15 In March 2017 the Council approved an Air Quality Action Plan (AQAP) as part of its statutory duties required by the Local Air Quality framework. It outlines the actions to be taken to improve air quality in the District between 2017 and 2020 (CDC, 2017).

3 Methodology

3.1 Existing Conditions

3.1.1 Information on existing air quality has been obtained by collating the results of monitoring carried out by CDC. Background concentrations for the site have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid (Defra, 2017).

3.2 Construction Impacts

3.2.1 The Institute of Air Quality Management (IAQM) has issued revised guidance on the assessment of dust from demolition and construction (Holman et al, 2014). Within the IAQM guidance, an 'impact' is described as a change in pollutant concentrations or dust deposition and an 'effect' is described as the consequence of an impact.

3.2.2 During demolition and construction the main potential effects are dust annoyance and locally elevated concentrations of PM_{10}.The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

3.2.3 Separation distance is also an important factor. Large dust particles (greater than 30 µm), responsible for most dust annoyance, will largely deposit within 100 m of sources. Intermediate particles (10-30 µm) can travel 200-500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10µm) are deposited slowly and may travel up to 1 km; however, the impact on the short-term concentrations of PM_{10} occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

3.2.4 The Institute of Air Quality Management (IAQM) has issued revised guidance on the assessment of dust from demolition and construction (Holman *et al.*, 2014). The IAQM guidance recommends that the risk of dust generation is combined with the sensitivity of the area surrounding the site to determine the risk of dust impacts from construction and demolition activities. Depending on the level of risk (high, medium, low or negligible) for each activity, appropriate mitigation is selected.

3.2.5 In accordance with the IAQM, the dust emission magnitude is defined as either large, medium or small (**Table 3.1**) taking into account the general activity descriptors on site and professional judgement.

3.2.6 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2014 guidance (**Table 3.2**), taking into account professional judgement.

Table 3.1: Criteria for Dust Emission Magnitude

Dust Emission Magnitude	Activity
Large	**Demolition** >50,000 m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20 m above ground level

Dust Emission Magnitude	Activity
	Earthworks >10,000 m^2 site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8 m high bunds formed, >100,000 tonnes material moved
	Construction >100,000 m^3 building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty soil type (e.g. clay), >100 m unpaved roads
Medium	**Demolition** 20,000 - 50,000 m^3 building demolished, dusty material (e.g. concrete) 10-20 m above ground level
	Earthworks 2,500 - 10,000 m^2 site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4 m – 8 m high bunds, 20,000 - 100,000 tonnes material moved
	Construction 25,000 - 100,000 m^3 building volume, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material, 50 -100 m unpaved roads
Small	**Demolition** <20,000 m^3 building demolished, non-dusty material, <10 m above ground level, work in winter
	Earthworks <2,500 m^2 site area, non-dusty soil, <5 earth moving vehicles active simultaneously, <4 m high bunds, <20,000 tonnes material moved
	Construction <25,000 m^3, non-dusty material
	Trackout <10 HDVs out / day, non-dusty soil, < 50 m unpaved roads

Table 3.2: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors	Ecological Receptors
High	>100 dwellings, hospitals, schools, care homes within 50 m 10 – 100 dwellings within 20 m Museums, car parks, car showrooms within 50 m PM_{10} concentrations approach or are above the daily mean objective.	National or Internationally designated site within 20 m with dust sensitive features / species present
Medium	>100 dwellings, hospitals, schools, care homes within 100 m 10 – 100 dwellings within 50 m < 10 dwellings within 20 m Offices/shops/parks within 20 m PM_{10} concentrations below the daily mean objective.	National or Internationally designated site within 50 m with dust sensitive features / species present Nationally designated site or particularly important plant species within 20 m
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350 m < 10 dwellings within 20 – 350 m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.	Nationally designated site or particularly important plant species 20 – 50 m Locally designated site with dust sensitive features within 50 m

3.2.7 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 3.3**), taking into account professional judgement.

Table 3.3: Risk of Dust Impacts

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

3.2.8 Based on the risk of dust impacts, appropriate mitigation is selected from the IAQM guidance using professional judgement.

Significance Criteria

3.2.9 The construction impact significance criteria are based on the IAQM guidance. The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations.

3.2.10 With appropriate mitigation in place, the residual effect of construction impacts on air quality is assessed as not significant.

3.3 Road Traffic Impacts

Human Health Receptors

3.3.1 Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc. When identifying these receptors, particular attention has been paid to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

3.3.2 Based on the above criteria, eleven existing properties have been identified as residential receptors for the assessment. The locations of existing residential receptors were chosen to represent locations where impacts from road traffic related to the proposed development are likely to be the greatest, i.e. as a result of development traffic at junctions. These locations are described in **Table 3.4**. Receptors were modelled at a height of 1.5 m representing ground floor exposure (shown in **Figure 1**).

3.3.3 Concentrations have also been predicted at three diffusion tube monitors located in order to verify the modelled results (see **Appendix B** for further details on the verification method).

Table 3.4: Receptor Locations Description

Receptor	Location	Height (m)
R1	Eco Town, Charlotte Ave	1.5
R2	Eco Town, Charlotte Ave	1.5
R3	Eco Town, Charlotte Ave	1.5
R4	Fox Cottage	1.5
R5	2/30 Kings End	1.5
R6	24 Kings End	1.5
R7	27 Kings End	1.5
R8	Cambridge House	1.5
R9	41 Kings End	1.5
R10	49a Kings End	1.5
R11	Juniper Gardens	1.5

3.3.4 Receptors R1 and R2 have been chosen in order to assess the suitability of the site for residential development. These receptors are located at the junction of Charlotte Avenue with B4100 where there is a combined effect of both road links and both developments traffic flows.

Impact Predictions

3.3.5 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of Heavy Duty Vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data. The model has been run using 2016 meteorological data from the Brize Norton meteorological station, which is considered suitable for this area given the distance and elevation compared to the Site (see **Appendix C** for further details on the model inputs).

3.3.6 AADT flows and the proportions of HDVs, for roads within 250 m of the proposed development site and existing receptors have been provided by PBA (PBA, 2018). Future traffic data scenarios take into account the wider North West Bicester Eco Town scheme. Traffic data for the existing receptors and monitoring locations within the AQMA was extracted from the Bicester Office Park Planning Application reference 17/02534/OUT (Trium, 2017). The traffic data used in this assessment is summarised in **Appendix D**.

3.3.7 The traffic data extracted from the Bicester Office Park application includes the Office Park itself plus other committed developments (Trium, 2017), representing a worst-case scenario since the application is not yet decided. The future scenario with the Proposed Development in place (DS) assumes that the increase in traffic brought by the development in Banbury Road south of the A4095 will go through Queens Avenue/Kings End. This represents a worst-case assumption as part of the traffic flows would potentially turn to St John's Street to access the commercial and leisure area.

3.3.8 Traffic emissions were calculated using the Emission Factor Toolkit (EFT) v8.0, which utilises NOx emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data were entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model.

3.3.9 In order to take account of uncertainties relating to future year vehicle emissions, an assessment has been carried out utilising 2021 opening year emission factors and background concentrations combined with traffic data from 2026, this is considered a conservative assumption of emissions in the future. **Appendix E** provides a justification for the selection of future year vehicle emission factors. A sensitivity test has also been carried out using 2022 emissions factors and background concentrations to illustrate the effect of a change in the vehicle emission year.

Assessment Criteria

Human Health Impacts

3.3.10 The relevant objectives for human health are set out in paragraph 2.2.4, above. There is no official guidance in the UK on how to assess the significance of air quality impacts of a new development. The approach developed by the IAQM and Environmental Protection UK (EPUK), which considers the change in air quality as a result of a proposed development on existing receptors, has therefore been used (Moorcroft and Barrowcliffe *et al.*, 2017).

3.3.11 The guidance sets out three stages: determining the magnitude of change at each receptor, describing the impact, and assessing the overall significance. Impact magnitude relates to the change in pollutant concentration; the impact description relates this change to the air quality objective.

3.3.12 **Table 3.5** sets out the impact magnitude descriptors, whilst **Table 3.6** sets out the impact descriptors.

Table 3.5: Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude (Change in Concentration)	Annual Mean NO_2 and PM_{10} (40 µg/m³)	Annual Mean $PM_{2.5}$ (25 µg/m³)	Annual Mean of 32 µg/m³ equating to 35 days above 50 µg/m³ for PM_{10}
Very Large (>9.5%)	≥3.8 µg/m³	≥2.375 µg/m³	≥3.04 µg/m³
Large (>5.5% - ≤9.5%)	>2.2 – ≤3.8 µg/m³	>1.375 – ≤2.375 µg/m³	>1.76 - ≤3.04 µg/m³
Medium (>1.5% - ≤5.5%)	>0.6 – ≤2.2 µg/m³	>0.375 – ≤1.375 µg/m³	>0.48 - ≤1.76 µg/m³
Small (>0.5% - ≤1.5%)	>0.2 – ≤0.6 µg/m³	>0.125 – ≤0.375 µg/m³	>0.16 - ≤0.48 µg/m³
Imperceptible (≤0.5%)	≤0.2 µg/m³	≤0.125 µg/m³	≤0.16 µg/m³

Table 3.6: Impact Descriptor for Changes in Concentration at a Receptor

Concentration with the development in place in relation to Objective / Limit Value	Change in Concentration				
	Imperceptible	Small	Medium	Large	Very Large
> 109.5 % (a)	Negligible	Moderate	Major	Major	Major
>102.5% - ≤109.5% (b)	Negligible	Moderate	Moderate	Major	Major
>94.5% - ≤102.5% (c)	Negligible	Minor	Moderate	Moderate	Major
>75.5% - ≤94.5% (d)	Negligible	Negligible	Minor	Moderate	Moderate
≤75.5% (e)	Negligible	Negligible	Negligible	Minor	Moderate

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.
(a) NO_2 or PM_{10}: > 44 µg/m³ annual mean; $PM_{2.5}$ >27.5 µg/m³ annual mean; PM_{10} >35.2 µg/m³ annual mean (days)
(b) NO_2 or PM_{10}: > 40.8 – ≤ 44 µg/m³ annual mean; $PM_{2.5}$ > 25.5 – ≤27.5 µg/m³ annual mean; PM_{10} >32.6 – ≤35.2 µg/m³ annual mean (days)
(c) NO_2 or PM_{10}: > 38 – ≤40.8 µg/m³ annual mean; $PM_{2.5}$ >23.75 – ≤25.5 µg/m³ of annual mean; PM_{10} >30.4 – ≤32.6 µg/m³ annual mean (days)
(d) NO_2 or PM_{10}: >30 - ≤38 µg/m³ annual mean; $PM_{2.5}$ >18.75 - ≤23.6 µg/m³ annual mean; PM_{10} <24 - ≤ 30.4 µg/m³ annual mean (days)
(e) NO_2 or PM_{10}: ≤30 µg/m³ annual mean; $PM_{2.5}$ ≤18.75 µg/m³; annual mean; PM_{10} ≤24 µg/m³ annual mean (days)

3.3.13 The guidance states that the assessment of significance should be based on professional judgement, taking into account factors including:

- the number of properties affected by minor, moderate or major air quality impacts and a judgement on the overall balance;
- the magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 3.5** and **3.6** findings;
- whether or not an exceedance of an objective or limit value is predicted to arise in the operational study area (where there are significant changes in traffic) where none existed before or an exceedance area is substantially increased;
- the uncertainty, comprising the extent to which worst-case assumptions have been made; and
- the extent to which an objective or limit value is exceeded.

3.3.14 Where impacts can be considered in isolation at an individual receptor, moderate or major impacts (i.e. per **Table 3.6**) may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is significant or not.

Assumptions and Limitations

3.3.15 There are many components that contribute to the uncertainty in predicted concentrations. 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 is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

3.3.16 A disparity between national road transport emissions projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years. Whilst projections suggest that both annual mean nitrogen oxides and NO_2 concentrations from road traffic emissions should have fallen significantly over the past 6 – 8 years, at many monitoring sites levels have remained relatively stable, or have shown a slight increase (Carslaw *et al.*, 2011).

3.3.17 The opening year of the development is anticipated to be 2021. The traffic flows for the development have been predicted for 2026. In order to take account of uncertainties in future year vehicle emission factors, the assessment has been carried out for 2026, utilising 2021 emission factors and background concentrations. This is considered to provide a conservative assessment of concentrations in the area as it assumes that all development traffic will be on the road network at the opening year.

4 Baseline Conditions

4.1 LAQM

4.1.1 CDC has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, four AQMAs have been declared due to exceedances of the annual and hourly mean NO_2 objective. The proposed site is not located within an AQMA; the closest one to the site is the AQMA No 4 located at Queens Avenue/Kings End, approximately 2 km south of the site.

4.2 Monitoring

Nitrogen Dioxide

4.2.1 CDC deploys NO_2 diffusion tubes at a number of locations (**Figure 1**). The closest and most representative monitoring locations are described in **Table 4.1** below.

Table 4.1: Measured NO_2 Concentrations, (2012-2016)

Site ID	Site Type	Within AQMA	Annual Mean (µg/m³)				
			2012	2013	2014	2015	2016
Howes Lane 2014*	R	N	-	-	23.4	23.9	25.6
Tamarisk Gardens	UB	N	17.6	17.4	15.9	15.7	17.2
North Street	K	Y	**45.6**	**44.7**	**41.9**	39.8	37.9
Field Street	K	Y	**41.6**	**40.3**	36.2	36.5	34.3
Queens Ave*	K	Y	**45**	**41**	**40.3**	38.7	38.7
Kings End South*	K	y	**49.0**	**48.5**	**46.9**	**46.0**	**46.0**
Objective			40				

Exceedances of the objective highlighted in bold. R= Roadside; K=Kerbside; UB= Urban Background.
Data taken from CBC 2017 ASR
*Used for model verification

4.2.2 Measured concentrations at the closest monitoring location to the development site, Howes Lane 2014 (circa 500 m), have been well below the relevant objective. Measured concentrations at remaining monitoring locations were below the objective in 2015 and 2016, except for Kings End monitoring location. There is no clear trend in concentrations over time.

Particulates (PM_{10} and $PM_{2.5}$)

4.2.3 There is no PM_{10} or $PM_{2.5}$ monitoring undertaken in close proximity to the proposed development site.

4.3 Background Concentrations

4.3.1 In addition to these measured concentrations, estimated background concentrations for the site have been obtained from the national maps provided by Defra (Defra, 2017) (shown in **Table 4.2**).

4.3.2 The background concentrations are all well below the relevant objectives.

Table 4.2: Estimated Annual Mean Background Concentrations

Year	Location	Annual Mean (µg/m³)			
		NO_x	NO_2	PM_{10}	$PM_{2.5}$
2016	457_224	12.1	9.1	13.9	9.3
	458_222	15.6	11.6	14.9	10.4
	458_224	13.3	10.0	14.1	9.8
2021	457_224	9.4	7.3	13.5	8.9
	458_222	12.4	9.3	14.4	9.9
	458_224	10.5	8.0	13.6	9.3
2022	457_224	9.0	7.0	13.4	8.8
	458_222	11.9	9.0	14.3	9.8
	458_224	10.1	7.7	13.6	9.2
Objectives		**-**	**40**	**40**	**25**

4.4 Predicted Baseline Concentrations

Human Health Receptors

4.4.1 The ADMS-Roads model has been run to predict baseline NO_2, PM_{10} and $PM_{2.5}$ concentrations at each of the existing receptor locations identified in **Table 3.4**. The results for the baseline scenarios are presented in **Table 4.3** below.

Table 4.3: Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$ in 2016 and 2021

Receptor	Annual Mean (µg/m³)					
	NO_2		PM_{10}		$PM_{2.5}$	
	2016	2021	2016	2021	2016	2021
R1	23.8	21.9	16.3	16.8	11.1	11.1
R2	21.4	19.8	15.9	16.2	10.8	10.7
R3	24.4	21.0	16.5	16.7	11.2	11.0
R4	37.5	35.9	19.5	20.2	13.1	13.1
R5	**40.7**	39.2	20.1	21.0	13.5	13.6
R6	36.6	35.0	19.4	20.1	13.0	13.1
R7	**43.2**	**41.8**	21.0	22.2	14.0	14.2
R8	32.4	30.8	18.7	19.3	12.6	13.6
R9	**43.8**	**42.5**	21.2	22.5	14.1	16.4
R10	**43.4**	**42.1**	21.1	22.4	14.0	17.3
R11	38.3	27.9	18.1	17.4	12.2	16.0
Objectives	**40**		**40**		**25**	

Exceedances highlighted in bold

4.4.2 Predicted baseline concentrations are above the relevant objectives at receptors R5, R7, R9 and R10 in 2016. In 2021, the same receptors are predicted to exceed the relevant objective, except receptor R5. These receptors are all located within the AQMA. None of the predicted annual mean NO_2 concentrations exceed 60 µg/m³ and therefore exceedance of the 1-hour mean NO_2 objective is considered unlikely.

4.4.3 Whilst reductions in pollutant concentrations are predicted between 2016 and 2021, the reductions are lower than would have been anticipated due the large increase in baseline traffic between these two dates.

4.4.4 The predicted PM_{10} and $PM_{2.5}$ annual mean concentrations are all below the objectives at all existing receptors in 2016 and 2021. None of the predicted annual mean PM_{10} concentrations exceed 32 $\mu g/m^3$ and therefore the 24-hour mean PM_{10} objective is not expected to be exceeded.

5 Impact Assessment

5.1 Construction Impacts

5.1.1 The main potential effects during construction are dust deposition and elevated PM_{10} concentrations. The following activities have the potential to cause emissions of dust:

- Site preparation including delivery of construction material, erection of fences and barriers;
- Earthworks including digging foundations and landscaping;
- Materials handling such as storage of material in stockpiles and spillage;
- Construction and fabrication of units; and
- Disposal of waste materials off-site.

5.1.2 Typically the main cause of unmitigated dust generation on construction sites is from vehicles using unpaved haul roads, and off-site from the suspension of dust from mud deposited on local roads by construction traffic. The main determinants of unmitigated dust annoyance are the weather and the distance to the nearest receptor.

5.1.3 Based on the IAQM criteria (**Table 3.1**), the dust emissions magnitude is considered to be large given the site area. The study area is considered to be of high sensitivity, as there are more than 10 committed dwellings within 20 m of the site boundary (**Table 3.2**). Appropriate mitigation corresponding to a high risk site is therefore required during the construction phase (**Table 3.3**). With appropriate mitigation in place the construction impacts are described as not significant.

5.2 Road Traffic Impacts

Human Health Receptors

5.2.1 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2021, both without and with the proposed development in place are presented in **Table 5.1** below.

Table 5.1: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Existing Receptors

Receptor	2021 Annual Mean (µg/m^3)								
	NO_2			PM_{10}			$PM_{2.5}$		
	DM	DS	Change	DM	DS	Change	DM	DS	Change
R1	21.9	22.5	0.57	16.8	16.9	0.12	11.1	11.1	0.07
R2	19.8	20.4	0.63	16.2	16.3	0.12	10.7	10.8	0.07
R3	21.0	21.2	0.20	16.7	16.8	0.04	11.0	11.1	0.03
R4	35.9	36.2	0.30	20.2	20.3	0.10	13.1	13.2	0.05
R5	39.2	39.5	0.32	21.0	21.1	0.11	13.6	13.6	0.06
R6	35.0	35.3	0.32	20.1	20.2	0.10	13.1	13.1	0.05
R7	**41.8**	**42.2**	0.39	22.2	22.3	0.12	14.2	14.3	0.06
R8	30.8	31.1	0.29	19.3	19.4	0.07	13.6	12.6	0.04
R9	**42.5**	**42.9**	0.41	22.5	22.6	0.12	16.4	14.4	0.07
R10	**42.1**	**42.5**	0.41	22.4	22.5	0.11	17.3	14.4	0.07
R11	27.9	28.1	0.20	17.4	17.5	0.04	16.0	11.5	0.03
Objective	**40**		**-**	**40**		**-**	**25**		**-**

5.2.2 The predicted NO_2 concentrations in 2021 without and with the proposed development in place are above the relevant objectives for receptors R7, R9 and R10. For the remaining receptor locations, the predicted NO_2 concentrations are below the objective. None of the predicted annual mean NO_2 concentrations exceed 60 µg/m^3 and therefore exceedance of the 1-hour mean NO_2 objective is unlikely.

5.2.3 The predicted PM_{10} and $PM_{2.5}$ concentrations in 2021, without and with the proposed development in place, are below the relevant objectives at all existing receptor locations. None of the predicted annual mean PM_{10} concentrations exceed 32 µg/m^3 and therefore the 24-hour mean PM_{10} objective is not predicted to be exceeded.

Table 5.2: Impact Magnitude and Descriptors for Annual Mean NO_2, PM_{10} and $PM_{2.5}$ Concentrations

Receptor	Impact Magnitude			Impact Descriptor		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	Small	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R2	Medium	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R3	Imperceptible	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R4	Small	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R5	Small	Imperceptible	Imperceptible	**Minor Adverse**	Negligible	Negligible
R6	Small	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R7	Small	Imperceptible	Imperceptible	**Moderate Adverse**	Negligible	Negligible
R8	Small	Imperceptible	Imperceptible	Negligible	Negligible	Negligible
R9	Small	Imperceptible	Imperceptible	**Moderate Adverse**	Negligible	Negligible
R10	Small	Imperceptible	Imperceptible	**Moderate Adverse**	Negligible	Negligible
R11	Imperceptible	Imperceptible	Imperceptible	Negligible	Negligible	Negligible

5.2.4 Based on the impact magnitude descriptors presented in **Table 3.5**, the changes in annual mean NO_2 concentrations range from imperceptible to medium. Small changes occur at the majority of the receptor locations modelled with the exception of receptor R2, where the change in concentrations is described as medium. The changes in PM_{10} and $PM_{2.5}$ concentrations are all imperceptible.

5.2.5 Using the criteria set out in **Table 3.6**, the impact on annual mean NO_2 concentrations is described as minor adverse at receptor R5 and as moderate adverse at receptor R7, R9 and R10.

5.2.6 Although the changes brought by the development at receptors R7, R9 and R10 are small, the impact is described as moderate adverse because the predicted NO_2 annual mean concentrations are already exceeding without the Proposed Development in place. These receptors are located within the AQMA and therefore are expected to benefit from measures to reduce NO_2 concentrations in the AQMA, as per the Cherwell District Council Air Quality Action Plan (CDC, 2017).

5.2.7 The impact on PM_{10} concentrations is described as negligible, and the annual mean of 32 µg/m^3 equating to 35 days above 50 µg/m^3 for PM_{10} is described as negligible at all receptor locations.

5.2.8 As shown in **Appendix E**, NO_x emissions from the vehicle fleet will reduce very significantly in the future. The selection of the vehicle emission year therefore has a significant impact on the predicted concentrations. It is therefore considered that an improvement in future vehicle emissions is also likely to decrease the impact predicted at receptors R7, R9 and R10. This has been demonstrated by an additional set of modelling which has been undertaken to assess the effect of a change in future emission year.

5.2.9 The sensitivity test modelling uses the same 2026 traffic data combined with 2022 emission factors and background concentrations, instead of 2021 emission factors and background concentrations. In essence, this illustrates the sensitivity of the results to the emission factor year, but also how the reductions in vehicle emissions counteract the effect of the development traffic. The results of the 2022 sensitivity test modelling are shown in **Table 5.3**.

Table 5.3: Effect of Change in Emission Year

Receptor	2021 Without Development			2022 With Development		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	21.9	16.8	11.1	20.7	16.8	11.0
R2	19.8	16.2	10.7	18.8	16.2	10.7
R3	21.0	16.7	11.0	19.6	16.7	10.9
R4	35.9	20.2	13.1	33.8	20.1	13.0
R5	39.2	21.0	13.6	36.9	21.0	13.5
R6	35.0	20.1	13.1	33.0	20.1	13.0
R7	**41.8**	22.2	14.2	39.5	22.2	14.1
R8	30.8	19.3	12.6	29.0	19.2	12.5
R9	**42.5**	22.5	14.4	**40.1**	22.5	14.3
R10	**42.1**	22.4	14.3	39.7	22.4	14.3
R11	27.9	17.4	11.4	25.7	17.3	11.3

Exceedances highlighted in bold.

5.2.10 **Table 5.3** shows that the exceedances experienced at receptors R7 and R10 in 2021 without the development in place are removed by 2022 even with the development in place due to the predicted improvement in vehicle emissions and background concentrations. The exceedance is not removed at receptors R9, but the predicted concentration is lower than in 2021 without the development in place. As not all of the road traffic will be on the road network in 2021, the predicted moderate impacts at receptors R7, R9 and R10 when using 2021 emission factors is unlikely to occur in practice.

5.3 Site Suitability

5.3.1 Receptors R1, R2 and R3 represent the worst-case locations for the existing and propose properties within the Eco Town development and also for the Proposed Development. These receptors are located at the junction of Charlotte Avenue with B4100 where there is a combined effect of both road links and both developments traffic flows.

5.3.2 There are no exceedances of air quality strategy objectives at these locations.

6 Mitigation

6.1 Construction

6.1.1 The following standard high-risk mitigation measures from the IAQM 2014 guidance are recommended. These should be included within a Construction Environmental Management Plan and agreed with the Local Authority.

Communication

- Develop and implement a stakeholder communications plan.
- Display the name and contact details of persons accountable on the site boundary.
- Display the head or regional office information on the site boundary.

Management

- Develop and implement a dust management plan.
- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site run off of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove potentially dusty materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure all vehicles comply with the London Low Emission Zone and the NRMM standards, where applicable.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators where possible.

- Produce a Construction Logistics Plan to manage the delivery of goods and materials.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- Ensure equipment is readily available on site to clean up spillages of dry materials.
- No on-site bonfires and burning of waste materials on site.

Demolition

- Incorporate soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
- Ensure water suppression is used during demolition operation.
- Avoid explosive blasting, using appropriate manual and mechanical alternatives.
- Bag and remove any biological debris or damp down such material before demolition.

Earthworks

- Re-vegetate earthworks and exposed areas /soil stockpiles to stabilise surfaces as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

Construction

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless required for a particular process.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankersand stored silos with suitable emissions control systems.

Trackout

- Use water assisted dust sweepers on the site access and local roads.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials.
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable.
- Install hard surfaced haul routes which are regularly damped down.
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.

- The site access gate to be located at least 10m from receptors where possible.

6.2 Operation

6.2.1 The assessment has taken an conservative approach with traffic assumptions representing a worst-case scenario (**section 3.3.6**). The change in concentration at the majority of the receptor locations is described as small, including receptors R7, R9 and R10, where there are exceedances of the annual mean NO_2 objective in 2021, with and without the development in place. As a result, the impact at these receptors is described as moderate adverse, with a maximum increase in NO_2 concentration of 0.4 µg/m^3 predicted to result from the development traffic. The sensitivity test has demonstrated that the exceedances experienced at receptors R7 and R10 will be removed by 2022 and reduced at receptor R9.

6.2.2 Overall, the effect of development traffic is judged to be not significant as the moderate impact at receptors R7, R9 and R10 is unlikely to occur in practice. Reductions in vehicle emission are likely to outweigh the impact of development traffic. No mitigation measures are therefore required for the direct effects of the development.

6.2.3 There are no predicted exceedances of the air quality objectives within the development site. Therefore, the site is considered suitable for the proposed residential use without the need for further specific mitigation measures.

7 Conclusions

7.1.1 The air quality impacts associated with the proposed redevelopment of the site at the Plot SGR1, located within the boundary of the Bicester District Council have been assessed.

7.1.2 To date CDC has declared four AQMAs due to exceedances of the annual and hourly mean NO_2 objective. The proposed site is not located within an AQMA, the closest AQMA to the site is the AQMA No 4, approximately 2 km south of the site.

7.1.3 The construction works have the potential to create dust. During construction it is recommended that a package of mitigation measures is put in place to minimise the risk of elevated PM_{10} concentrations and dust nuisance in the surrounding area. With mitigation in place the construction impacts are judged as not significant.

7.1.4 There are no predicted exceedances of the air quality strategy objectives within the site. The site is therefore suitable for the proposed residential use without the need for specific mitigation measures in relation to air quality.

7.1.5 A moderate impact on NO_2 concentrations is predicted at receptors R7, R9 and R10 when it is assumed that all development traffic is on the road network at the 2021 opening year. The impact at all other receptors is minor or negligible. Additional modelling has shown that the predicted improvements in vehicle emissions would remove the identified exceedances in two years which will be before all the development traffic is on the road network. Therefore, the effect of development traffic is considered to be not significant and mitigation against the direct air quality impacts of development traffic is not necessary.

7.1.6 Overall, it is concluded that there are no air quality constraints to the proposed residential development.

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Appendix A Glossary

Abbreviations	Meaning
AADT	Annual Average Daily Traffic
ADMS	Air Dispersion Modelling System
APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CDC	Cherwell District Council
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
Diffusion Tube	A passive sampler used for collecting NO_2 in the air
EA	Environmental Agency
EFT	Emission Factor Toolkit
EHO	Environmental Health Officer
EPUK	Environmental Protection UK
HDV	Heavy Duty Vehicle; a vehicle with a gross vehicle weight greater than 3.5 tonnes. Includes Heavy Goods Vehicles and buses
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAQO	National Air Quality Objective as set out in the Air Quality Strategy and the Air Quality Regulations
NO_2	Nitrogen Dioxide
NO_x	Nitrogen oxides, generally considered to be nitric oxide and NO_2. Its main source is from combustion of fossil fuels, including petrol and diesel used in road vehicles
NPPF	National Planning Policy Framework
PBA	Peter Brett Associates LLP
$PM_{10}/PM_{2.5}$	Small airborne particles less than 10/2.5 μm in diameter
PPG	Planning Practice Guidance
Receptor	A location where the effects of pollution may occur
SPG	Supplementary Planning Guidance
TEA	Triethanolamine

Appendix B Model Verification

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides ($NO_x = NO + NO_2$). The model has been run to predict the 2016 annual mean road-NO_x contribution at three monitoring locations (identified in **Table 4.1**). Concentrations have been modelled at a height of 2 m for all monitoring locations.

The model output of road-NO_x has been compared with the 'measured' road-NO_x, which was calculated from the measured NO_2 concentrations and the adjusted background NO_2 concentrations within the NO_x from NO_2 calculator.

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure C.1). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (Figure C.2).

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

Primary adjustment factor: 2.2138

Secondary adjustment factor: 0.9955

The results imply that overall, the model was under-predicting the road-NO_x contribution. This is a common experience with this and most other models. The final NO_2 adjustment is minor.

Figure C.3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line.

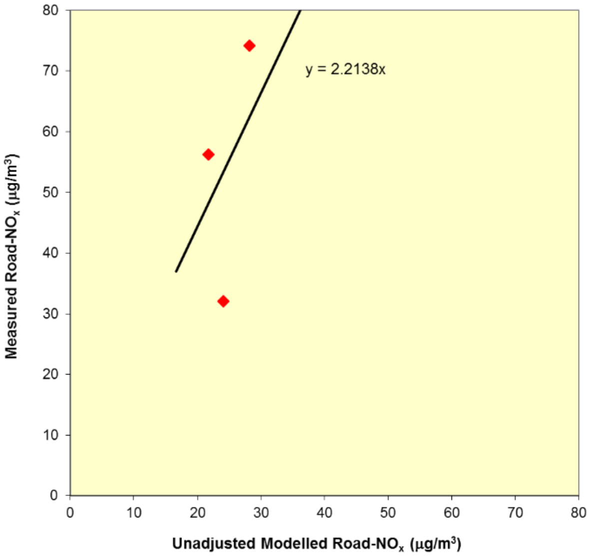


Figure C.1: Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x Concentrations

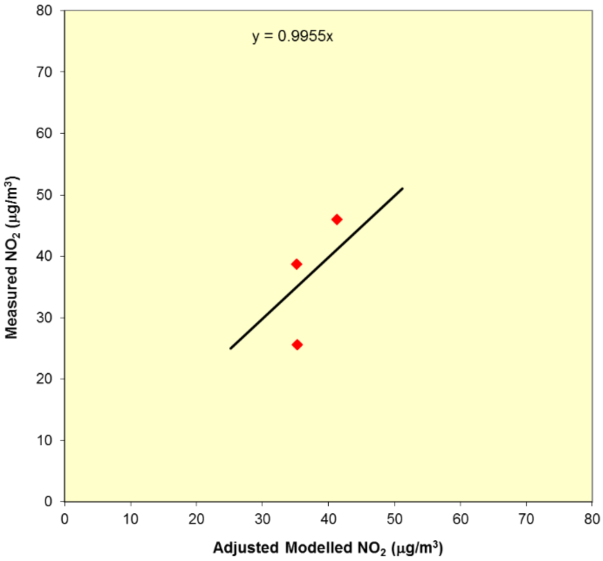


Figure C.2: Comparison of Measured NO_2 with Primary Adjusted Modelled NO_2 Concentrations

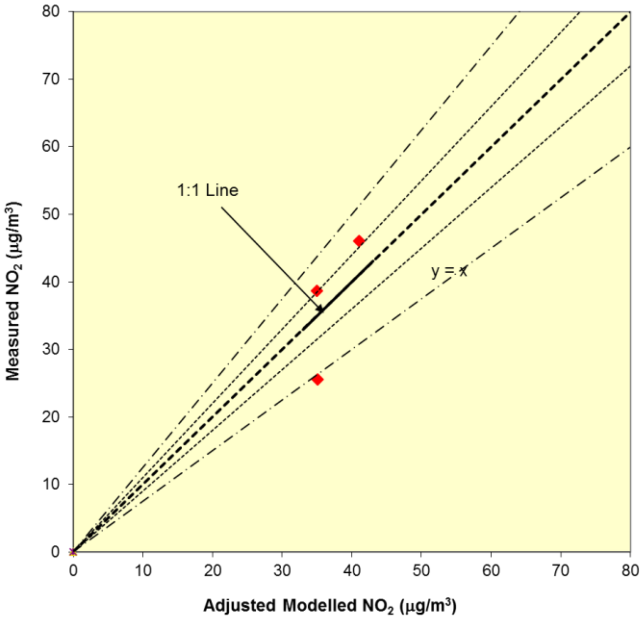


Figure C.3: Comparison of Measured NO_2 with Fully Adjusted Modelled NO_2 Concentrations

Particulates (PM_{10} and $PM_{2.5}$)

There is no PM_{10} or $PM_{2.5}$ monitoring in close proximity to the proposed development site. Therefore, the primary adjustment factor calculated for NO_2 concentrations has been applied to the modelled road-particulates concentrations.

Appendix C Model Inputs and Results Processing Tools

Meteorological Data	Hourly meteorological data from Brize Norton for 2016. The wind-rose is shown in figure D1.
ADMS	Version 4.1.1
Latitude	52º
Surface Roughness	A value of 0.5 for Parkland /Open suburbia was used to represent the modelled area. A value of 0.3 for agricultural areas was used to represent the meteorological station site.
Minimum Monin-Obukhov length	A value of 10 for small towns was used to represent the modelled area and the meteorological station site.
Street Canyon	No canyon
Emission Factor Toolkit (EFT)	V8.0 , November 2017.
NO_x to NO_2 Conversion	NO_x to NO_2 calculator version 6.1, 17 October 2017
Background Maps	2015 reference year background maps

Appendix D Traffic Data and Road Network

Location	Speed (kph)	2016 Baseline		2026 Without Development		2026 With Development	
		AADT	HDV (%)	AADT	HDV (%)	AADT	HDV (%)
Kings End/Queens Av*	48	21238	0.70	29802	0.6	30255	0.
Oxford Road/Kings End*	24	21238	0.70	29802	0.6	30255	0.60
Banbury Road south A4095	64	6768	7.7	4546	7.7	4999	7.0
Southwold lane	80	25610	7.7	31347	7.7	31382	7.7
A4095 West	24	16512	7.7	14505	7.7	14541	7.7
Banbury Road north A4095	64	16574	7.7	26128	7.7	26651	7.5
Charlotte Av	32	1138	7.7	3054	7.7	3671	6.4

* Traffic data for the existing receptors and monitoring locations within the AQMA was extracted from the Planning Application reference 17/02534/OUT (Trium, 2017).

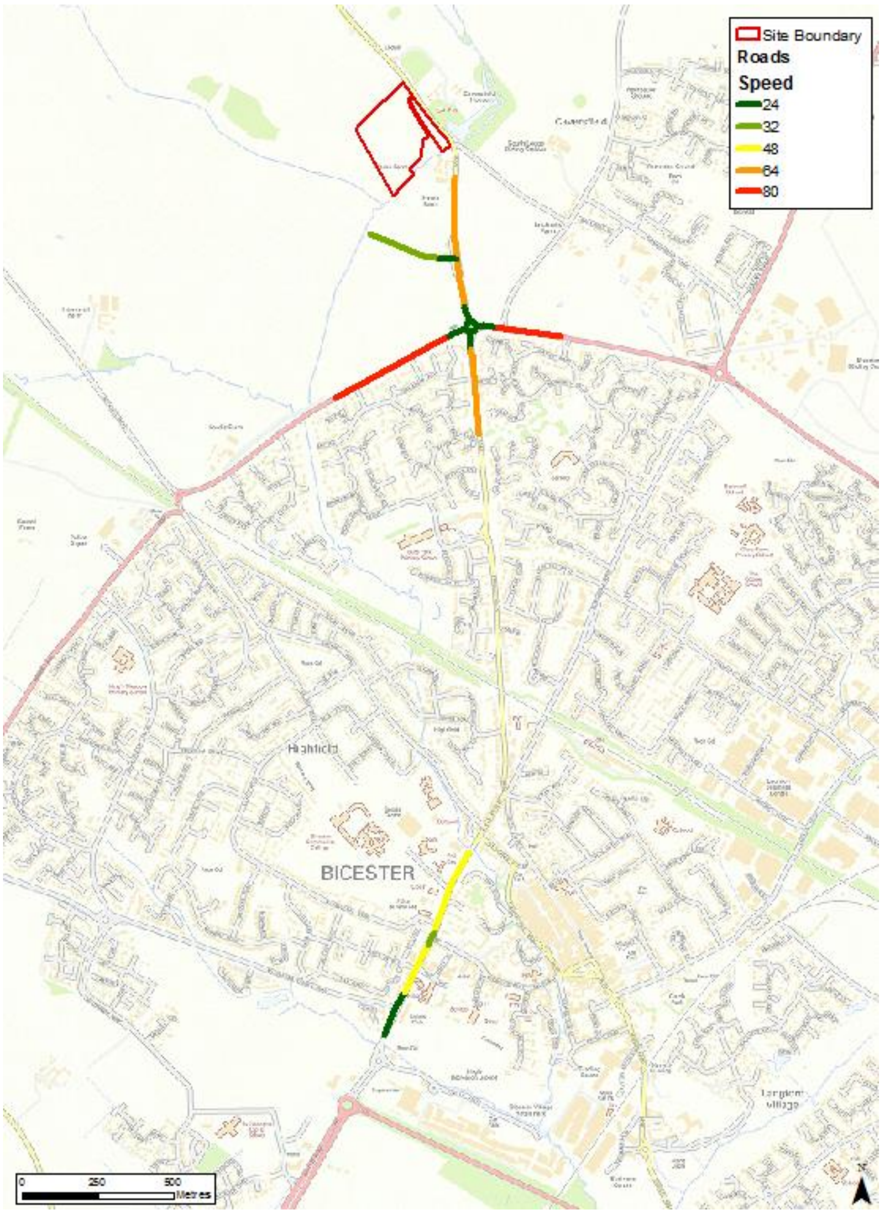


Figure D.1: Modelled Road Network Sources

Appendix E Future Year Modelling – Road Transport Emissions Factors

Introduction

Atmospheric dispersion modelling is used to determine the effect of future development traffic on local air quality. The modelling utilises predictions of the composition and emissions profile of the vehicle fleet which are produced by Defra in the emissions factor toolkit (EFT). The composition and emissions profiles are provided on a year by year basis from 2013 to 2030, with the database being periodically updated.

The main issue with regard to the modelling of future traffic impacts is the choice of emission factors to use given that there is a degree of uncertainty as to the accuracy of the emission factors, as well as uncertainty introduced by the modelling process and the traffic data on which the predictions are based. This has become more important in recent years as it has been realised that previous versions of the EFT were likely to have significantly underestimated the real world emissions of the vehicle fleet, as well as the more recent revelations concerning the use of 'defeat devices' on VW group vehicles.

This note therefore sets out PBAs approach to the choice of vehicle emission factors for future year assessments. The note has been revised following updating of the Defra Emissions Factor Toolkit in November 2017.

Modelling Methodology

As a prelude to the discussion of emission factors, it is useful to recap on the general methodology that is used for dispersion modelling of road traffic emissions:

- Traffic data is entered into the dispersion model to represent the baseline situation and the model is used to predict how NO_x emissions are dispersed in the environment.
- The dispersion modelling predictions are compared to monitoring data to obtain a verification factor; the factor by which the predicted road traffic concentration must be multiplied by to agree with the monitored concentration.
- The modelling is repeated for the future year situation; with traffic data representing the situation without the development in place (the 'without' scheme scenario) and with the development in place ('with' scheme). In both cases, the verification factor obtained from the baseline modelling is used to multiply the model results by, in essence assuming that the model is equally as accurate in the future as it was for the baseline scenario.

The verification factor is one of the key elements in the discussion regarding vehicle emission factors. One element of uncertainty in the modelling is the degree to which the emission factors in the EFT are different to actual emissions of the vehicle fleet on the local road network. The use of the verification factor for the future year predictions essentially assumes that the difference between the EFT emission factors and real world emissions is the same in the future as it was in the baseline year. In other words, unless there is some reason to believe that the future year emission factors are less accurate than the baseline year emission factors, the degree to which the EFT emission factors and real world emission factors differ is taken into account in the modelling by the use of the verification factor. This is discussed further in the following sections.

Emission Factor Toolkit

The EFT contains estimates of the future composition of the vehicle fleet in terms of the age and type of vehicles. The composition of the vehicle fleet is primarily related to the age of the vehicles (in terms of their emissions class) and the fuel that they use (i.e. petrol or diesel). In general terms, the majority of new vehicles replace much older vehicles, and as the emissions performance of vehicles is generally taken to improve over time, both current and historical versions of the EFT predict very large reductions in NO_x emissions in the future. It is also obvious that the further one looks into the future, the more uncertain the predictions become as they depend on the rate of vehicle renewal and the size and fuel mix of the vehicles bought; which are all estimates.

The emissions performance of the vehicles is classified in terms of Euro type approval testing; Euro 1 to 6 concerning light duty vehicles and Euro I to VI heavy duty vehicles. Whilst the introduction of each Euro class has generally seen a tightening of emission standards, the standards up until now have been based on laboratory testing of vehicles. The emissions performance of the vehicles in real world driving conditions has been higher than the laboratory testing results, especially for diesel vehicles. This factor was not recognised in earlier versions of the EFT, and combined with the fact that diesel vehicles have much higher NO_x emissions than petrol vehicles and there has been a very large increase in the number of diesel vehicles on the road, has meant that the NO_x emissions and NO_2 concentrations have not reduced as previously predicted.

The trends in NO_x emissions in the vehicle fleet, especially diesel vehicles and the accuracy of the current version of the EFT, is therefore critical in terms of the choice of emission factors in modelling.

Trends in NO_x emissions

For light duty vehicles, the latest Euro standard is Euro 6, which was introduced from September 2015 (with a derogation in the UK for the registration of new vehicles until September 2016).

The emissions standards currently relate to a laboratory test whereby the average emission rate is calculated over an idealised drive cycle. The cycle used is the New European Drive Cycle (NEDC) and there has been extensive criticism that the drive cycle does not represent real world driving conditions. It has therefore been agreed that a new drive cycle will be introduced, the World Light-duty Test Cycle (WLDTC), as well as an on-road test termed Real Driving Emissions (RDE).

Up until September 2017, Euro 6 vehicles were only tested in the laboratory against the NEDC, and these vehicles are termed Euro 6ab. However, from September 2017, new models are tested against the WLDTC and will also have a RDE test. The initial introduction of the RDE test will allow vehicles to have average RDE test emissions of 2.1 times the WLDTC test standard. The 2.1 factor is termed the conformity factor and will apply to new vehicle models from September 2017 and all new vehicles from September 2019. From January 2020, the conformity factor will reduce to 1.5 for new vehicle models (January 2021 for all new vehicles).

Air Quality Consultants undertook some research into the performance of diesel vehicles to support a methodology that they have adopted for undertaking air quality assessments[1]. As part of the analysis, they compared the real word test results of current Euro 6ab diesel vehicles and calculated an average conformity factor of 3.9 from the tests that were assessed. This work led to AQC publishing the CURED v2A calculator which attempted to take account of the real world emissions performance of diesel vehicles. The approach using CURED v2A was generally accepted to be conservative when considering developments a long time in the future.

Subsequently, the Department for Transport have undertaken testing of Euro 5 and 6ab diesel vehicles and found that the average NO_x emissions were 1135 mg/km for Euro 5 vehicles and 500 mg/km for Euro 6ab vehicles[2]. These work out to be a conformity factor of 6.30 and 6.25 for Euro 5 and Euro 6ab respectively. Adding in the DfTr results to the AQC results gives an overall average conformity factor for Euro 6ab vehicles tested of 4.1.

A paper presented by Dr Marc Stettler at the recent Westminster Energy, Environment & Transport Forum[3] included results of RDE testing of existing Euro 6ab vehicles. Whilst there was wide range in the results, a number of the vehicles tested did already comply with the Euro 6c standard.

[1] Emissions of Nitrogen Oxides from Modern Diesel Vehicles. AQC January 2016

[2] Vehicle Emissions Testing Programme DfTr Cm 9259 April 2016

[3] Priorities for reducing air quality impacts of road vehicles. Dr Marc Stettler 17th May 2016

Similar results have been reported in a study led by Rosalind O'Drscoll of Imperial College[4]. This showed that the average NO_x emissions were 4.5 times higher than the Euro 6 limit, with an average NO_2 percentage of 44%.

From the emissions testing work undertaken to date on Euro 6ab vehicles it is clear that the NO_x emissions performance of Euro 6ab vehicles is significantly better than Euro 5 vehicles, although not in line with the laboratory standards. The introduction of Euro 6 should therefore see a significant reduction in NO_x emissions in the future, as outlined in the following table.

Emission Standard	Real Driving Emissions NO_x mg/km
Euro 5, DfTr testing	1135
Euro 6ab, DfTr testing	500
Euro 6c, September 2017 models	168
Euro 6c, January 2020 models	120

Further testing of vehicles is ongoing, with Emissions Analytics regularly publishing the results of real world emissions testing on vehicles[5]. Also, in the November 2017 budget, the government announced a one-off tax on new diesel cars not meeting Euro 6c standards. Both of these factors should help put pressure on vehicle manufacturers to meet the RDE standards. In the longer term, there is also the move to electric vehicles which will gather pace.

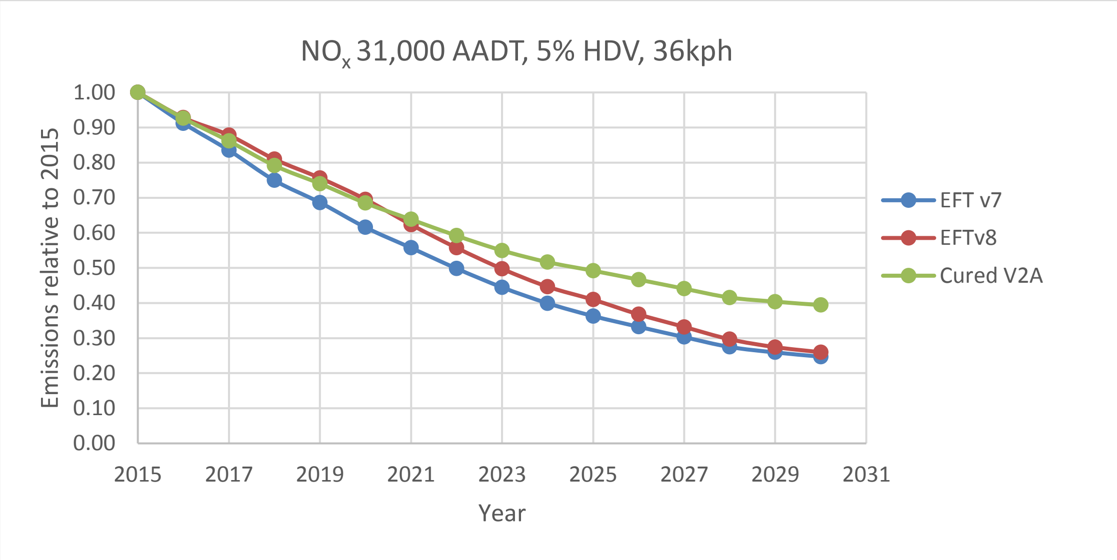
Emissions in the EFT

As noted in Section 3, the EFT contains estimates of vehicle emissions by Euro Class. The database was updated in November 2017 from v7.0 to v8.0. It now uses NO_x emissions factors for the vehicles taken from the European Environment Agency's COPERT 5 database, compared to the previous COPERT 4 version v11. In the November 2015 submissions to the European Union for compliance against EU Limit Values, Defra used COPERT 4 v11 factors without taking account of the real world performance of the vehicle fleet to data.

The EFT now takes account of the real world performance of Euro 6ab diesel cars, applying a high conformity factor to these vehicles. For Euro 6c vehicles, it assumes that the RDE will be effective in bringing down vehicle emissions. The following graph shows the relative decline in vehicle NO_x emissions predicted for a road in outer London with 5% Heavy Duty Vehicle traffic travelling at 36kph. As air quality models are verified against historic data, the emissions decline is shown relative to 2015.

[4] A Portable Emissions Measurement System (PEMS) study of NO_x and primary NO_2 emissions from Euro 6 diesel passenger cars and comparison with COPERT emission factors. Rosalind O'Driscoll. September 2016

[5] http://equaindex.com/equa-air-quality-index/



For emission years prior to 2021, the CURED v2A methodology is likely to give similar results to using the EFT v8.0 data. Post 2021, when the introduction of Euro 6c begins to take effect, then CURED v2A and the EFT v8.0 begin to diverge.

Future Year Assessment Methodology

The selection of emission factors for a future year assessment depends partly on the situation regarding the assessment to be undertaken. Where pollutant concentrations are low and are unlikely to exceed threshold levels, then one may take a conservative approach and keep emission factors at current levels. This will produce a conservative result, but as the result will be 'acceptable' in terms of leading to no exceedances of National Air Quality Strategy Objectives, then it is a reasonable approach to adopt as it avoids uncertainty as to whether there will be exceedances in the future.

In contrast, where pollutant concentrations are high, then a different approach to uncertainty is required. In addition, for a formal Environmental Impact Assessment the legal requirement is to assess 'likely significant effects'. This is not 'worst case' significant effects, but 'likely' significant effects and therefore must allow for a degree of uncertainty in the predictions.

As discussed in Section 2, the use of the verification factor in the modelling takes account, amongst other things, of the difference in the real world emissions performance of vehicles in the fleet. For developments up until 2021, the current EFT should be reasonably accurate as to NO_x emissions as the problem with the performance of diesel vehicles has been recognised. As such, one is justified in using the emission factors for the year of the assessment as the uncertainty in the emission factors is taken account of by using the verification factor.

Developments post 2021 will increasingly be influenced by the assumption that the RDE testing of diesel vehicles is effective, which may or may not turn out to be the case. In essence, the result is likely to lie between the green and red curves of the previous graph. This is likely to become less important as the actual levels of emissions is significantly reduced in the future. If a conservative approach is warranted, one could follow the green curve, the effect of which is outlined in the table below.

Traffic Data year	EFT v8 year
2015	2015
2016	2016
2017	2017
2018	2018
2019	2019

Traffic Data year	EFT v8 year
2015	2015
2020	2020
2021	2021
2022	2021
2023	2022
2024	2022
2025	2023
2026	2023
2027	2024
2028	2024
2029	2025
2030	2025
Beyond 2030	2025

In the case of a large development with a completion year a long time into the future, then if only completion year traffic data is available, it is likely to be appropriate to assume that the completed year traffic data occurs at the opening year of the development. As appropriate, the change a change in emission year in accordance with the above table may be considered.

Appendix F Figures

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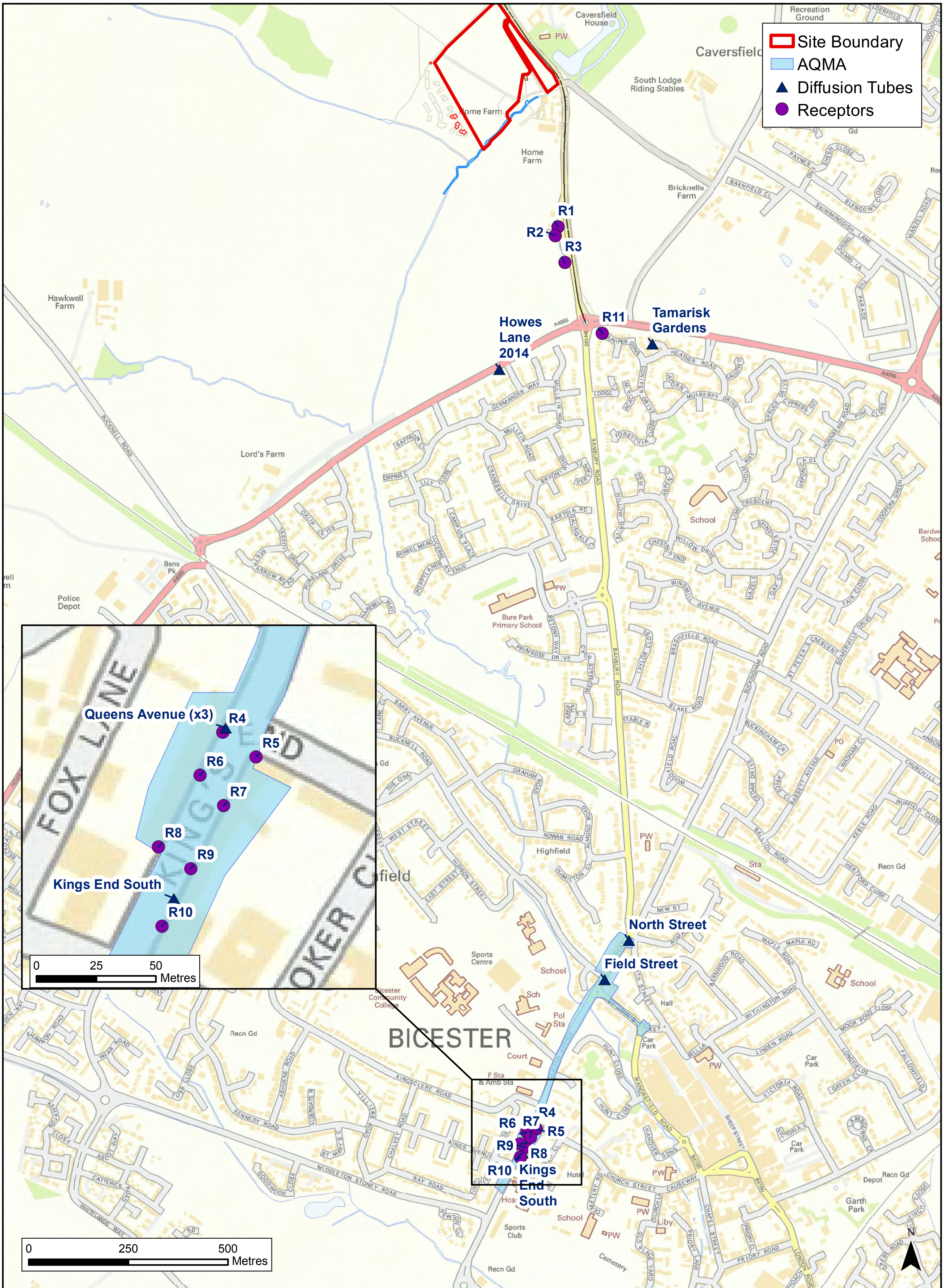

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Air Quality Receptors and Monitoring Locations

Figure 1 | Rev A