NW Bicester Outline Application

Addendum Environmental Statement re Air Quality

Application 1: Land to the North of the Railway Line and A4095 Lords Lane and West of B4100 Banbury Road, surrounding Lords Farm and Hawkwell Farm, Bicester, Oxfordshire

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Addendum to Environmental Statement

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1 Introduction

This document should be read as an addendum to the NW Bicester Application 1 North of Railway Environmental Statement: Volume 1 Main Text (5050-UA005241-UE31R-01), submitted with outline planning application (Ref: 14/01384/OUT) on 13 August 2014. Since the production of the Enviromental Statement, changes have been made in relative to the ratio of gas CHP and biomass CHP engines within the proposed energy centre located within the Application 1 area. The Energy Statement Addendum (5027-UA005241-UE21R-01) identifies the proposed amendment and therefore supersedes the original Energy Statement submitted on 8 August 2014. Consequently, the air quality assessment has been reviewed based upon the change in emissions. The air quality assessment of operational impacts has been updated, where applicable, to reflect the revised techological solution.

The purpose of this addendum is to fully replace Chapter 8 *Air Quality* as well as Appendix 8A *Dispersion Modelling Inputs*.

CHAPTER 8

Air Quality

8 Air Quality

8.1 Introduction

8.1.1.1 This Chapter assesses the Development's potential to cause air quality impacts during both the construction and operational phases. These may include fugitive dust emissions associated with construction works, road vehicle exhaust emissions from traffic generated during the operational phase and operational emissions from on-site energy production in the Energy Centre and associated Combined Heat and Power (CHP) plant and back up gas boilers.

8.2 Regulatory and Policy Framework

8.2.1.1 This impact assessment has been undertaken in accordance with current international and national legislation, and national, regional and local plans and policies relating to air quality in the context of the proposed Development. A summary of the relevant legislation and policies, the requirements of these policies and the proposed Development response has been provided in Table 8-1.

Table 8-1 Air Quality Regulatory and Policy Framework

Policy/Legislation	Summary of Requirements	Development Response
Air Quality (England) Regulations (2000) (Ref 8-1)	Provides Air Quality Objectives (AQOs) for seven pollutants (as outlined in Table 8-2). These are used by Local Authorities (LAs) when undertaking their duties in accordance with the Environment Act (1995)	Assessment of potential increases in pollution concentrations against the relevant AQOs as defined in the Air Quality (England) Regulations (2000) (Ref 8-1)
Air Quality (England) (Amendment) Regulations (2002) (Ref 8-2)	Amends the relevant AQOs for benzene and carbon monoxide	The most recent AQOs have been considered throughout this assessment
Air Quality Standards Regulations (2010) (Ref 8-3)	Transposes the European Union (EU) Air Quality Directive (2008/50/EC) into UK law. Air Quality Limit Values (AQLVs) were published in these regulations for seven pollutants, in addition to Target Values for an additional five pollutants (as outlined in Table 8-2)	Assessment of potential increases in pollution concentrations against the relevant AQLVs as defined in the Air Quality Standards Regulations (2010) (Ref 8-3)
Environment Act (1995) (Ref 8-4)	Requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, Air Quality Objectives (AQOs) and	Consideration has been given to the potential impacts on the AQOs and AQMAs in the vicinity of the Site

	measures for improving ambient air quality and defines Local Air Quality Management (LAQM). This requires LAs to assess air quality within their area of jurisdiction on a periodic basis. Any location where the relevant standards are not achieved must be declared an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs	
National Planning Policy Framework (NPPF) (Ref 8-5)	Sets out the Government's core policies and principles with respect to land use planning, including air quality. Includes the following: "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" "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."	This assessment considers the potential air quality impacts as a result of the Development
Environmental Protection Act (1990) (Ref 8-6)	Sets out the main requirements with respect to dust control from industrial or trade premises not regulated under	This assessment considers potential dust impacts during the construction phase of the proposed Development

	the Environmental Permitting (England and Wales) Regulations (2010) (Ref 8-7)	
ESD 10, Cherwell Local Plan (Ref 8-8)	Air quality assessments are required for development proposals which have the potential to adversely impact upon air quality	Potential construction and operational air quality impacts as a result of the Development have been assessed

8.2.1.2 Table 8-2 shows the AQOs for pollutants considered within this assessment. These were selected to represent the most significant species likely to be emitted as a result of the Development. It should be noted that the AQOs are generally in line with the AQLVs, although the requirements for compliance vary slightly.

Table 8-2 Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration ($\mu g/m^3$)	Averaging Period
Nitrogen dioxide (NO_2)	200	1-hour average; not to be exceeded more than 18 times a year
	40	Annual average
Particulate matter with an aerodynamic diameter of less than 10µm (PM_{10})	50	24-hour mean; not to be exceeded more than 35 times a year
	40	Annual mean

8.2.1.3 Table 8-3 shows the critical levels for pollutants considered within this assessment.

Table 8-3 Critical Levels

Pollutant	Critical Level	
	Concentration ($\mu g/m^3$)	Averaging Period
Oxides of nitrogen (NO_x)	30	Annual mean

8.2.2 Critical Loads and Levels

8.2.2.1 A critical load is defined by the UK Air Pollution Information System (APIS) as:

"A quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. The exceedence of a critical load is defined as the atmospheric deposition of the pollutant above the critical load."

8.2.2.2 A critical level is defined as:

"Threshold for direct effects of pollutant concentrations according to current knowledge. Exceedence of a critical level is defined as the atmospheric concentration of the pollutant above the critical level."

8.2.2.3 A critical load refers to deposition of a pollutant, while a critical level refers to pollutant concentrations in the atmosphere (which usually have direct effects on vegetation or human health).

8.2.2.4 When pollutant loads (or concentrations) exceed the critical load or level it is considered that there is a risk of harmful effects. The excess over the critical load or level is termed the exceedence. A larger exceedence is often considered to represent a greater risk of damage.

8.2.2.5 Maps of critical loads and levels and their exceedences have been used to show the potential extent of pollution damage and aid in developing strategies for reducing pollution. Decreasing deposition below the critical load is seen as means for preventing the risk of damage. However, even a decrease in the exceedence may infer that less damage will occur.

8.2.2.6 Critical loads have been designated within the UK based on the sensitivity of the receiving habitat and have been reviewed for the purpose of this assessment.

8.3 Methodology

8.3.1 General Approach

8.3.1.1 The Development has the potential to cause air quality impacts during the construction and operational phases. These can be summarised as:

- Construction phase: impacts as a result of dust emissions from demolition, earthworks, construction and trackout;
- Operational phase: impacts as a result of NO_2 and PM_{10} emissions generated by traffic travelling to and from the Site; and,
- Operational phase: impacts as a result of NO_x emissions from the proposed Energy Centre.

8.3.1.2 Potential impacts have been assessed in accordance with the following methodology which is based upon the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction' (Ref 8-9) and Environmental Protection UK (EPUK) 'Development Control: Planning for Air Quality (2010 update)' (Ref 8-10).

8.3.1.3 It should be noted that road vehicle exhaust and Energy Centre emissions have been combined when considering potential impacts in order to ensure cumulative changes in NO_x and NO_2 concentrations were analysed.

8.3.2 Consultation

8.3.2.1 The Environmental Protection Officer at Cherwell District Council (CDC), Sean Gregory, was contacted to obtain the district's latest monitoring data.

8.3.3 The Study Area

Construction Dust

8.3.3.1 Dust impacts have been assessed within 350m from the site boundary and 100m from the construction vehicle route up to 500m from the site entrance, as required by the IAQM assessment methodology (Ref 8-9).

Operational Emissions

8.3.3.2 Impacts on NO_2 and PM_{10} concentrations as a result of emissions from additional road traffic generated by the Development and releases from the Energy Centre have been assessed over the area National Grid Reference (NGR): 454500, 221000 to 460500, 226500. This was defined based on the extents of the provided traffic data, locations of sensitive receptors and anticipated emission dispersion from the relevant pollutant sources. Reference should be made to Drawing 8-12 for a map of the operational emissions assessment extents.

8.3.4 Methodology for Establishing Baseline Conditions

Establishing the Existing Baseline

8.3.4.1 Baseline air quality conditions in the vicinity of the Site have been defined from a number of sources. These include:

- Review of CDC LAQM reports;
- Review of the Department for Food, Environment and Rural Affairs (DEFRA) LAQM website (http://www.defra.gov.uk/environment/quality/air/air-quality/laqm/); and,
- Review of the Air Pollution Information System (APIS) website (www.apis.ac.uk).

8.3.4.2 Review of Ordnance Survey mapping and aerial photography available via GoogleEarth was also undertaken in order to identify sensitive receptor locations around the Development.

Forecasting the Future Baseline ("Without Development" Scenario)

8.3.4.3 Although it is anticipated that PM_{10} concentrations will reduce in the future, there is some uncertainty in regards the magnitude of change. As such, existing background data was utilised with the outputs of a dispersion modelling assessment of road vehicle exhaust emissions should the Development not proceed to predict annual mean PM_{10} concentrations during the opening year of

2031. Although this is likely to over-predict actual concentrations during the operation of the Development, the approach was considered to provide a robust and suitable assessment scenario.

8.3.4.4 There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. The Highways Agency's Interim Advice Note 170/12 (Ref 8-11) considers that currently published future NO_x and NO_2 projections may be too pessimistic and advises a Gap Analysis Method for the prediction of future year conditions. This was utilised along with the associated spreadsheet (version 1.1) to predict future year annual mean NO_2 concentrations based on a dispersion modelling assessment of road vehicle exhaust emissions during the base year, projected base year and Development opening year should the proposals not proceed, as well as background monitoring data from the LA. This process is discussed further in Appendix 8A.

Defining the importance/ sensitivity of resource

8.3.4.5 The sensitivity of the local environment to potential dust impacts has been assessed using the criteria outlined in the following tables. This has been reproduced from the IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction' (Ref 8-9).

Table 8-4 Determining the Importance / Sensitivity of Resources - Construction Dust

Sensitivity of resource or receptor	Examples	
	Human Receptors	Ecological Receptors
High	• Users expect of high levels of amenity • High aesthetic or value property • People expected to be present continuously for extended periods of time • Locations where members of the public are exposed over a time period relevant to the AQO for PM_{10} e.g. residential properties, hospitals, schools and residential care homes	• Internationally or nationally designated site e.g. Special Area of Conservation (SAC)
Medium	• Users would expect to enjoy a reasonable level of amenity • Aesthetics or value of their property could be diminished by soiling • People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	• Nationally designated site e.g. Sites of Special Scientific Interest (SSSI)
Low	• Enjoyment of amenity would not reasonably be expected • Property would not be expected to be diminished in appearance • Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	• Locally designated site e.g. Local Nature Reserve (LNR)

8.3.4.6 The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts during the construction phase:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and the receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;

- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and,
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

8.3.4.7 These factors were considered in the undertaking of this assessment.

8.3.4.8 The sensitivity of the area to dust soiling effects on people and property was subsequently determined based on the criteria shown in Table 8-5.

Table 8-5 Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

8.3.4.9 Table 8-6 outlines the sensitivity of the area to human health impacts.

Table 8-6 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Conc.	Number of Receptors	Distance from Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium	Low
	28 - 32µg/m^3	10 - 100	High	High	Medium	Low	Low
	24 - 28µg/m^3	1 - 10	High	Medium	Low	Low	Low
	Less than 24µg/m^3	More than 100	High	Low	Medium	Low	Low
Medium	-	More than 10	High	Medium	Low	Low	Low
	-	1 - 10	Medium	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

8.3.4.10 Table 8-7 outlines the sensitivity ecological receptors to potential construction dust impacts.

Table 8-7 Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from Source	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

8.3.4.11 The sensitivity of human receptors to operational road traffic exhaust and Energy Centre emission impacts has not been defined in accordance with the EPUK 'Development Control: Planning for Air Quality (2010 update)' (Ref 8-10) guidance document.

8.3.4.12 The sensitivity of ecological receptors to operational road traffic exhaust and Energy Centre emission impacts has been assessed using the criteria provided in Table 8-8. It is noted that these are different to the defined sensitivities to potential dust impacts due to the variations in significance associated with different pollutants.

Table 8-8 Ecological Receptor Sensitivity - Operational Emissions

Sensitivity	Criteria
Very high	Ecological designations of very high importance and rarity, international scale and very limited potential for substitution (e.g. Ramsar sites, SACs and Special Protection Areas (SPA))
High	Ecological designations of high importance and rarity, national scale and limited potential for substitution (e.g. SSSIs and National Nature Reserves (NNRs))
Medium	Ecological designations with medium importance and rarity, regional scale and limited potential for substitution
Low	Ecological designations with low importance and rarity, local scale (e.g LNRs)

8.3.5 Methodology for Assessing Impacts

Construction Phase Assessment

8.3.5.1 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction' (Ref 8-9).

8.3.5.2 Activities on the proposed construction site have been divided into four types to reflect their different potential impacts. These are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout (the transport of dust and dirt onto the public road network where it may then be resuspended).

8.3.5.3 The potential for dust emissions is assessed for each activity that is likely to take place and considers three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and,
- The risk of health effects due to a significant increase in exposure to PM_{10}.

8.3.5.4 The assessment steps are detailed below.

Step 1

8.3.5.5 Step 1 screens the requirement for a more detailed assessment. Should sensitive receptors be identified within 350m of the site boundary or 100m of the construction vehicle route up to 500m from the site entrance then the assessment proceeds to Step 2. Should sensitive receptors not be present

within the relevant distances then neutral impacts would be expected and further assessment is not necessary.

Step 2

8.3.5.6 Step 2 assesses the risk of potential dust impacts. A site is allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and,
- The sensitivity of the area to dust impacts, which can defined as low, medium or high sensitivity (Step 2B).

8.3.5.7 The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.

8.3.5.8 Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 8-9.

Table 8-9 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	• Total building volume greater than 50,000m^3 • Potentially dusty construction material (e.g. concrete) • On-site crushing and screening • Demolition activities greater than 20m above ground level
	Earthworks	• Total site area greater than 10,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • More than ten heavy earth moving vehicles active at any one time • Formation of bunds greater than 8m in height • More than 100,000 tonnes of material moved
	Construction	• Total building volume greater than 100,000m^3 • Piling • On site concrete batching • Sandblasting
	Trackout	• More than 100 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Demolition	• Total building volume 20,000m^3 to 50,000m^3 • Potentially dusty construction material • Demolition activities 10m to 20m above ground level

	Earthworks	• Total site area 2,500m^2 to 10,000m^2 • Moderately dusty soil type (e.g. silt) • Five to ten heavy earth moving vehicles active at any one time • Formation of bunds 4m to 8m in height • Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	• Total building volume 25,000m^3 to 100,000m^3 • Potentially dusty construction material (e.g. concrete) • Piling • On site concrete batching
	Trackout	• 25 to 100 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m
Small	Demolition	• Total building volume under 20,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber) • Demolition activities less than 10m above ground level
	Earthworks	• Total site area less than 2,500m^2 • Soil type with large grain size (e.g. sand) • Less than five heavy earth moving vehicles active at any one time • Formation of bunds less than 4m in height • Total material moved less than 10,000 tonnes • Earthworks during wetter months
	Construction	• Total building volume less than 25,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• Less than twenty five HDV trips per day • Surface material with low potential for dust release • Unpaved road length less than 50m

8.3.5.9 Step 2C combines the dust emissions magnitude with the sensitivity of the area to determine the risk of unmitigated impacts. Table 8-10 outlines the risk category from demolition.

Table 8-10 Dust Risk Category from Demolition

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

8.3.5.10 Table 8-11 outlines the dust risk category from earthworks and construction activities.

Table 8-11 Dust Risk Category from Earthworks and Construction

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

8.3.5.11 Table 8-12 outlines the dust risk category from trackout.

Table 8-12 Dust Risk Category from Trackout

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

Step 3

8.3.5.12 Step 3 requires the identification of site specific mitigation measures within the IAQM guidance (Ref 8-9) to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Step 4

8.3.5.13 Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be 'not significant'. This has been described as neutral within this report to provide continuity between assessment terminologies.

8.3.5.14 The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The IAQM guidance (Ref 8-9) suggests the provision of details of the assessor's qualifications and experience. These can be provided upon request.

Operational Emissions

8.3.5.15 The Development has the potential to impact on existing air quality during the operational phase as a result of road traffic emissions of NO_2 and PM_{10} and Energy Centre emissions of NO_x. Potential impacts have been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling. Reference should be made to Appendix 8A for assessment input data and a detailed methodology.

8.3.5.16 Receptors potentially sensitive to traffic exhaust emissions were considered in two categories;

- Human sensitive receptors; and,
- Ecological sensitive receptors.

8.3.5.17 These were assessed in accordance with the methodology outlined in the following Sections.

Human Sensitive Receptors

8.3.5.18 Human receptors potentially sensitive to operational road traffic exhaust and Energy Centre emissions were identified within the vicinity of the Site. DEFRA guidance LAQM.TG(09) (Ref 8-12) provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and,
- Care homes.

8.3.5.19 These were considered during the selection of receptor locations.

8.3.5.20 The magnitude of change in pollutant concentrations was defined based on the criteria outlined in Table 8-13.

Table 8-13 Operational Emissions - Magnitude of Change

Magnitude of Change	Change in Pollutant Level as Proportion of Annual Mean Concentration (%)
Large	Greater than 10
Medium	5 - 10
Small	1 - 5
Imperceptible	Less than 1

8.3.5.21 Impact significance was defined based on the interaction between predicted annual mean concentration with the Development in place and the magnitude of change, as outlined in Table 8-14.

Table 8-14 Operational Emissions - Significance of Impact

Absolute Concentration in Relation to Objective/Limit Value	Magnitude of Change		
	Small	Medium	Large
Above Objective/Limit Value With Scheme (>40µg/m^3)	Slight	Moderate	Substantial
Just Below Objective/Limit Value With Scheme (36-40µg/m^3)	Slight	Moderate	Moderate
Below Objective/Limit Value With Scheme (30-36 µg/m^3)	Negligible	Slight	Slight
Well Below Objective/Limit Value With Scheme (<30 µg/m^3)	Negligible	Negligible	Slight

Note: *Any 'imperceptible' changes in pollutant concentrations are considered to be an impact of Negligible significance.*

8.3.5.22 Any increases in pollutant concentrations would be considered an 'adverse' impact, whilst reductions would be considered 'beneficial'.

8.3.5.23 Following the prediction of impacts at discrete receptor locations the EPUK document (Ref 8-10) provides guidance on determining the overall air quality impact significance of the operation of a development. The following factors are identified for consideration by the assessor:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;
- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant;
- The magnitude of changes and the descriptions of the impacts at the receptors;
- Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced; and,

- The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

8.3.5.24 These factors were considered and an overall significance determined for the impact of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The EPUK guidance (Ref 8-10) suggests the provision of details of the assessor's qualifications and experience. These can be provided upon request.

Ecological Sensitive Receptors

8.3.5.25 Road vehicle exhaust and Energy Centre emissions associated with operation of the Development have the potential to result in variations in NO_x concentrations and nitrogen deposition rates at ecological designations. The magnitude of change and impact significance was assessed using the criteria outlined in Table 8-13 and Table 8-14, whilst the sensitivity of the receptor was defined using Table 8-8.

8.3.6 Limitations and Assumptions

8.3.6.1 A number of assumptions have been made to inform the assessment. These are detailed in the relevant Sections and Appendix 8A and include:

- The soil type on site is potentially dusty;
- The unpaved construction road length will be greater than 100m;
- The accuracy of estimates of background pollutant concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions between the Site and observation station;
- Overall dispersion model limitations;
- Uncertainties associated with pollutant monitoring data, including analyser locations;
- The Energy Centre will operate at maximum load 24-hours per day, 365-days per year; and,
- The standby boilers will only operate when periods when the CHP engines are not operational and will have lower emission rates due to their lesser power rating.

8.4 Description of the Baseline Conditions

8.4.1 Existing Baseline

8.4.1.1 Existing air quality conditions in the vicinity of the Site were identified in order to provide a baseline for the assessment. These are detailed in the following Sections.

Local Air Quality Management

8.4.1.2 As required by the Environment Act (1995) (Ref 8-4), CDC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO_2 are above the AQO at locations of relevant exposure. As such, one AQMA has been declared at Hennef Way, Banbury, which is located approximately 20km north-west of the Site.

8.4.1.3 Although traffic data was not available to describe flows within the Banbury AQMA, due to the distance between the Site and the designation, it is not anticipated that the proposals would result in significant air quality impacts at this location. As such, this AQMA has not been considered further in the context of this assessment.

8.4.1.4 CDC has also identified three additional areas where AQMAs should be declared due to exceedences of the annual mean AQO for NO_2. These include:

- Horsefair/North Bar, Banbury;
- Kings End/Queens Avenue, Bicester; and,
- Bicester Road, Kidlington.

8.4.1.5 The proposed AQMA at Kings End/Queens Avenue, Bicester, is approximately 1.5km south-east of the Development. Potential impacts on annual mean NO_2 concentrations within this sensitive area have been considered within this chapter.

8.4.1.6 The proposed Horsefair/North Bar AQMA and Bicester Road AQMA are approximately 19.6km and 12.5km from the Development. Although traffic data was not available to describe flows within these locations, due to the distance between the Site and the proposed designations, it is not anticipated that the proposals would result in significant air quality impacts at these positions. As such, these proposed AQMAs have not been considered further in the context of this assessment.

8.4.1.7 CDC has concluded that concentrations of all other pollutants considered within the Air Quality Strategy (Ref 8-13) are below the relevant AQOs and as such no further AQMAs have been declared to date.

Air Quality Monitoring

8.4.1.8 Monitoring of pollutant concentrations is undertaken by CDC using passive diffusion tubes throughout their area of jurisdiction. Review of the most recent LAQM Progress Report (Ref 8-14) indicated ten monitoring locations in the vicinity of the site. Results are shown in Table 8-15. Exceedences of the AQO are highlighted in **bold**. Reference should be made to Drawing 8-1 for a map of the monitoring locations.

Table 8-15 NO_2 Diffusion Tube Monitoring Results

Site		Type	Annual Mean Concentration (µg/m^3)		
				2012	2013
1	Villiers Road	Urban Background	19.0	20.5	19.8
2	Kings End West	Kerbside	30.1	31.1	29.1
3	Kings End South	Roadside	**49.5**	**49.0**	**48.5**
4	Kings End North	Roadside	**43.9**	**46.0**	35.8
5	Field Street	Kerbside	**42.9**	**41.6**	38.6
6	North Street	Kerbside	**46.1**	**45.6**	**42.7**
7	Queens Avenue/Kings End	Kerbside	**42.9**	**45.0**	**41.0**
8	Market Square	Kerbside	35.7	**45.6**	37.1
9	Tamarisk Gardens	Urban Background	22.3	17.6	17.4
10	Causeway	Kerbside	-	-	23.1

8.4.1.9 As indicated in Table 8-15, annual mean NO_2 concentrations were above the AQO at six of the diffusion tube locations in recent years. This is to be expected due to their roadside and kerbside locations in an area proposed to be designated as an AQMA.

Background Pollutant Concentrations

8.4.1.10 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. The proposed Development is located in grid square NGR: 456500, 224500. Data for this location was downloaded from the DEFRA website (Ref 8-15) for the purpose of this assessment and is summarised in Table 8-16 for the base year, current year and development opening year.

Table 8-16 Predicted Background Concentrations

Pollutant	Predicted Background Concentration (µg/m^3)		
	2013	2014	2031
NO_x	15.95	15.42	10.52
NO_2	11.66	11.32	7.92
PM_{10}	18.15	17.95	16.80

Sensitive Receptors

8.4.1.11 A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for construction dust and operational emission impacts in the following Sections.

Construction Dust

8.4.1.12 Receptors sensitive to potential dust impacts during demolition, earthworks and construction were identified from a desk-top study of the area up to 350m from the Development boundary. These are summarised in Table 8-17.

Table 8-17 Demolition, Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	10 - 100	1
20 - 50	10 - 100	1
50 - 100	10 - 100	-
100 - 350	Over 100	-

8.4.1.13 Reference should be made to Drawing 8-2 for a graphical representation of demolition, earthworks and construction dust sensitive locations.

8.4.1.14 Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 100m from the road network within 500m of the site access. These are summarised in Table 8-18. It is anticipated that construction traffic will use the A41/Vendee Drive from the M40 Junction 9 and the A421 around the east of Bicester, as described in Chapter 3.

Table 8-18 Trackout Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Residential Receptors	Approximate Number of Ecological Receptors
Less than 20	1 - 10	1
20 - 50	10 - 100	1
50 - 100	Over 100	-

8.4.1.15 Reference should be made to Drawing 8-3 for a graphical representation of trackout dust sensitive receptor locations. As indicated in Table 8-18, there are a number of sensitive receptors in the vicinity of the local highway network that may be affected by trackout dust.

8.4.1.16 A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 8-19.

Table 8-19 Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The Site is located in a residential/ agricultural area. Dust generation may have historically occurred as a result of wind-blown emissions from fields
The likelihood of concurrent dust generating activity on nearby sites	Concurrent construction of the Exemplar site, as well as Application 2 and Application 3, could result in impacts associated with cumulative dust generation
Pre-existing screening between the source and the receptors	The Site is bound by vegetation to the west, providing a natural protective screen. Other boundaries are predominantly open
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the south-west of the Development, as shown in Drawing 8-11. As such, receptors to the north-east of the Site would be most affected by dust emissions
Conclusions drawn from local topography	The land use in close proximity to the Site is residential to the south and east and agricultural to the north and west. The terrain is predominantly flat. As such, receptors to the south and east of the Site are most likely to be affected by construction dust emissions
Duration of the potential impact, as a receptor may become more sensitive over time	Currently it is unclear as to the duration of the construction phase. However, it will extend over a significant period
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific additional receptor sensitivities identified during the baseline

8.4.1.17 Based on the criteria shown in Table 8-4, the sensitivity of the receiving environment to potential dust soiling impacts is considered to be high. This is because users would expect to enjoy a reasonable level of amenity, aesthetics or value of their property could be diminished by soiling and people would be expected to be present for extended periods of time e.g. residential properties.

8.4.1.18 The sensitivity of the receiving environment to specific dust impacts is shown in Table 8-20.

Table 8-20 Sensitivity of the Surrounding Area to Specific Dust Impacts

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	Medium
Human Health	Low	Low	Low	Low
Ecological	Medium	Medium	Medium	Medium

Operational Phase Emissions - Human Receptors

8.4.1.19 Human receptors sensitive to potential road vehicle exhaust and Energy Centre emission impacts were identified from a desk top study and are summarised in Table 8-21. Reference should be made to Drawing 8-4 for a map of operational phase emission human receptor locations.

Table 8-21 Operational Phase Emissions - Human Sensitive Receptors

Receptor		NGR (m)	
		X	Y
R1	Residential - Ardley Road, Bucknell	455941	225647
R2	Residential - Bicester Road, Bucknell	455952	225569
R3	Residential - Middleton Road, Bucknell	455770	225504
R4	Residential - Swallofield Farm	455191	224952
R5	Residential - Lovelynch House	455426	223131
R6	Residential - A4095, Chesterton	455756	221656
R7	Residential - B4100, Watergate Lodge	457252	226297
R8	Residential - Fringford Road, Old School Close	458643	225146
R9	Residential - Fringford Road, Bricknells Farm	458448	224757
R10	Residential - A4421	459464	225338
R11	Residential - A4421, Harmon Close	459211	224880
R12	Residential - Pine Close	458936	224316
R13	Residential - Juniper Gardens	458208	224460
R14	Residential - Mullein Road	458144	224415
R15	Residential - Trefoil Drive	457402	224005
R16	Residential - Goldsmith Close	457188	223851
R17	Residential - Chaucer Close	456961	223612
R18	Kings Meadow School	457050	223408
R19	Residential - Wensum Crescent	456619	223133
R20	Residential - Isis Avenue	456435	222804
R21	Residential - Shannon Road	456924	222626

R22	Residential - St Marys Close	457521	222372
R23	Bicester Community Hospital	457982	222342
R24	Brookside Primary School	458023	223008
R25	Residential - North Street	458276	222932
R26	Residential - Manor Farm	460386	222898
R27	Residential - Bucknell Road	458195	222841
R28	Residential - Queens Crescent	458099	222604
R29	Residential - Kings End	458024	222469
R30	Residential - Kestrel Way	459190	221258
R31	Residential - Shearwater Drive	459972	221840
R32	Residential - Sunderland Drive	459384	224033
R33	Residential - Derwent Road	456772	223360

8.4.1.20 The human sensitive receptors identified in Table 8-21 represent worst case locations. However, this is not an exhaustive list and there may be other locations within the vicinity of the Site that may experience air quality impacts as a result of the Development that have not been individually identified above.

Operational Phase Emissions - Ecological Receptors

8.4.1.21 Ecological receptors sensitive to potential road vehicle exhaust and Energy Centre emission impacts were identified from a desk top study and are summarised in Table 8-22. Reference should be made to Drawing 8-4 for a map of operational phase ecological receptor locations.

Table 8-22 Operational Phase Emissions - Ecological Receptors

Receptor		NGR (m)	
		X	Y
ER1	Ardley Cutting and Quarry SSSI	454952	225914
ER2	Ardley Cutting and Quarry SSSI	454987	225887
ER3	Ardley Cutting and Quarry SSSI	455576	225321
ER4	Ardley Cutting and Quarry SSSI	455585	225308
ER5	Bure Park LNR	457623	224175

8.4.1.22 It should be noted that during the desk-top study, Ardley Trackways SSSI was also identified as a statutory designation in the vicinity of the Development. However, as this is a geological site, it is not considered sensitive to potential air quality impacts and so has not been assessed further within this chapter.

8.4.1.23 The ecological sensitive receptors identified in Table 8-22 represent worst-case locations and were selected based on the closest point of the designation to each relevant road link. However, this is not an exhaustive list and there may be

other locations within the vicinity of the site that may experience air quality impacts as result of the Development that have not been individually identified above.

8.4.1.24 Existing nitrogen deposition rates and critical loads for each ecological receptor location are shown in Table 8-23.

Table 8-23 Baseline Ecological Receptor Conditions

Receptor	Nitrogen Deposition (kgN/ha/yr)		
	Baseline	Critical Load	
		Min	Max
ER1	24.57	15	25
ER2	24.57	15	25
ER3	24.57	15	25
ER4	24.57	15	25
ER5	24.57	10	20

8.4.1.25 As indicated in Table 8-23, nitrogen deposition is high at all receptor locations, with exceedences of the minimum critical loads as a baseline condition.

8.4.1.26 Ecological receptor sensitivity was defined based upon the methodology outlined in Table 8-8. These are detailed with Table 8-24.

Table 8-24 Operational Phase Emissions - Ecological Receptor Sensitivity

Receptor		Sensitivity
ER1	Ardley Cutting and Quarry SSSI	High
ER2	Ardley Cutting and Quarry SSSI	High
ER3	Ardley Cutting and Quarry SSSI	High
ER4	Ardley Cutting and Quarry SSSI	High
ER6	Bure Park LNR	Low

8.4.2 Future Baseline

8.4.2.1 Future baseline conditions have been predicted through dispersion modelling as detailed previously. Concentrations and deposition rates at the receptor locations are detailed in the assessment Sections below.

8.5 Design and Mitigation

8.5.1 Construction Approach and Mitigation of Short-Term Construction Effects

8.5.1.1 The IAQM guidance (Ref 8-9) provides a number of potential mitigation measures to reduce impacts during the construction phase. These measures have been adapted for the Development as summarised in Table 8-25. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan if required by the LA.

Table 8-25 Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Develop and implement a Stakeholder Communications Plan that includes community engagement • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LA
Site Management	• Record all dust and air quality complaints • Record any exceptional incidents that cause dust/or air emissions, and the action taken to resolve the situation
Monitoring	• Undertake daily on-site and off-site inspection to monitor dust. • Carry out regular site inspections to monitor compliance with the DMP • Increase frequency of site inspections when activities with a high potential to produce dust are being carried out
Preparing and Maintaining the Site	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible • Fully enclose site or specific operations where there is a high potential for dust production and the site as activities for an extensive period • Avoid site runoff of water or mud • Use dust as water suppressant where applicable • Remove materials that have a potential to produce dust from site as soon as possible • Cover, seed or fence stockpiles to prevent wind whipping
Operating Vehicle/ Machinery and Sustainable Travel	• All vehicles to switch of engines - no idling vehicles • Avoid the use of diesel or petrol powered generators where practicable • Impose a maximum-speed-limit of 15mph on surfaced and 10mph on un-surfaced haul roads and work areas • Produce a Construction Logistics Plan to manage deliveries

	• Implement a Travel Plan that supports and encourages sustainable travel
Operations	• Cutting equipment to use water as dust suppressant or suitable local extract ventilation • Use enclosed chutes and covered skips • Minimise drop heights • Ensure equipment is readily available on site to clean any spillages
Waste Management	• No bonfires
Earthworks and Construction	• Re-vegetate earthworks and exposed areas • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate • Only remove the cover in small areas during work and not all at once • Avoid scabbling • Ensure sand and other aggregates are stored and not able to dry out • Ensure bulk cement and other fine power materials are delivered and stored to prevent escape
Trackout	• Use water-assisted dust sweeper on the access and local roads • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving sites are covered to prevent escape of materials • Inspect on-site routes for integrity, instigate necessary repairs and record in site log book • Implement a wheel washing system at a suitable location near site exit • Access gates 10m from receptors where possible

8.5.2 Scheme Design and Mitigation of Permanent Operational Effects

8.5.2.1 A suitable stack for dispersion of NO_x emissions from the Energy Centre has been included within the proposals in order to control operational air quality impacts to an acceptable level.

8.5.2.2 A Travel Plan has been produced to promote sustainable transport modes and reduce single-occupancy vehicle trips. Reference should be made to Chapter 16 for further details of the Transport Assessment and associated Travel Plan.

8.6 Construction Impacts

8.6.1.1 During the construction phase of the proposed Development there is the potential for air quality impacts as a result of fugitive dust emissions. These are assessed below.

8.6.2 Step 1

8.6.2.1 The undertaking of activities such as demolition, excavation, ground works, cutting, construction, concrete batching and storage of materials has the

potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

8.6.2.2 The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

8.6.2.3 The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 350m of the site boundary. As such, a detailed assessment of potential dust impacts has been undertaken.

8.6.3 Step 2

Demolition

8.6.3.1 Demolition will involve the removal of existing buildings at the Site. It is anticipated that the volume of building to be demolished is likely to be less than 20,000m^3. As such, the magnitude of potential dust emissions from demolition activities is considered small, in accordance with the criteria outlined in Table 8-9.

8.6.3.2 Table 8-20 indicates the sensitivity of the area to dust soiling effects on people and property is high. In accordance with the criteria outlined in Table 8-10, the Development is considered to be medium risk for dust soiling as a result of demolition activities.

8.6.3.3 Table 8-20 indicates the sensitivity of the area to human health is low. In accordance with the criteria outlined in Table 8-10, the Development is considered to be negligible risk for human health as a result of demolition activities.

8.6.3.4 Table 8-20 indicated the sensitivity of the area to ecological impacts is medium. In accordance with the criteria outlined in Table 8-10, the Development is considered to be a low risk site for ecological impacts as a result of demolition activities.

Earthworks

8.6.3.5 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. The Site covers an area greater than 10,000m^2. In accordance with the criteria outlined in Table 8-9, the magnitude of potential dust emissions from earthworks is therefore large.

8.6.3.6 Table 8-20 indicates the sensitivity of the area to dust soiling effects on people and property is high. In accordance with the criteria outlined in Table 8-11, the Development is considered to be high risk for dust soiling as a result of earthworks activities.

8.6.3.7 Table 8-20 indicates the sensitivity of the area to human health is low. In accordance with the criteria outlined in Table 8-11, the Development is considered to be low risk for human health as a result of earthwork activities.

8.6.3.8 Table 8-20 indicated the sensitivity of the area to ecological impacts is medium. In accordance with the criteria outlined in Table 8-11, the Development is considered to be a medium risk site for ecological impacts as a result of earthworks activities.

Construction

8.6.3.9 Due to the size of the Site, the total building volume is likely to be greater than 100,000m^3. In accordance with the criteria outlined in Table 8-9, the magnitude of potential dust emissions from construction is therefore high.

8.6.3.10 Table 8-20 indicates the sensitivity of the area to dust soiling effects on people and property is high. In accordance with the criteria outlined in Table 8-11, the Development is considered to be high risk for dust soiling as a result of construction activities.

8.6.3.11 Table 8-20 indicates the sensitivity of the area to human health is low. In accordance with the criteria outlined in Table 8-11, the Development is considered to be low risk for human health as a result of construction activities.

8.6.3.12 Table 8-20 indicated the sensitivity of the area to ecological impacts is medium. In accordance with the criteria outlined in Table 8-11, the Development is considered to be a medium risk site for ecological impacts as a result of construction activities.

Trackout

8.6.3.13 Information on the number of HDV trips to be generated during the construction phase of the Development was not available from the transport consultants at the time of assessment.

8.6.3.14 Based on the Site area, it is anticipated that the unpaved road length is likely to be greater than 100m. In accordance with the criteria outlined in Table 8-9, the magnitude of potential dust emissions from trackout is therefore large.

8.6.3.15 Table 8-20 indicates the sensitivity of the area to dust soiling effects on people and property is medium. In accordance with the criteria outlined in Table 8-12, the Development is considered to be medium risk for dust soiling as a result of trackout activities.

8.6.3.16 Table 8-20 indicates the sensitivity of the area to human health is low**.** In accordance with the criteria outlined in Table 8-12, the Development is considered to be low risk for human health as a result of trackout activities.

8.6.3.17 Table 8-20 indicated the sensitivity of the area to ecological impacts is medium. In accordance with the criteria outlined in Table 8-12, the Development is considered to be a medium risk site for ecological impacts as a result of construction activities.

Summary of the Risk of Dust Effects

8.6.3.18 A summary of the potential risk from each dust generating activity is provided in Table 8-26.

Table 8-26 Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	High	High	Medium
Human Health	Negligible	Low	Low	Low
Ecological	Low	Medium	Medium	Medium

8.6.3.19 As indicated in Table 8-26, the potential risk of dust soiling is high from earthworks and construction and medium from demolition and trackout. The potential risk of human health impacts is low for earthworks, construction and trackout and negligible for demolition. The potential risk to ecological areas is low for demolition and medium for earthworks, construction and trackout activities.

8.6.3.20 It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk has been predicted based on a worst-case scenario of works being undertaken at the Site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

8.6.4 Step 3

8.6.4.1 Mitigation options for the Site have previously been summarised in Table 8-25.

8.6.5 Step 4

8.6.5.1 Assuming the relevant mitigation measures outlined in Table 8-25 are implemented, the residual impact from all dust generating activities is predicted to be neutral, in accordance with IAQM guidance (Ref 8-9).

8.6.5.2 As the assessment of potential dust impacts has been undertaken using worst-case assumptions and in accordance with IAQM guidance (Ref 8-9), confidence in this prediction is high.

8.7 Permanent Operational Impacts

8.7.1.1 Additional vehicle movements associated with the operation of the proposed Development will generate exhaust emissions on the local and regional road networks. Additionally, atmospheric emissions from the Energy Centre may cause air quality impacts in the vicinity of the Site. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive locations.

8.7.1.2 The assessment considered the following scenarios:

- Do-minimum; and,
- Do-something.

8.7.1.3 The "do-minimum" (i.e. without Development) scenario was representative of baseline traffic data for 2031. The "do-something" scenario was representative of baseline traffic data for 2031 in addition to predicted operational traffic associated with the Development and emissions from the Energy Centre.

8.7.2 Human Receptors

Nitrogen Dioxide

8.7.2.1 Annual mean NO_2 concentrations were predicted for each scenario and are summarised in Table 8-27. It should be noted that the do-something results include the NO_2 contribution from both road traffic and Energy Centre emissions. Reference should be made to Drawing 8-5 and 8-6 for graphical representations of predicted NO_2 concentrations.

Table 8-27 Predicted Annual Mean NO_2 Concentrations - Operational Phase

Receptor		Predicted 2031 Annual Mean NO_2 Concentration ($\mu g/m^3$)			Predicted Change as a Proportion of the AQO (%)
		Do-Min	Do-Some	Change	
R1	Residential - Ardley Road, Bucknell	15.23	15.36	0.13	0.33
R2	Residential - Bicester Road, Bucknell	15.25	15.62	0.37	0.93
R3	Residential - Middleton Road, Bucknell	15.05	15.28	0.22	0.56
R4	Residential - Swallofield Farm	17.92	18.21	0.29	0.71
R5	Residential - Lovelynch House	16.33	16.39	0.06	0.14
R6	Residential - A4095, Chesterton	17.98	18.10	0.12	0.29
R7	Residential - B4100, Watergate Lodge	17.14	17.25	0.11	0.28
R8	Residential - Fringford Road, Old School Close	14.39	14.69	0.31	0.76
R9	Residential - Fringford Road, Bricknells Farm	14.62	15.07	0.44	1.11
R10	Residential - A4421	17.16	17.38	0.22	0.54
R11	Residential - A4421, Harmon Close	15.86	16.10	0.24	0.60
R12	Residential - Pine Close	18.45	18.80	0.36	0.89
R13	Residential - Juniper Gardens	20.66	21.34	0.68	1.70
R14	Residential - Mullein Road	17.25	17.95	0.70	1.75
R15	Residential - Trefoil Drive	16.55	17.55	1.01	2.52
R16	Residential - Goldsmith Close	17.49	18.06	0.58	1.44
R17	Residential - Chaucer Close	17.26	17.54	0.29	0.72
R18	Kings Meadow School	14.42	14.64	0.22	0.54

R19	Residential - Wensum Crescent	18.04	18.04	-0.00	0.00
R20	Residential - Isis Avenue	19.08	19.03	-0.06	-0.15
R21	Residential -Shannon Road	15.55	15.78	0.22	0.55
R22	Residential - St Marys Close	16.67	16.80	0.13	0.33
R23	Bicester Community Hospital	24.89	25.24	0.35	0.88
R24	Brookside Primary School	14.90	15.04	0.14	0.36
R25	Residential - North Street	30.47	31.09	0.63	1.56
R26	Residential - Manor Farm	16.31	16.35	0.04	0.11
R27	Residential - Bucknell Road	23.13	23.51	0.37	0.93
R28	Residential - Queens Crescent	22.45	22.75	0.29	0.74
R29	Residential - Kings End	22.59	22.88	0.29	0.72
R30	Residential - Kestrel Way	22.72	22.93	0.21	0.52
R31	Residential - Shearwater Drive	16.17	16.26	0.09	0.22
R32	Residential - Sunderland Drive	16.78	16.92	0.14	0.34
R33	Residential - Derwent Road	16.44	16.56	0.12	0.31

8.7.2.2 As indicated in Table 8-27, predicted NO_2 concentrations were below the AQO at all receptors in both scenarios considered. It should be noted that pollution levels are predicted to reduce at some locations due to variations in traffic flow as a result of the proposals.

8.7.2.3 Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 8-28. These were calculated based on the criteria shown in Table 8-13 and Table 8-14.

Table 8-28 Predicted Annual Mean NO_2 Impacts - Operational Phase

Receptor		Magnitude of Change	Predicted Concentration	Significance of Impact
R1	Residential - Ardley Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R2	Residential - Bicester Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R3	Residential - Middleton Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R4	Residential - Swallofield Farm	Imperceptible	Well Below Objective	Negligible
R5	Residential - Lovelynch House	Imperceptible	Well Below Objective	Negligible
R6	Residential - A4095, Chesterton	Imperceptible	Well Below Objective	Negligible
R7	Residential - B4100, Watergate	Imperceptible	Well Below	Negligible

	Lodge		Objective	
R8	Residential - Fringford Road, Old School Close	Imperceptible	Well Below Objective	Negligible
R9	Residential - Fringford Road, Bricknells Farm	Small	Well Below Objective	Negligible
R10	Residential - A4421	Imperceptible	Well Below Objective	Negligible
R11	Residential - A4421, Harmon Close	Imperceptible	Well Below Objective	Negligible
R12	Residential - Pine Close	Imperceptible	Well Below Objective	Negligible
R13	Residential - Juniper Gardens	Small	Well Below Objective	Negligible
R14	Residential - Mullein Road	Small	Well Below Objective	Negligible
R15	Residential - Trefoil Drive	Small	Well Below Objective	Negligible
R16	Residential - Goldsmith Close	Small	Well Below Objective	Negligible
R17	Residential - Chaucer Close	Imperceptible	Well Below Objective	Negligible
R18	Kings Meadow School	Imperceptible	Well Below Objective	Negligible
R19	Residential - Wensum Crescent	Imperceptible	Well Below Objective	Negligible
R20	Residential - Isis Avenue	Imperceptible	Well Below Objective	Negligible
R21	Residential -Shannon Road	Imperceptible	Well Below Objective	Negligible
R22	Residential - St Marys Close	Imperceptible	Well Below Objective	Negligible
R23	Bicester Community Hospital	Imperceptible	Well Below Objective	Negligible
R24	Brookside Primary School	Imperceptible	Well Below Objective	Negligible
R25	Residential - North Street	Small	Below Objective	Negligible
R26	Residential - Manor Farm	Imperceptible	Well Below Objective	Negligible
R27	Residential - Bucknell Road	Imperceptible	Well Below Objective	Negligible
R28	Residential - Queens Crescent	Imperceptible	Well Below Objective	Negligible
R29	Residential - Kings End	Imperceptible	Well Below	Negligible

			Objective	
R30	Residential - Kestrel Way	Imperceptible	Well Below Objective	Negligible
R31	Residential - Shearwater Drive	Imperceptible	Well Below Objective	Negligible
R32	Residential - Sunderland Drive	Imperceptible	Well Below Objective	Negligible
R33	Residential - Derwent Road	Imperceptible	Well Below Objective	Negligible

8.7.2.4 As indicated in Table 8-28, the significance of impacts as a result of the Development was predicted to be negligible at all receptor locations. It should be noted that the predicted change in pollutant concentrations was based on emissions associated with both road traffic and the Energy Centre and therefore provides a robust assessment scenario.

Particulate Matter

8.7.2.5 Annual mean PM_{10} concentrations were predicted for each scenario and are summarised in Table 8-29. Reference should be made to Drawing 8-8 and 8-9 for graphical representations of predicted PM_{10} concentrations.

Table 8-29 Predicted Annual Mean PM_{10} Concentrations - Operational Phase

Receptor		Predicted 2031 Annual Mean PM_{10} Concentration ($\mu g/m^3$)			Predicted Change as a Proportion of the AQO (%)
		Do-Min	Do-Some	Change	
R1	Residential - Ardley Road, Bucknell	16.70	16.73	0.02	0.06
R2	Residential - Bicester Road, Bucknell	16.67	16.72	0.05	0.12
R3	Residential - Middleton Road, Bucknell	16.61	16.70	0.08	0.21
R4	Residential - Swallofield Farm	17.13	17.24	0.11	0.28
R5	Residential - Lovelynch House	16.95	16.92	-0.03	-0.07
R6	Residential - A4095, Chesterton	17.36	17.39	0.03	0.08
R7	Residential - B4100, Watergate Lodge	17.18	17.20	0.02	0.05
R8	Residential - Fringford Road, Old School Close	16.53	16.54	0.01	0.02
R9	Residential - Fringford Road, Bricknells Farm	16.55	16.56	0.01	0.02
R10	Residential - A4421	17.23	17.25	0.02	0.06
R11	Residential - A4421, Harmon Close	16.89	16.90	0.02	0.04
R12	Residential - Pine Close	17.05	17.09	0.04	0.10

R13	Residential - Juniper Gardens	17.29	17.32	0.03	0.07
R14	Residential - Mullein Road	16.89	16.91	0.02	0.05
R15	Residential - Trefoil Drive	16.96	16.92	-0.03	-0.08
R16	Residential - Goldsmith Close	16.93	16.92	-0.02	-0.05
R17	Residential - Chaucer Close	17.18	17.14	-0.04	-0.10
R18	Kings Meadow School	16.50	16.51	0.01	0.02
R19	Residential - Wensum Crescent	17.44	17.36	-0.07	-0.18
R20	Residential - Isis Avenue	17.20	17.16	-0.03	-0.08
R21	Residential -Shannon Road	16.68	16.71	0.03	0.08
R22	Residential - St Marys Close	17.03	17.06	0.03	0.08
R23	Bicester Community Hospital	17.89	17.96	0.06	0.15
R24	Brookside Primary School	16.55	16.56	0.01	0.04
R25	Residential - North Street	18.25	18.34	0.09	0.23
R26	Residential - Manor Farm	16.71	16.72	0.01	0.01
R27	Residential - Bucknell Road	17.53	17.59	0.06	0.15
R28	Residential - Queens Crescent	17.59	17.64	0.05	0.13
R29	Residential - Kings End	17.59	17.64	0.05	0.13
R30	Residential - Kestrel Way	17.66	17.70	0.04	0.11
R31	Residential - Shearwater Drive	16.99	17.02	0.03	0.07
R32	Residential - Sunderland Drive	17.05	17.06	0.01	0.04
R33	Residential - Derwent Road	17.03	16.99	-0.04	-0.10

8.7.2.6 As indicated in Table 8-29, predicted PM_{10} concentrations were below the relevant AQO at all receptor locations for both scenarios considered. It should be noted that pollution levels are predicted to reduce at some locations due to variations in traffic flow as a result of the proposals.

8.7.2.7 Predicted impacts on annual mean PM_{10} concentrations at the sensitive receptor locations are summarised in Table 8-30. These were calculated based on the criteria shown in Table 8-13 and Table 8-14.

Table 8-30 Predicted Annual Mean PM_{10} Concentrations - Operational Phase

Receptor		Magnitude of Change	Predicted Concentration	Significance of Impact
R1	Residential - Ardley Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R2	Residential - Bicester Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R3	Residential - Middleton Road, Bucknell	Imperceptible	Well Below Objective	Negligible

R4	Residential - Swallofield Farm	Imperceptible	Well Below Objective	Negligible
R5	Residential - Lovelynch House	Imperceptible	Well Below Objective	Negligible
R6	Residential - A4095, Chesterton	Imperceptible	Well Below Objective	Negligible
R7	Residential - B4100, Watergate Lodge	Imperceptible	Well Below Objective	Negligible
R8	Residential - Fringford Road, Old School Close	Imperceptible	Well Below Objective	Negligible
R9	Residential - Fringford Road, Bricknells Farm	Imperceptible	Well Below Objective	Negligible
R10	Residential - A4421	Imperceptible	Well Below Objective	Negligible
R11	Residential - A4421, Harmon Close	Imperceptible	Well Below Objective	Negligible
R12	Residential - Pine Close	Imperceptible	Well Below Objective	Negligible
R13	Residential - Juniper Gardens	Imperceptible	Well Below Objective	Negligible
R14	Residential - Mullein Road	Imperceptible	Well Below Objective	Negligible
R15	Residential - Trefoil Drive	Imperceptible	Well Below Objective	Negligible
R16	Residential - Goldsmith Close	Imperceptible	Well Below Objective	Negligible
R17	Residential - Chaucer Close	Imperceptible	Well Below Objective	Negligible
R18	Kings Meadow School	Imperceptible	Well Below Objective	Negligible
R19	Residential - Wensum Crescent	Imperceptible	Well Below Objective	Negligible
R20	Residential - Isis Avenue	Imperceptible	Well Below Objective	Negligible
R21	Residential - Shannon Road	Imperceptible	Well Below Objective	Negligible
R22	Residential - St Marys Close	Imperceptible	Well Below Objective	Negligible
R23	Bicester Community Hospital	Imperceptible	Well Below Objective	Negligible
R24	Brookside Primary School	Imperceptible	Well Below Objective	Negligible
R25	Residential - North Street	Imperceptible	Well Below	Negligible

			Objective	
R26	Residential - Manor Farm	Imperceptible	Well Below Objective	Negligible
R27	Residential - Bucknell Road	Imperceptible	Well Below Objective	Negligible
R28	Residential - Queens Crescent	Imperceptible	Well Below Objective	Negligible
R29	Residential - Kings End	Imperceptible	Well Below Objective	Negligible
R30	Residential - Kestrel Way	Imperceptible	Well Below Objective	Negligible
R31	Residential - Shearwater Drive	Imperceptible	Well Below Objective	Negligible
R32	Residential - Sunderland Drive	Imperceptible	Well Below Objective	Negligible
R33	Residential - Derwent Road	Imperceptible	Well Below Objective	Negligible

8.7.2.8 As indicated in Table 8-30, predicted impacts on annual mean PM_{10} concentrations as a result of the Development were predicted to be negligible at all receptor locations.

Overall Impact Significance

8.7.2.9 The overall significance of operational phase emission impacts on human receptors was determined as negligible. This was based on the most significant predicted impact at discrete receptor locations and the considerations outlined previously. Further justification is provided in Table 8-31.

Table 8-31 Overall Operational Phase Emission Impact Significance - Human Receptors

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Air quality impacts were predicted to be negligible at all receptor locations. These represent worst-case locations and therefore it is unlikely that any other sensitive receptors would be significantly affected by the proposed Development
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	The Development includes the provision of residential units. As shown in Drawing 8-6 and 8-9, pollutant concentrations at these locations are predicted to be below the relevant AQOs during the operational phase. As such, new receptors will not be introduced to poor air quality
The magnitude of changes and the descriptions of the impacts at the receptors	A small increase in annual mean NO_2 concentrations was predicted at six receptors. However, these were considered to be of negligible significance due to the magnitude of predicted

	concentrations at the relevant locations An imperceptible increase in annual mean PM_{10} concentrations was predicted at all receptor locations. As such, the resultant impact significance was negligible
Whether or not an exceedence of an objective or limit value is predicted to arise in the study area where none existed before or an exceedence area is substantially increased	There were no predicted exceedences of the annual mean AQOs for NO_2 or PM_{10} at any receptor location either with or without the Development
Whether or not the study area exceeds an objective or limit value and this exceedence is removed or the exceedence area is reduced	There were no predicted exceedences of the annual mean AQOs for NO_2 or PM_{10} at any receptor location either with or without the Development
The extent to which an objective or limit value is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3	There were no predicted exceedences of the annual mean AQOs for NO_2 or PM_{10} at any receptor location either with or without the Development

8.7.2.10 As the assessment of potential impacts resulting from operational phase emissions has been undertaken using dispersion modelling, adopted worst-case assumptions and was in accordance with the EPUK guidance document (Ref: 8-10), confidence in this prediction is high.

8.7.3 Ecological Receptors

Oxides of Nitrogen

8.7.3.1 Annual mean NO_x concentrations were predicted at the ecological receptors for each scenario and are summarised in Table 8-32. Exceedences of the critical level are shown in **bold** text. It should be noted that the do-something results include the NO_x contribution from both road traffic and Energy Centre emissions.

Table 8-32 Predicted Annual Mean NO_x Concentrations - Operational Phase

Receptor		Predicted 3031 Annual Mean NO_x Concentration (µg/m^3)			Predicted Change as a Proportion of Critical Level (%)
		Do-Min	Do-Some	Change	
ER1	Ardley Cutting and Quarry SSSI	**30.52**	**30.72**	0.19	0.64
ER2	Ardley Cutting and Quarry SSSI	**39.98**	**40.19**	0.21	0.71
ER3	Ardley Cutting and Quarry SSSI	19.97	20.39	0.42	1.41
ER4	Ardley Cutting and Quarry SSSI	19.98	20.54	0.56	1.88
ER5	Bure Park LNR	19.36	20.14	0.79	2.62

8.7.3.2 As indicated in Table 8-32, NO_x concentrations were predicted to exceed the critical level at receptors ER1 and ER2 in both scenarios. This is as a result of the high pollutant levels at these locations due to the proximity of the M40.

8.7.3.3 Predicted impacts on annual mean NO_x concentrations at the ecological receptors are summarised in Table 8-33.

Table 8-33 Predicted Annual Mean NO_x Impacts - Operational Phase

Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
ER1	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER2	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER3	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER4	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER5	Bure Park LNR	Small	Low	Negligible

8.7.3.4 As indicated in Table 8-33, the significance of impacts as a result of the Development was predicted to be negligible at three receptors and slight adverse at two locations. It should be noted that the relevant critical level was not predicted to be exceeded at the two locations where slight adverse impacts were predicted. Additionally, the Highways Agency's Design Manual for Roads and Bridges (DMRB) guidance (Ref 8-16) indicates that increases in annual mean NO_x concentrations at ecological designations of less than 2µg/m^3 are not considered significant and can be screened out of an assessment. As such, the predicted impacts are considered acceptable in the context of the Development.

Nitrogen Deposition

8.7.3.5 Annual nitrogen deposition rates were predicted at the ecological receptors for each scenario and are summarised in Table 8-34. It should be noted that the do-something results include the nitrogen deposition contribution from both road traffic and Energy Centre emissions.

Table 8-34 Predicted Annual Nitrogen Deposition Rates - Operational Phase

Receptor		Predicted 2031 Annual Nitrogen Deposition (kgN/ha/yr)			Predicted Change as a Proportion of Critical Load (%)	
		Do-Min	Do-Some	Change	Minimum Critical Load	Maximum Critical Load
ER1	Ardley Cutting and Quarry SSSI	27.42	27.45	0.022	0.15	0.09
ER2	Ardley Cutting and Quarry SSSI	28.62	28.64	0.025	0.17	0.10
ER3	Ardley Cutting and Quarry SSSI	24.82	24.85	0.037	0.25	0.15

ER4	Ardley Cutting and Quarry SSSI	24.82	24.87	0.048	0.32	0.19
ER5	Bure Park LNR	24.97	25.08	0.124	1.14	0.62

8.7.3.6 As indicated in Table 8-34, nitrogen deposition rates were predicted to exceed the critical levels at receptors ER1, ER2 and ER5 in both scenarios. This is due to the high baseline deposition rates at these locations, which is indicative of much of the UK.

8.7.3.7 Predicted impacts on nitrogen deposition rates at the ecological receptors are summarised in Table 8-35.

Table 8-35 Predicted Annual Nitrogen Deposition Impacts - Operational Phase

Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
ER1	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER2	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER3	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER4	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER5	Bure Park LNR	Small	Low	Negligible

8.7.3.8 As indicated in Table 8-33, the significance of impacts on annual nitrogen deposition as a result of the Development was predicted to be negligible at all ecological receptors.

8.8 Cumulative Impacts

8.8.1 Construction Impacts

8.8.1.1 The Bicester Eco Development is split into four phases: Exemplar Site, Application One (North of Railway Line), Application Two (South of Railway Line) and Application Thee (Infrastructure). Should the construction phase programmes overlap then there is the potential for increases in dust impacts at sensitive locations in the vicinity of the site. However, these may only occur if significant dust generating activities are undertaken within 350m of each other. Given the size of the Site it is not anticipated these conditions will occur on a regular basis. Additionally, suitable mitigation for each development phase will be implemented to control emissions at source. As such, the cumulative air quality impacts associated with fugitive dust emissions during construction are considered to be of neutral significance.

8.8.2 Permanent Operational Impacts

8.8.2.1 Additional vehicle movements associated with the operation of other committed and proposed developments will generate exhaust emissions on the local and regional road networks. Additionally, atmospheric emissions from the Energy

Centres associated with both Application One and Application Two may cause air quality impacts in the vicinity of the Site. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations as a result of cumulative atmospheric emissions.

8.8.2.2 The assessment considered the following scenarios:

- Do-minimum; and,
- Cumulative.

8.8.2.3 The "do-minimum" (i.e. without Development) scenario was representative of baseline traffic data for 2031. The "do-something" scenario was representative of baseline traffic data for 2031 in addition to anticipated variations in traffic flows as a result of the proposed Development and other committed developments, as well as emissions from the two Energy Centres.

8.8.2.4 Potential impacts are predicted for human and ecological receptors in the following sections.

Human Receptors

Nitrogen Dioxide

8.8.2.5 Annual mean NO_2 concentrations were predicted for each scenario and are summarised in Table 8-36. Reference should be made to Drawing 8-7 for a graphical representation of predicted NO_2 concentrations.

Table 8-36 Predicted Cumulative Annual Mean NO_2 Concentrations - Operational Phase

Receptor		Predicted 2031 Annual Mean NO_2 Concentration ($\mu g/m^3$)			Predicted Change as a Proportion of the AQO (%)
		Do-Min	Cumulative	Change	
R1	Residential - Ardley Road, Bucknell	15.23	15.50	0.27	0.68
R2	Residential - Bicester Road, Bucknell	15.25	16.13	0.88	2.20
R3	Residential - Middleton Road, Bucknell	15.05	15.57	0.52	1.30
R4	Residential - Swallofield Farm	17.92	18.62	0.69	1.73
R5	Residential - Lovelynch House	16.33	16.89	0.56	1.40
R6	Residential - A4095, Chesterton	17.98	18.26	0.28	0.71
R7	Residential - B4100, Watergate Lodge	17.14	17.36	0.21	0.53
R8	Residential - Fringford Road, Old School Close	14.39	14.81	0.42	1.06
R9	Residential - Fringford Road, Bricknells Farm	14.62	15.22	0.59	1.49

R10	Residential - A4421	17.16	17.53	0.37	0.93
R11	Residential - A4421, Harmon Close	15.86	16.24	0.38	0.95
R12	Residential - Pine Close	18.45	19.16	0.71	1.78
R13	Residential - Juniper Gardens	20.66	21.68	1.02	2.55
R14	Residential - Mullein Road	17.25	18.27	1.02	2.55
R15	Residential - Trefoil Drive	16.55	17.94	1.39	3.48
R16	Residential - Goldsmith Close	17.49	18.80	1.31	3.28
R17	Residential - Chaucer Close	17.26	19.29	2.04	5.09
R18	Kings Meadow School	14.42	15.49	1.07	2.68
R19	Residential - Wensum Crescent	18.04	18.44	0.40	1.01
R20	Residential - Isis Avenue	19.08	19.14	0.05	0.13
R21	Residential -Shannon Road	15.55	16.17	0.61	1.53
R22	Residential - St Marys Close	16.67	16.99	0.32	0.80
R23	Bicester Community Hospital	24.89	25.72	0.83	2.09
R24	Brookside Primary School	14.90	15.21	0.31	0.78
R25	Residential - North Street	30.47	31.97	1.50	3.74
R26	Residential - Manor Farm	16.31	16.40	0.09	0.23
R27	Residential - Bucknell Road	23.13	24.03	0.90	2.24
R28	Residential - Queens Crescent	22.45	23.15	0.70	1.75
R29	Residential - Kings End	22.59	23.28	0.69	1.74
R30	Residential - Kestrel Way	22.72	23.22	0.49	1.23
R31	Residential - Shearwater Drive	16.17	16.38	0.20	0.51
R32	Residential - Sunderland Drive	16.78	17.06	0.28	0.70
R33	Residential - Derwent Road	16.44	18.15	1.71	4.27

8.8.2.6 As indicated in Table 8-36, predicted NO_2 concentrations were below the AQO at all receptors in both scenarios considered.

8.8.2.7 Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 8-37. These were calculated based on the criteria shown in Table 8-13 and Table 8-14.

Table 8-37 Predicted Cumulative Annual Mean NO_2 Impacts - Operational Phase

Receptor		Magnitude of Change	Predicted Concentration	Significance of Impact
R1	Residential - Ardley Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R2	Residential - Bicester Road,	Small	Well Below	Negligible

	Bucknell		Objective	
R3	Residential - Middleton Road, Bucknell	Small	Well Below Objective	Negligible
R4	Residential - Swallofield Farm	Small	Well Below Objective	Negligible
R5	Residential - Lovelynch House	Small	Well Below Objective	Negligible
R6	Residential - A4095, Chesterton	Imperceptible	Well Below Objective	Negligible
R7	Residential - B4100, Watergate Lodge	Imperceptible	Well Below Objective	Negligible
R8	Residential - Fringford Road, Old School Close	Small	Well Below Objective	Negligible
R9	Residential - Fringford Road, Bricknells Farm	Small	Well Below Objective	Negligible
R10	Residential - A4421	Imperceptible	Well Below Objective	Negligible
R11	Residential - A4421, Harmon Close	Imperceptible	Well Below Objective	Negligible
R12	Residential - Pine Close	Small	Well Below Objective	Negligible
R13	Residential - Juniper Gardens	Small	Well Below Objective	Negligible
R14	Residential - Mullein Road	Small	Well Below Objective	Negligible
R15	Residential - Trefoil Drive	Small	Well Below Objective	Negligible
R16	Residential - Goldsmith Close	Small	Well Below Objective	Negligible
R17	Residential - Chaucer Close	Medium	Well Below Objective	Negligible
R18	Kings Meadow School	Small	Well Below Objective	Negligible
R19	Residential - Wensum Crescent	Small	Well Below Objective	Negligible
R20	Residential - Isis Avenue	Imperceptible	Well Below Objective	Negligible
R21	Residential -Shannon Road	Small	Well Below Objective	Negligible
R22	Residential - St Marys Close	Imperceptible	Well Below Objective	Negligible
R23	Bicester Community Hospital	Small	Well Below Objective	Negligible

R24	Brookside Primary School	Imperceptible	Well Below Objective	Negligible
R25	Residential - North Street	Small	Below Objective	Negligible
R26	Residential - Manor Farm	Imperceptible	Well Below Objective	Negligible
R27	Residential - Bucknell Road	Small	Well Below Objective	Negligible
R28	Residential - Queens Crescent	Small	Well Below Objective	Negligible
R29	Residential - Kings End	Small	Well Below Objective	Negligible
R30	Residential - Kestrel Way	Small	Well Below Objective	Negligible
R31	Residential - Shearwater Drive	Imperceptible	Well Below Objective	Negligible
R32	Residential - Sunderland Drive	Imperceptible	Well Below Objective	Negligible
R33	Residential - Derwent Road	Small	Well Below Objective	Negligible

8.8.2.8 As indicated in Table 8-37, the significance of impacts as a result of the Development was predicted to be negligible at all receptor locations. It is noted that the same impact significance was predicted when only the proposed Development was assessed.

Particulate Matter

8.8.2.9 Annual mean PM_{10} concentrations were predicted for each scenario and are summarised in Table 8-38. Reference should be made to Drawing 8-10 for a graphical representation of predicted PM_{10} concentrations.

Table 8-38 Predicted Cumulative Annual Mean PM_{10} Concentrations - Operational Phase

Receptor		Predicted 2031 Annual Mean PM_{10} Concentration ($\mu g/m^3$)			Predicted Change as a Proportion of the AQO (%)
		Do-Min	Cumulative	Change	
R1	Residential - Ardley Road, Bucknell	16.70	16.76	0.06	0.15
R2	Residential - Bicester Road, Bucknell	16.67	16.80	0.12	0.31
R3	Residential - Middleton Road, Bucknell	16.61	16.82	0.21	0.51
R4	Residential - Swallofield Farm	17.13	17.41	0.28	0.70
R5	Residential - Lovelynch House	16.95	17.09	0.15	0.37

R6	Residential - A4095, Chesterton	17.36	17.44	0.08	0.20
R7	Residential - B4100, Watergate Lodge	17.18	17.24	0.05	0.13
R8	Residential - Fringford Road, Old School Close	16.53	16.54	0.01	0.04
R9	Residential - Fringford Road, Bricknells Farm	16.55	16.57	0.02	0.04
R10	Residential - A4421	17.23	17.29	0.06	0.15
R11	Residential - A4421, Harmon Close	16.89	16.93	0.04	0.10
R12	Residential - Pine Close	17.05	17.15	0.10	0.26
R13	Residential - Juniper Gardens	17.29	17.36	0.06	0.16
R14	Residential - Mullein Road	16.89	16.94	0.05	0.12
R15	Residential - Trefoil Drive	16.96	16.86	-0.09	-0.23
R16	Residential - Goldsmith Close	16.93	16.88	-0.05	-0.13
R17	Residential - Chaucer Close	17.18	17.08	-0.10	-0.26
R18	Kings Meadow School	16.50	16.52	0.02	0.05
R19	Residential - Wensum Crescent	17.44	17.27	-0.17	-0.42
R20	Residential - Isis Avenue	17.20	17.16	-0.04	-0.09
R21	Residential -Shannon Road	16.68	16.76	0.09	0.21
R22	Residential - St Marys Close	17.03	17.11	0.08	0.20
R23	Bicester Community Hospital	17.89	18.05	0.15	0.38
R24	Brookside Primary School	16.55	16.58	0.04	0.09
R25	Residential - North Street	18.25	18.48	0.23	0.58
R26	Residential - Manor farm	16.71	16.72	0.01	0.03
R27	Residential - Bucknell Road	17.53	17.68	0.15	0.37
R28	Residential - Queens Crescent	17.59	17.71	0.12	0.31
R29	Residential - Kings End	17.59	17.72	0.13	0.31
R30	Residential - Kestrel Way	17.66	17.77	0.11	0.27
R31	Residential - Shearwater Drive	16.99	17.06	0.07	0.18
R32	Residential - Sunderland Drive	17.05	17.09	0.04	0.09
R33	Residential - Derwent Road	17.03	16.93	-0.10	-0.25

8.8.2.10 As indicated in Table 8-38, predicted PM_{10} concentrations were below the relevant AQO at all receptor locations for both scenarios considered.

8.8.2.11 Predicted impacts on annual mean PM_{10} concentrations at the sensitive receptor locations are summarised in Table 8-39. These were calculated based on the criteria shown in Table 8-13 and Table 8-14.

Table 8-39 Predicted Cumulative Annual Mean PM_{10} Concentrations - Operational Phase

Receptor		Magnitude of Change	Predicted Concentration	Significance of Impact
R1	Residential - Ardley Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R2	Residential - Bicester Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R3	Residential - Middleton Road, Bucknell	Imperceptible	Well Below Objective	Negligible
R4	Residential - Swallofield Farm	Imperceptible	Well Below Objective	Negligible
R5	Residential - Lovelynch House	Imperceptible	Well Below Objective	Negligible
R6	Residential - A4095, Chesterton	Imperceptible	Well Below Objective	Negligible
R7	Residential - B4100, Watergate Lodge	Imperceptible	Well Below Objective	Negligible
R8	Residential - Fringford Road, Old School Close	Imperceptible	Well Below Objective	Negligible
R9	Residential - Fringford Road, Bricknells Farm	Imperceptible	Well Below Objective	Negligible
R10	Residential - A4421	Imperceptible	Well Below Objective	Negligible
R11	Residential - A4421, Harmon Close	Imperceptible	Well Below Objective	Negligible
R12	Residential - Pine Close	Imperceptible	Well Below Objective	Negligible
R13	Residential - Juniper Gardens	Imperceptible	Well Below Objective	Negligible
R14	Residential - Mullein Road	Imperceptible	Well Below Objective	Negligible
R15	Residential - Trefoil Drive	Imperceptible	Well Below Objective	Negligible
R16	Residential - Goldsmith Close	Imperceptible	Well Below Objective	Negligible
R17	Residential - Chaucer Close	Imperceptible	Well Below Objective	Negligible
R18	Kings Meadow School	Imperceptible	Well Below Objective	Negligible
R19	Residential - Wensum Crescent	Imperceptible	Well Below Objective	Negligible
R20	Residential - Isis Avenue	Imperceptible	Well Below Objective	Negligible

R21	Residential - Shannon Road	Imperceptible	Well Below Objective	Negligible
R22	Residential - St Marys Close	Imperceptible	Well Below Objective	Negligible
R23	Bicester Community Hospital	Imperceptible	Well Below Objective	Negligible
R24	Brookside Primary School	Imperceptible	Well Below Objective	Negligible
R25	Residential - North Street	Imperceptible	Well Below Objective	Negligible
R26	Residential - Manor Farm	Imperceptible	Well Below Objective	Negligible
R27	Residential - Bucknell Road	Imperceptible	Well Below Objective	Negligible
R28	Residential - Queens Crescent	Imperceptible	Well Below Objective	Negligible
R29	Residential - Kings End	Imperceptible	Well Below Objective	Negligible
R30	Residential - Kestrel Way	Imperceptible	Well Below Objective	Negligible
R31	Residential - Shearwater Drive	Imperceptible	Well Below Objective	Negligible
R32	Residential - Sunderland Drive	Imperceptible	Well Below Objective	Negligible
R33	Residential - Derwent Road	Imperceptible	Well Below Objective	Negligible

8.8.2.12 As indicated in Table 8-39, predicted impacts on annual mean PM_{10} concentrations as a result of the Development were predicted to be negligible at all receptor locations.

Overall Impact Significance

8.8.2.13 The overall significance of cumulative operational phase emission impacts on human receptors was determined as negligible. This was based on the most significant predicted impact at discrete receptor locations and the considerations outlined previously within Table 8-31.

Ecological Receptors

Oxides of Nitrogen

8.8.2.14 Annual mean NO_x concentrations were predicted at the ecological receptors for each scenario and are summarised in Table 8-40. Exceedences of the critical level are shown in **bold** text.

Table 8-40 Predicted Cumulative Annual Mean NO_x Concentrations - Operational Phase

Receptor		Predicted 2031 Annual Mean NO_x Concentration ($\mu g/m^3$)			Predicted Change as a Proportion of Critical Level (%)
		Do-Min	Cumulative	Change	
ER1	Ardley Cutting and Quarry SSSI	**30.52**	**30.99**	0.47	1.55
ER2	Ardley Cutting and Quarry SSSI	**39.98**	**40.50**	0.52	1.72
ER3	Ardley Cutting and Quarry SSSI	19.97	20.99	1.02	3.40
ER4	Ardley Cutting and Quarry SSSI	19.98	21.35	1.37	4.56
ER5	Bure Park LNR	19.36	20.23	0.88	2.93

8.8.2.15 As indicated in Table 8-40, NO_x concentrations were predicted to exceed the critical level at sensitive locations ER1 and ER2 in both scenarios. This is as a result of the high pollutant levels at these locations due to the proximity of the M40.

8.8.2.16 Predicted impacts on annual mean NO_x concentrations at the ecological receptors are summarised in Table 8-41.

Table 8-41 Predicted Cumulative Annual Mean NO_x Impacts - Operational Phase

Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
ER1	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER2	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER3	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER4	Ardley Cutting and Quarry SSSI	Small	High	Slight
ER5	Bure Park LNR	Small	Low	Negligible

8.8.2.17 As indicated in Table 8-41, the significance of impacts as a result of the Development was predicted to be negligible at one receptor and slight adverse at four locations. It should be noted that the relevant critical level was not predicted to be exceeded at the three locations where slight adverse impacts were predicted. Additionally, changes of this magnitude would not be considered significant in accordance with the Highways Agency DMRB guidance, as outlined previously. As such, they are considered acceptable in the context of the Development.

Nitrogen Deposition

8.8.2.18 Annual nitrogen deposition rates were predicted at the ecological receptors for each scenario and are summarised in Table 8-42.

Table 8-42 Predicted Cumulative Annual Nitrogen Deposition Rates - Operational Phase

Receptor		Predicted 2031 Annual Nitrogen Deposition (kgN/ha/yr)			Predicted Change as a Proportion of Critical Load (%)	
		Do-Min	Cumulative	Change	Minimum Critical Load	Maximum Critical Load
ER1	Ardley Cutting and Quarry SSSI	27.42	27.48	0.053	0.36	0.21
ER2	Ardley Cutting and Quarry SSSI	28.62	28.67	0.057	0.38	0.23
ER3	Ardley Cutting and Quarry SSSI	24.82	24.90	0.085	0.57	0.34
ER4	Ardley Cutting and Quarry SSSI	24.82	24.93	0.113	0.75	0.45
ER5	Bure Park LNR	24.97	25.12	0.153	1.53	0.77

8.8.2.19 As indicated in Table 8-42, nitrogen deposition rates were predicted to exceed the critical levels at receptors ER1, ER2 and ER5 in both scenarios. This is due to the high baseline deposition rates at these locations, which is indicative of much of the UK.

8.8.2.20 Predicted impacts on nitrogen deposition rates at the ecological receptors are summarised in Table 8-43.

Table 8-43 Predicted Cumulative Annual Nitrogen Deposition Impacts - Operational Phase

Receptor		Magnitude of Change	Receptor Sensitivity	Significance of Impact
ER1	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER2	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER3	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER4	Ardley Cutting and Quarry SSSI	Imperceptible	High	Negligible
ER5	Bure Park LNR	Small	Low	Negligible

8.8.2.21 As indicated in Table 8-33, the significance of impacts on annual nitrogen deposition as a result of the Development was predicted to be negligible at all ecological receptors.

8.9 Summary

8.9.1.1 An Air Quality EIA has been undertaken for the proposed Development. Baseline air quality conditions were determined and potential impacts associated with atmospheric emissions during the construction and operational phases assessed.

8.9.1.2 An assessment of potential impacts associated with fugitive dust emissions during the construction phase was undertaken in accordance with the IAQM methodology. This indicated that although there was a risk of dust generation during certain activities, suitable mitigation measures would control emissions, resulting in impacts of neutral significance.

8.9.1.3 Potential impacts associated with NO_2 and PM_{10} emissions from road traffic exhaust emissions and NO_x emissions from the Energy Centre during the operational phase were assessed using dispersion modelling and the EPUK guidance. This indicated that negligible impacts were predicted on annual mean NO_2 and PM_{10} concentrations at all human receptor locations.

8.9.1.4 Potential impacts on annual mean NO_x concentrations were predicted to be slight adverse at two ecological receptors within the vicinity of the site. It should be noted that the relevant critical level was not predicted to be exceeded at these locations and changes of the predicted magnitude would not be considered significance in accordance with Highways Agency guidance. As such, they are considered acceptable in the context of the Development. Impacts on annual nitrogen deposition were predicted to be negligible at all ecological designations.

8.9.1.5 Potential cumulative impacts associated with other committed and proposed developments in the vicinity of the Site were also assessed.

8.9.1.6 Although the construction phases of a number of developments may overlap, it is considered the implementation of suitable mitigation options should control impacts to an acceptable level. As such, As such, the cumulative air quality impacts associated with fugitive dust emissions during construction are considered to be of neutral significance.

8.9.1.7 Potential cumulative impacts associated with NO_2 and PM_{10} emissions from road traffic exhaust emissions and NO_x emissions from the Energy Centres were assessed. This indicated impacts were similar to those predicted when only the Development was assessed. As such, it is considered cumulative impacts would not be any greater to those associated with the current proposals.

Table 8-44 Air Quality Impact Significance Rating Summary

Impact description	Mitigation	Temporary/ Permanent	Residual Significance rating
Soiling as a result of dust emissions during the construction phase	As outlined in Table 8-25	Temporary	Neutral
Human health impacts as a result of dust emissions during the construction phase	As outlined in Table 8-25	Temporary	Neutral
Ecological impacts as a	As outlined in Table 8-	Temporary	Neutral

result of dust emissions during the construction phase	25		
Operational road traffic and Energy Centre emissions impacts on annual mean NO_2 concentrations at human receptors	As outlined in Section 8.5.2	Permanent	Negligible
Operational road traffic and Energy Centre emissions impacts on annual mean PM_{10} concentrations at human receptors	As outlined in Section 8.5.2	Permanent	Negligible
Operational road traffic and Energy Centre emissions impacts on annual mean NO_x concentrations at ecological receptors	As outlined in Section 8.5.2	Permanent	Slight Adverse
Operational road traffic and Energy Centre emissions impacts on annual nitrogen deposition at ecological receptors	As outlined in Section 8.5.2	Permanent	Negligible

Glossary and Abbreviations

APIS	Air Pollution Information System
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
CDC	Cherwell District Council
CHP	Combined Heat and Power
DEFRA	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
EPUK	Environmental Protection UK
DMRB	Design Manual for Roads and Bridges
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LNR	Local Nature Reserve
NGR	National Grid Reference
NNR	National Nature Reserve
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_x	Total oxides of nitrogen
NPPF	National Planning Policy Framework
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
SAC	Special Area of Conservation
SSSI	Site of Special Scientific Interest
z_0	Roughness length

References

Ref 8-1 The Air Quality (England) Regulations, 2000

Ref 8-2 The Air Quality (England) (Amendment) Regulations, 2002

Ref 8-3 The Air Quality Standards Regulations, 2010

Ref 8-4 The Environment Act, 1995

Ref 8-5 National Planning Policy Framework, Department for Communities and Local Government, 2012

Ref 8-6 Environmental Protection Act, 1990

Ref 8-7 Environmental Permitting (England and Wales) Regulations, 2010

Ref 8-8 The Cherwell Local Plan, Cherwell District Council, 2014

Ref 8-9 Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2014

Ref 8-10 Development Control: Planning for Air Quality (2010 update), Environmental Protection UK, 2010

Ref 8-11 Interim Advice Note 170/12v3, Highways Agency, 2013

Ref 8-12 Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009

Ref 8-13 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007

Ref 8-14 Air Quality Progress Report, Cherwell District Council, 2014

Ref 8-15 http://laqm.defra.gov.uk/maps/maps2011.html

Ref 8-16 Design Manual for Roads and Bridges Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007

List of Appendices

APPENDIX 8A

Dispersion Modelling Inputs

Appendix 8A - Dispersion Modelling Inputs

Road Traffic Assessment Inputs

Additional vehicle trips associated with the development have the potential to result in air quality impacts as a result of increased traffic exhaust emissions. Dispersion modelling using ADMS Roads was therefore undertaken to predict pollutant concentrations at sensitive locations both with and without the development in order to consider potential changes as a result of the proposals.

The dispersion model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length; and,
- Monin-Obukhov length.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using the ADMS Roads dispersion model (version 3.2). ADMS Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

Assessment Area

Ambient concentrations were predicted over the area NGR: 454500, 221000 to 460500, 226500. A Cartesian grid with a height of 1.5m, to represent exposure at ground level, was used within the model to produce data suitable for contour plotting using the Surfer software package.

Reference should be made to Figure 8-12 for a graphical representation of the assessment extents.

Traffic Flow Data

Traffic data for use in the assessment was provided by Hyder Consulting (UK) Ltd, the Transport Consultants for the development. This included the following scenarios:

- 2012 Baseline;
- 2031 Do Minimum (DM) - anticipated traffic flows without the Development;

- 2031 Do Something (DS) - anticipated traffic flows including predicted variations as a result of the Development; and,
- 2031 Cumulative - anticipated traffic flows including predicted variations as a result of the Development and other committed and proposed developments.

Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Road widths were estimated from aerial photography and UK highway design standards.

A summary of the baseline traffic data used in the assessment is provided in Table 8A-1.

Table 8A-1 Baseline Traffic Data

Road Link		Road Width (m)	24-hour AADT Flow	HDV Prop. (%)	Mean Speed (km/h)
1	A41 Northbound, N of M40 J9	7.3	13,446	6.8	90
2	A41 Southbound, N of M40 J9	8.0	11,511	6.8	90
3A1	A41 Oxford Road Northbound, S of A41 Junction	7.8	12,565	6.8	60
3A2	A41 Oxford Road Northbound, A41 Junction	10.4	12,565	6.8	20
3B1	A41 Oxford Road Southbound, S of A41 Junction	7.6	12,565	6.8	60
3B2	A41 Oxford Road Southbound, A41 Junction	9.9	12,565	6.8	20
4A	Vendee Drive	5.0	2,995	6.8	40
4B	Vendee Drive Junction at A41	5.0	2,995	6.8	10
4C	Vendee Drive Junction at A4095	5.0	2,995	6.8	10
5A	A41 Northbound between Pringle Drive and Middleton Stoney Road	7.9	7,894	6.8	20
5B	A41 Southbound between Pringle Drive and Middleton Stoney Road	7.3	7,894	6.8	20
5C	A41 Junction from Pringle Drive Roundabout Northbound	8.0	7,894	6.8	10
5D	A41 Junction from Pringle Drive Roundabout Southbound	9.1	7,894	6.8	10
5E	A41 between Pringle Drive and Middleton Stoney Road	8.8	15,789	6.8	30
5F	A41 between Pringle Drive and Middleton Stoney Road Junction	10.3	15,789	6.8	10
6A	Middleton Stoney Road, W of Kings End	9.5	9,033	6.8	80
6B	Middleton Stoney Road, W of Kings End Junction	9.6	9,033	6.8	20
7	Middleton Stoney Road, W of Howes Lane	7.0	6,024	6.8	80
8A	Howes Lane	7.0	7,949	6.8	80

8B	Howes Lane Junction at Middleton Stoney Road	11.9	7,949	6.8	20
8C	Howes Lane Junction at Bucknell Road	14.8	7,949	6.8	20
9A	Lords Lane	10.2	11,555	6.8	80
9B	Lords Lane Junction at Bucknell Road	13.8	11,555	6.8	20
9C	Lords Lane Junction at Banbury Road	12.9	11,555	6.8	20
10A	Bucknell Road, N of Lords Lane	5.5	2,184	6.8	90
10B	Bucknell Road, N of Lords Lane Junction	17.1	2,184	6.8	20
11A	Bucknell Road, S of Howes Lane	10.7	6,830	6.8	30
11B	Bucknell Road, S of Howes Lane Junction at Lords Lane	12.1	6,830	6.8	10
11C	Bucknell Road, S of Howes Lane Junction at Queens Road	9.6	6,830	6.8	10
12A	Banbury Road, N of Lords Lane	5.8	11,456	6.8	80
12B	Banbury Road, N of Lords Lane Junction	15.3	11,456	6.8	20
13A	A4095 E of Banbury Road between B4100 and Buckingham Road	8.9	18,758	6.8	80
13B	A4095 E of Banbury Road Junction at B4100	15.3	18,758	6.8	20
13C	A4095 E of Banbury Road Junction W of Buckingham Road	18.7	18,758	6.8	20
13D	A4095 E of Banbury Road between Buckingham Road and Lauton Road	8.7	18,758	6.8	80
13E	A4095 E of Banbury Road Junction E of Buckingham Road	14.1	18,758	6.8	20
13F	A4095 E of Banbury Road Junction W of Lauton Road	12.1	18,758	6.8	20
13G	A4095 E of Banbury Road between Lauton Road and Charbridge Lane	6.8	18,758	6.8	50
13H	A4095 E of Banbury Road Junction E of Lauton Road	9.6	18,758	6.8	20
13I	A4095 E of Banbury Road Junction at Charbridge Lane	7.9	18,758	6.8	20
14A	Banbury Road, S of A4095	7.6	5,427	6.8	60
14B	Banbury Road, S of A4095 Junction at A4095	13.8	5,427	6.8	20
14C	Banbury Road, S of A4095 Junction at Queens Road	11.6	5,427	6.8	20
15A	Buckingham Road, S of Skimmingdish Lane	8.4	7,755	6.8	60
15B	Buckingham Road Junction at Skimmingdish	15.6	7,755	6.8	20

	Lane				
15C	Buckingham Road Junction at Queens Road	8.5	7,755	6.8	20
16A	Queens Road	7.8	12,381	6.8	20
16B	Queens Road Junction at B4100	11.8	12,381	6.8	10
16C	Queens Road Junction at B4030	11.7	12,381	6.8	10
17A	A41 E of A41 Oxford Road	9.3	21,857	6.8	90
17B	A41 E of A41 Oxford Road Junction at Oxford Road	15.8	21,857	6.8	20
17C	A41 E of A41 Oxford Road Junction at B4100	18.9	21,857	6.8	20
18A	A4421 Nuenkirchen Way	17.8	15,077	6.8	80
18B	A4421 Nuenkirchen Way Junction at B4100	17.1	15,077	6.8	20
18C	A4421 Nuenkirchen Way Junction at Peregrine Way	20.8	15,077	6.8	20
19A	A41, E of London Road Roundabout	10.5	23,325	6.8	80
19B	A41, E of London Road Roundabout Junction	18.0	23,325	6.8	20
20A	A4421, E of Skimmingdish Lane	9.7	15,714	6.8	80
20B	A4421, E of Skimmingdish Lane Junction at Peregrine Way	15.4	15,714	6.8	20
20C	A4421, E of Skimmingdish Lane Junction at A4421	12.1	15,714	6.8	20
21A	Shakespeare Drive	7.1	1,462	6.8	30
21B	Shakespeare Drive Junction at Howes Lane	9.8	1,462	6.8	10
21C	Shakespeare Drive Junction at Middleton Stoney Road	16.1	1,462	6.8	10
22	M40 J10 Northbound off sliproad	5.7	5,377	14.5	50
23A	Ardley Road E of B430	6.7	2,000	6.8	70
23B	Ardley Road E of B430 Junction	11.1	2,000	6.8	20
24	M40 J20 Southbound on sliproad	4.5	5,034	14.5	50
25A	B430 M40 Overbridge Eastbound	7.5	10,829	6.8	30
25B	B430 M40 Overbridge Westbound	6.8	10,829	6.8	30
26A	A4095 North of Chesterton	5.9	5,745	6.8	90
26B	A4095 North of Chesterton Junction	9.1	5,745	6.8	20
27	A41 E of Pioneer Road	6.9	22,479	6.8	90
28A	Bicester Road, E of A4421	5.1	6,367	6.8	30
28B	Bicester Road, E of A4421 Junction	10.6	6,367	6.8	10

29A	A4421 N of Skimmingdish Lane	7.1	12,152	6.8	80
29B	A4421 N of Skimmingdish Lane Junction	9.8	12,152	6.8	20
30A	Fringford Road	7.8	925	6.8	60
30B	Fringford Road Junction	10.2	925	6.8	10
31	B4100 banbury Road, N of Bainton Road	7.1	11,456	6.8	80
32A	Middleton Road, W of Bucknell	3.7	194	6.8	70
32B	Middleton Road, W of Bucknell Junction	8.4	194	6.8	10
33A	Green Lane W of Chesterton	5.7	3,815	6.8	80
33B	Green Lane W of Chesterton Junction	7.6	3,815	6.8	20
34A	Wendlebury Road E of M40	6.1	2,676	6.8	50
34B	Wendlebury Road E of M40	14.7	2,676	6.8	20
35	M40 Northbound, S of J10/ N of J9	10.1	85,545	14.5	100
36	M40 Southbound, S of J10/ N of J9	10.4	76,957	14.5	100
37	M40 Northbound, N of J10	10.9	80,638	14.5	100
38	M40 Southbound, N of J10	10.3	72,188	14.5	100

The 2031 traffic data is shown in Table 8A-2.

Table 8A-2 2031 Traffic Data

Road Link		24-hour AADT Traffic Flow			HDV Prop. (%)
		DM	DS	Cumulative	
1	A41 Northbound, N of M40 J9	15,178	15,166	15,173	6.8
2	A41 Southbound, N of M40 J9	12,354	12,434	12,541	6.8
3A1	A41 Oxford Road Northbound, S of A41 Junction	20,516	21,140	22,085	6.8
3A2	A41 Oxford Road Northbound, A41 Junction	20,516	21,140	22,085	6.8
3B1	A41 Oxford Road Southbound, S of A41 Junction	20,516	21,140	22,085	6.8
3B2	A41 Oxford Road Southbound, A41 Junction	20,516	21,140	22,085	6.8
4A	Vendee Drive	8,590	9,145	9,953	6.8
4B	Vendee Drive Junction at A41	8,590	9,145	9,953	6.8
4C	Vendee Drive Junction at A4095	8,590	9,145	9,953	6.8
5A	A41 Northbound between Pringle Drive and Middleton Stoney Road	10,981	11,435	12,122	6.8

5B	A41 Southbound between Pringle Drive and Middleton Stoney Road	10,981	11,435	12,122	6.8
5C	A41 Junction from Pringle Drive Roundabout Northbound	10,981	11,435	12,122	6.8
5D	A41 Junction from Pringle Drive Roundabout Southbound	10,981	11,435	12,122	6.8
5E	A41 between Pringle Drive and Middleton Stoney Road	21,962	22,870	24,245	6.8
5F	A41 between Pringle Drive and Middleton Stoney Road Junction	21,962	22,870	24,245	6.8
6A	Middleton Stoney Road, W of Kings End	10,450	10,934	11,640	6.8
6B	Middleton Stoney Road, W of Kings End Junction	10,450	10,934	11,640	6.8
7	Middleton Stoney Road, W of Howes Lane	10,450	9,425	15,025	6.8
8A	Howes Lane	11,183	10,304	9,008	6.8
8B	Howes Lane Junction at Middleton Stoney Road	11,183	10,304	9,008	6.8
8C	Howes Lane Junction at Bucknell Road	11,183	10,304	9,008	6.8
9A	Lords Lane	13,933	12,812	11,138	6.8
9B	Lords Lane Junction at Bucknell Road	13,933	12,812	11,138	6.8
9C	Lords Lane Junction at Banbury Road	13,933	12,812	11,138	6.8
10A	Bucknell Road, N of Lords Lane	3,390	2,615	1,476	6.8
10B	Bucknell Road, N of Lords Lane Junction	3,390	2,615	1,476	6.8
11A	Bucknell Road, S of Howes Lane	7,124	7,664	8,506	6.8
11B	Bucknell Road, S of Howes Lane Junction at Lords Lane	7,124	7,664	8,506	6.8
11C	Bucknell Road, S of Howes Lane Junction at Queens Road	7,124	7,664	8,506	6.8
12A	Banbury Road, N of Lords Lane	16,122	17,356	19,148	6.8
12B	Banbury Road, N of Lords Lane Junction	16,122	17,356	19,148	6.8
13A	A4095 E of Banbury Road between B4100 and Buckingham Road	21,003	21,305	21,741	6.8
13B	A4095 E of Banbury Road Junction at B4100	21,003	21,305	21,741	6.8
13C	A4095 E of Banbury Road Junction W of Buckingham Road	21,003	21,305	21,741	6.8

13D	A4095 E of Banbury Road between Buckingham Road and Lauton Road	21,003	21,305	21,741	6.8
13E	A4095 E of Banbury Road Junction E of Buckingham Road	21,003	21,305	21,741	6.8
13F	A4095 E of Banbury Road Junction W of Lauton Road	21,003	21,305	21,741	6.8
13G	A4095 E of Banbury Road between Lauton Road and Charbridge Lane	21,003	21,305	21,741	6.8
13H	A4095 E of Banbury Road Junction E of Lauton Road	21,003	21,305	21,741	6.8
13I	A4095 E of Banbury Road Junction at Charbridge Lane	21,003	21,305	21,741	6.8
14A	Banbury Road, S of A4095	8,329	9,485	11,247	6.8
14B	Banbury Road, S of A4095 Junction at A4095	8,329	9,485	11,247	6.8
14C	Banbury Road, S of A4095 Junction at Queens Road	8,329	9,485	11,247	6.8
15A	Buckingham Road, S of Skimmingdish Lane	12,349	13,642	15,620	6.8
15B	Buckingham Road Junction at Skimmingdish Lane	12,349	13,642	15,620	6.8
15C	Buckingham Road Junction at Queens Road	12,349	13,642	15,620	6.8
16A	Queens Road	20,206	21,000	22,169	6.8
16B	Queens Road Junction at B4100	20,206	21,000	22,169	6.8
16C	Queens Road Junction at B4030	20,206	21,000	22,169	6.8
17A	A41 E of A41 Oxford Road	34,202	35,238	36,800	6.8
17B	A41 E of A41 Oxford Road Junction at Oxford Road	34,202	35,238	36,800	6.8
17C	A41 E of A41 Oxford Road Junction at B4100	34,202	35,238	36,800	6.8
18A	A4421 Nuenkirchen Way	18,631	19,355	20,437	6.8
18B	A4421 Nuenkirchen Way Junction at B4100	18,631	19,355	20,437	6.8
18C	A4421 Nuenkirchen Way Junction at Peregrine Way	18,631	19,355	20,437	6.8
19A	A41, E of London Road Roundabout	17,716	17,966	18,341	6.8
19B	A41, E of London Road Roundabout Junction	17,716	17,966	18,341	6.8
20A	A4421, E of Skimmingdish Lane	22,666	23,610	25,002	6.8

20B	A4421, E of Skimmingdish Lane Junction at Peregrine Way	22,666	23,610	25,002	6.8
20C	A4421, E of Skimmingdish Lane Junction at A4421	22,666	23,610	25,002	6.8
21A	Shakespeare Drive	1,097	1,623	2,421	6.8
21B	Shakespeare Drive Junction at Howes Lane	1,097	1,623	2,421	6.8
21C	Shakespeare Drive Junction at Middleton Stoney Road	1,097	1,623	2,421	6.8
22	M40 J10 Northbound off sliproad	6,307	7,223	8,634	14.54
23A	Ardley Road E of B430	4,408	4,691	5,141	6.8
23B	Ardley Road E of B430 Junction	4,408	4,691	5,141	6.8
24	M40 J20 Southbound on sliproad	3,960	7,223	4,088	14.5
25A	B430 M40 Overbridge Eastbound	12,189	12,410	12,728	6.8
25B	B430 M40 Overbridge Westbound	12,189	12,410	12,728	6.8
26A	A4095 North of Chesterton	10,095	10,463	11,025	6.8
26B	A4095 North of Chesterton Junction	10,095	10,463	11,025	6.8
27	A41 E of Pioneer Road	29,932	30,073	30,276	6.8
28A	Bicester Road, E of A4421	4,925	4,916	4,890	6.8
28B	Bicester Road, E of A4421 Junction	4,925	4,916	4,890	6.8
29A	A4421 N of Skimmingdish Lane	16,831	17,242	17,893	6.8
29B	A4421 N of Skimmingdish Lane Junction	16,831	17,242	17,893	6.8
30A	Fringford Road	1,412	1,432	1,461	6.8
30B	Fringford Road Junction	1,412	1,432	1,461	6.8
31	B4100 banbury Road, N of Bainton Road	14,523	14,846	15,355	6.8
32A	Middleton Road, W of Bucknell	305	1,734	3,862	6.8
32B	Middleton Road, W of Bucknell Junction	305	1,734	3,862	6.8
33A	Green Lane W of Chesterton	5,766	5,886	6,066	6.8
33B	Green Lane W of Chesterton Junction	5,766	5,886	6,066	6.8
34A	Wendlebury Road E of M40	3,464	3,580	3,778	6.8
34B	Wendlebury Road E of M40	3,464	3,580	3,778	6.8
35	M40 Northbound, S of J10/ N of J9	86,553	87,863	89,892	14.5
36	M40 Southbound, S of J10/ N of J9	72,452	72,552	72,718	14.5
37	M40 Northbound, N of J10	81,104	81,186	81,319	14.5

38	M40 Southbound, N of J10	79,050	79,130	79,251	14.5

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 6.0.1) released in July 2014, which incorporates updated COPERT4v10 vehicle emissions factors for NO_x and vehicle fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with roadside levels not reducing as previously expected due to the implementation of new vehicle emission standards. A review of the Highways Agency Interim Advice Note 170/12 (Ref 8-10) proposes that currently published future NO_x and NO_2 projections may be too pessimistic and advises a Gap Analysis Method for the prediction of future year conditions. As such, the relevant spreadsheet was utilised within information from DEFRA and model outputs to represent future year NO_2 concentrations.

A summary of the traffic emission, traffic data and background pollutant concentrations utilised for each scenario is shown in Table 8A-3.

Table 8A-3 Data Requirements for Each Assessment Scenario

Scenario	Traffic Data (Year)	Vehicle Emission (Year)	NO_2 Background Concentration ($\mu g/m^3$)	PM_{10} Background Concentration ($\mu g/m^3$)
Base Year (2013)	2013	2013	19.80 (2013)	18.15 (2013)
Projected Base Year (2031)	2013	2031	13.78 (2031)	16.80 (2031)
Do-Minimum	2031	2031	13.78 (2031)	16.80 (2031)
Do-Something	2031	2031	13.78 (2031)	16.80 (2031)

Meteorological Data

Meteorological data used in the assessment was taken from Brize Norton meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive). Brize Norton meteorological station is located at NGR: 42881, 205734 which is approximately 32km north-west of the proposed development.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 8-11 for a wind rose of utilised meteorological data.

Roughness Length

A roughness length (z_0) of 1m was used in this dispersion modelling study. This value of z_0 is considered appropriate for the morphology of the dispersion modelling assessment area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m was used in this dispersion modelling study. This value is considered appropriate for the nature of the assessment area and is suggested within ADMS-Roads as being suitable for 'mixed urban/industrial'.

Background Concentrations

An annual mean NO_2 concentration of 19.80µg/m^3, as measured at the Villiers Road diffusion tube in 2013, was used to represent background levels in the vicinity of the site during the verification process. This monitoring location is distanced from major road sources and as such is considered to provide a reasonable estimation of background pollutant concentrations for an assessment of this nature.

An annual mean PM_{10} concentration of 18.15µg/m^3, as predicted by DEFRA, was used to represent background levels in the vicinity of this site for the verification process.

Background concentration estimates for 2013 were utilised for the future year scenarios in accordance with the Highways Agency Interim Advice Note (Ref-8-9). This was calculated by factoring the measured NO_2 concentration from the Villiers Road diffusion tube to 2031 using the relationship between the predicted 2013 and 2031 background concentrations provided by DEFRA. Therefore, an annual mean NO_2 concentration of 13.78µg/m^3 and an annual mean PM_{10} concentration of 16.80µg/m^3 were used to represent background levels in the vicinity of the site during 2031.

Reference should be made to Table 8A-3 for a summary of background pollutant concentrations for each scenario.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO_2 concentrations using the spreadsheet provided by DEFRA, which is the method detailed within LAQM.TG(09).

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2013 using traffic data, meteorological data and monitoring results from this year.

CDC undertakes diffusion tube monitoring of NO_2 concentrations at five suitable locations within the modelling extents. Monitoring results for these locations were obtained from the most recent LAQM Progress Report for the purpose of this assessment. The road contribution to total NO_x concentration at the monitoring locations was calculated following the methodology contained within DEFRA guidance LAQM.TG(09). The monitored annual mean NO_2 concentrations and calculated roadside NO_x concentrations are summarised in Table 8A-4.

Table 8A-4 Monitoring Results

Location		2013 Monitored NO_2 Concentration ($\mu g/m^3$)	Calculated Roadside NO_x Concentration ($\mu g/m^3$)
3	Kings End South	48.5	66.91
4	Kings End North	35.8	34.29
5	Field Street	38.6	41.02
6	North Street	42.7	51.33
7	Queens Avenue	41.0	46.98

The dispersion model was run with the traffic input data previously detailed to predict NO_x concentrations at the monitoring locations. The results are shown in Table 8A-5.

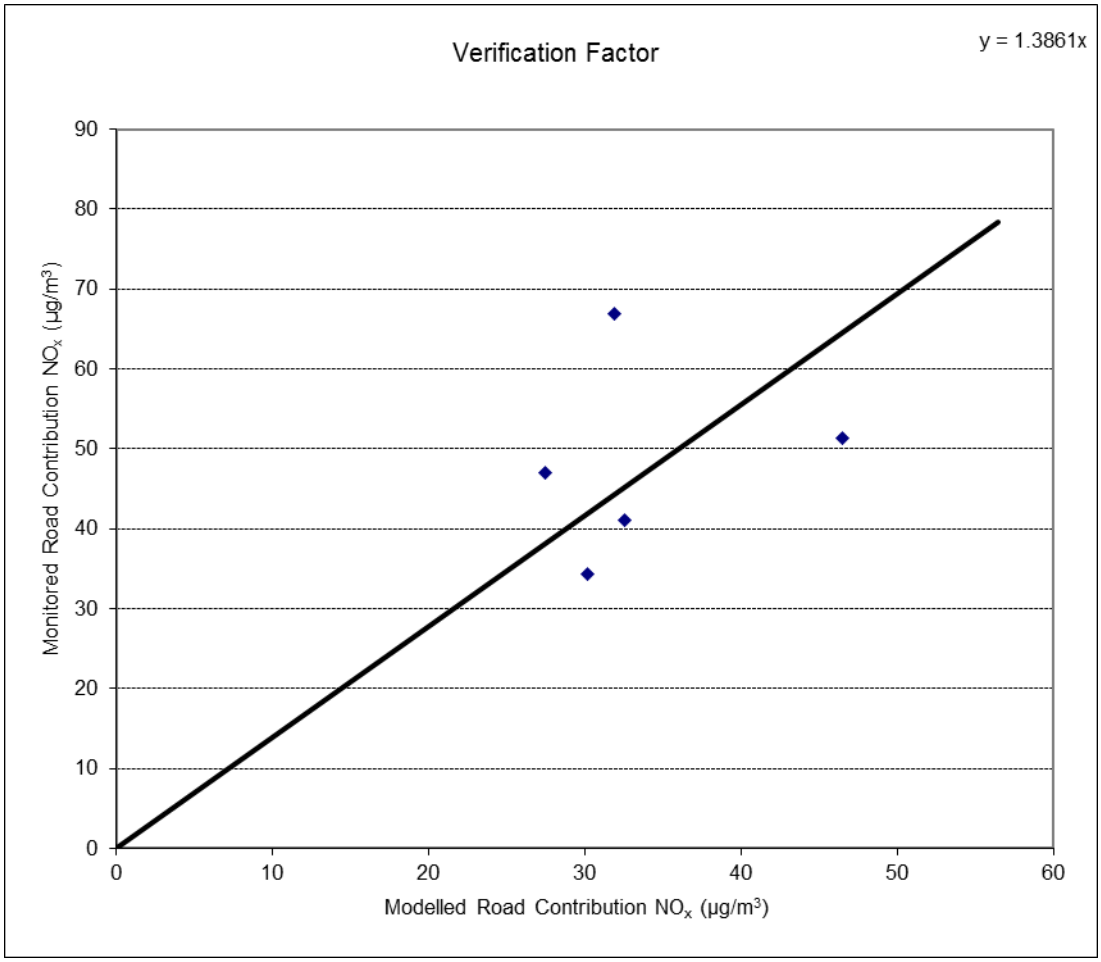
Table 8A-5 Modelled Concentrations

Location		Modelled Roadside NO_x Concentration ($\mu g/m^3$)
3	Kings End South	31.86
4	Kings End North	30.17
5	Field Street	32.51
6	North Street	46.50
7	Queens Avenue	27.50

The monitored and modelled NO_x road contribution concentrations were graphed and the equation of this trendline based on the linear progression through zero calculated, as shown in Graph 1. This indicated a verification factor of 1.3861 was required to be applied to all modelling results.

As PM_{10} monitoring is not undertaken within the assessment extents, a verification factor of 1.3861 was also used to adjust model predictions of this pollutant in accordance with the guidance provided within LAQM.TG(09).

Graph 1 Verification Factor



Energy Centre Assessment Inputs

Atmospheric emissions from the Energy Centre have the potential to result in air quality impacts in the vicinity of the Development. Dispersion modelling using ADMS 5 was therefore undertaken in order to consider potential changes as a result of the proposals. This included modelling of both Energy Centre 2 (EC2) (associated with Application 1 (North of Railway)) and Energy Centre 3 (EC3) (associated with Application 2 (South of Railway)). Concentrations were apportioned between the relevant sources to ensure both individual and cumulative impacts could be determined.

Assessment inputs are described in the following subsections.

Dispersion Model

Dispersion modelling was undertaken using ADMS 5 (v5.0.0), which is developed by Cambridge Environmental Research Consultants (CERC) Ltd. ADMS 5 is a short-range dispersion modelling software package that simulates a wide range of buoyant and passive releases to atmosphere. It is a new generation model utilising boundary layer height and Monin-Obukhov length to describe the atmospheric boundary layer and a skewed Gaussian concentration distribution to calculate dispersion under convective conditions.

The model utilises hourly meteorological data to define conditions for plume rise, transport and diffusion. It estimates the concentration for each source and receptor combination for each hour of input meteorology, and calculates user-selected long-term and short-term averages.

Source Locations

The relevant Energy Centre and stack locations are summarised in Table 8A-6.

Table 8A-6 Source Locations

Building	Building Location (NGR)		Stack	Stack Location (NGR)	
	X	Y		X	Y
EC2	457192	224241	EC2-1	457185	224250
			EC2-2	457185	224249
			EC2-3	457184	224250
			EC2-4	457184	224249
			EC-5	457185	224250
			EC-6	457185	224249
EC3	456641	223440	EC3-1	456640	223451
			EC3-2	456639	223451
			EC3-3	456639	223450
			EC3-4	456640	223450

Process Conditions

It is currently anticipated that EC2 will comprise four Ener-G E425 CHP engines and two arborElectroGen biomass CHP units and EC3 will comprise three Ener-G E425 CHP engines and one aborElectroGen biomass CHP. The relevant process conditions for these plants were obtained by the relevant technical data sheets and are summarised in Table 8A-7.

Table 8A-7 Process Conditions

CHP Engine	Parameter	Unit	CHP
Ener-G E425 CHP	Stack height	m	18
	Emission point diameter (internal)	m	0.25
	Flue gas emission velocity	m/s	15.58
	Temperature	˚C	120
aborElectroGen biomass CHP	Stack height	m	18
	Emission point diameter (internal)	m	0.20
	Flue gas emission velocity	m/s	7.32
	Temperature	˚C	170

Emissions

Emissions for the proposed CHP plant were obtained from Ener-G. These are summarised in Table 8A-8.

Table 8A-8 Process Conditions

CHP Engine	NO_x Exhaust Gas Concentration (mg/Nm^3)	NO_x Emission Rate (g/s)	PM_{10} Emission Rate (g/s)
E425	480	0.2551	N/A
aborElectroGen	500	0.0709	0.0021

Emissions of NO_x from combustion processes are predominantly in the form of nitrogen oxide (NO). Excess oxygen in the combustion gases and further atmospheric reactions cause the oxidation of NO to NO_2. Comparisons of ambient NO and NO_2 concentrations in the vicinity of point sources in recent years has indicated that it is unlikely that that more than 30% of the NO_x is present at ground level as NO_2.

Ground level NO_x concentrations have been predicted through dispersion modelling. NO_2 concentrations reported in the results section assume 70% conversion from NO_x to NO_2 for annual means and a 35% conversion for short term (hourly) concentrations, based upon Environment Agency methodology (Ref 8-15).

The model considered all CHP engines operating at maximum load 24-hours per day, 365-days per year in order to provide a worst-case scenario.

Meteorological Data

Meteorological data used in this assessment was taken from Brize Norton meteorological station over the period 1st January 2013 to 31st December 2013 (inclusive), as described previously.

Assessment Extents

Ambient concentrations were predicted over the area NGR: 454500, 221250 to 459750, 226500. One Cartesian at a height of 1.5m was used within the model to produce data suitable for contour plotting.

Discrete receptor locations were included in the model as detailed in Chapter 8.

Roughness Length

A roughness length (z_0) of 1m was used in this dispersion modelling study, as described previously.

Monin-Obukhov Length

A Monin-Obukhov length of 30m was used in this dispersion modelling study, as described previously.

Modelling Uncertainty

Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

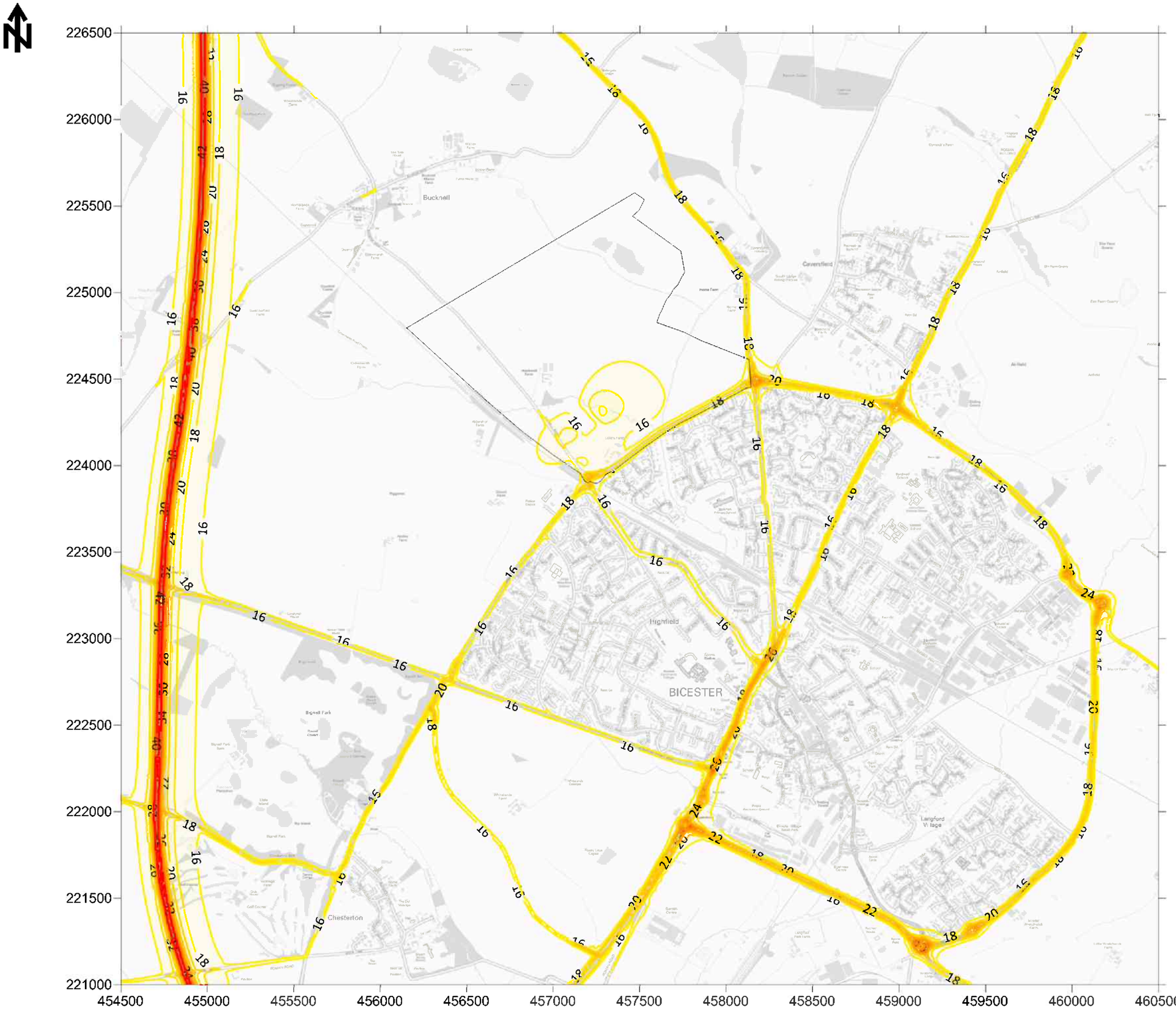
- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emissions estimates, background estimated and meteorology; and,
- Variability - randomness of measurements used.

Potential uncertainties in model results have been minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS 5 is a commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;
- Plant operating parameters - Operational parameters were supplied by Ener-G, the anticipated CHP engine manufacturer;
- Emission rates - Emission rates were supplied by Ener-G. These are based on the design specification and are therefore considered to represent suitable input parameters;
- Variability - All model inputs are as accurate as possible and worst-case conditions have been considered where necessary in order to ensure a robust assessment of potential pollutant concentrations.

AIR QUALITY

Drawings



Legend

Site Boundary

Predicted Annual Mean NO_2 Concentrations (µg/m³)

48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14

Title

Drawing 8-6 - Predicted Annual Mean NO_2 Concentration (µg/m³) DS

Project

Bicester
Environmental Statement

Hyder Consulting (UK) Limited
Firecrest Court
Centre Park
Warrington WA1 1RG
United Kingdom
Tel: +44 (0)1925 800 700
Fax: +44 (0)1925 830 207
www.hyderconsulting.com

Legend

Site Boundary

Predicted Annual Mean NO_2 Concentrations (µg/m³)

50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
18
16
14

Title

Drawing 8-7 - Predicted Annual Mean NO_2 Concentration (µg/m³) Cumulative

Project

Bicester
Environmental Statement

Hyder Consulting (UK) Limited
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Tel: +44 (0)1925 800 700
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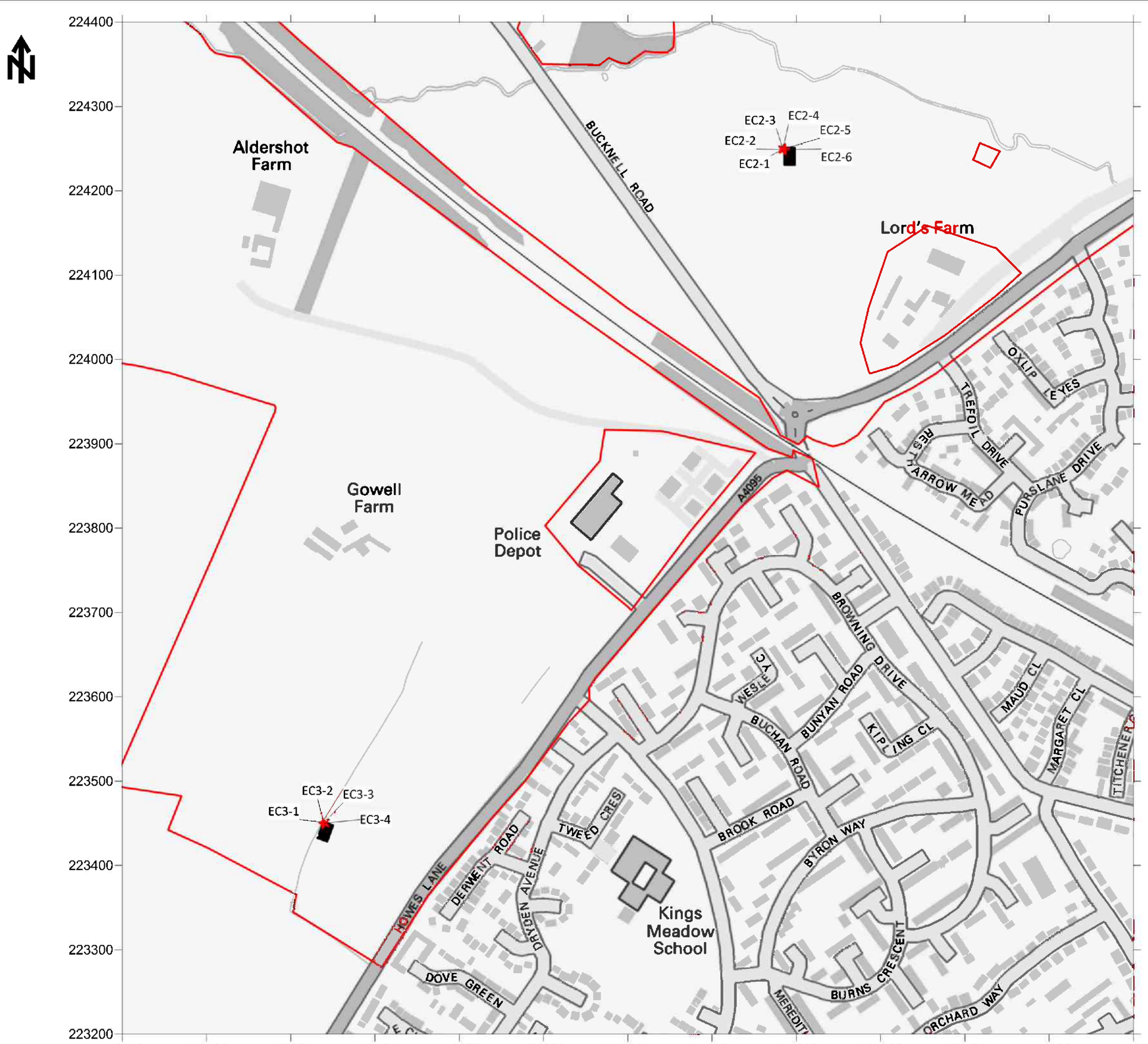

Legend

Application One Site Boundary

Application Two Site Boundary

Energy Centres

CHP Engine

Title

Drawing 8-13 - ADMS-5 Input

Project

Bicester
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