12 AIR QUALITY

12.1 INTRODUCTION

12.1.1 This chapter documents the assessment of the likely significant effects of the Proposed Development in terms of air quality that may arise from the construction and operational phases.

12.1.2 The Heyford Park masterplan has undergone a number of changes since the 2018 ES chapter was prepared as set out in chapter 0-4 of this SEI. However, it should be noted that these changes are not considered to have a material impact on the Air Quality chapter of the ES.

12.1.3 This chapter however, has been updated to reflect new emissions factors and an updated 2018 baseline scenario, as part of the Supplementary Environmental Information (SEI) report to compliment the original ES.

12.1.4 Since the completion of the 2018 ES there have been updates to the National Planning Policy Framework (NPPF) and Planning Practice Guidance Updates to these policies have been included below for completeness. However, the changes do not affect the assessment methodology or conclusions.

12.1.5 The main air pollutants of concern related to construction are dust and fine particulate matter (PM_{10}), whilst for road traffic they are nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$). For ecological habitats, the main pollutants of concern from road traffic emissions are oxides of nitrogen, with consequential nitrogen and acid deposition.

12.1.6 The Upper Heyford Sewerage Treatment Works (STW) is located approximately 175m south-east of the boundary of Parcel 17 (residential) and 20m south-east of the boundary of Parcel 18 (Sports Park) within the Application Site. The proposed residential properties in Parcel 17 are considered high sensitivity receptors in relation to odour impacts, whilst the Sports Park is considered to be a low sensitivity receptor. The STW is located further away from proposed residential properties within the Application Site than existing residential properties at Duvall Park on Camp Road. The closest of these properties within Duvall Park is located approximately 35m north-east of the STW boundary. The STW is relatively small and taking into account the sensitivity of proposed receptors in Parcel 18 and 17, the separation distance between the STW and the boundary of Parcel 17 and 18, and the prevailing wind direction (west to south-westerly), the STW is unlikely to have a significant effect on the Application Site and no further assessment has therefore been undertaken in this chapter.

12.1.7 An energy facility is proposed within the Application Site. The energy facility and associated infrastructure will form part of the energy strategy for the Proposed Development. The energy strategy is to be flexible to meet energy supply requirements depending on the best technology available at the time of the detailed design of the facilities. As no technology selection has been made at this time, an assessment of the likely significant effects resulting from an energy centre within the Application Site has not been included within this chapter. However, if an energy centre was incorporated within the development, emissions would need to comply with the requirements of the Medium Combustion Plant Directive. An appropriate stack height would be provided to adequately disperse emissions such that no significant air quality effects would result. This would be demonstrated by an air quality assessment which can be conditioned as part of a future Reserved Matters application.

12.1.8 There has been revised ecological guidance since the original ES chapter, and proposed exceedances shown in this SEI of critical loads on the Ardley Cutting and Quarry SSSI should be assessed by a trained ecologist to assess the impact of nitrogen and acid deposition upon the ecosystem.

12.1.9 This chapter describes: relevant legislation and planning policy, the assessment methodology; the baseline conditions at the Application Site and surroundings; the likely significant environmental effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after the mitigation measures have been employed, and the likely cumulative effects in conjunction with committed developments.

12.2 LEGISLATION AND PLANNING POLICY CONTEXT

National Legislation

Air Quality Objectives and Limit Values

Human Health

12.2.1 National Air Quality Objectives (NAQO) are defined by the Air Quality Standards (Amendment) Regulations 2016[1], which implement the European Union's Directive on ambient air quality and cleaner air for Europe (2008/50/EC).

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

12.2.3 The NAQOs for NO_2 and PM_{10} are shown in **Table 12.1**.

[1] Statutory Instrument 2002, No 3034, The Air Quality (England) (Amendment) Regulations 2016, HMSO, London

Table 12.1: Nitrogen Dioxide and PM_{10} Objectives

Pollutant	Time Period	Objective
Nitrogen dioxide (NO_2)	1-hour mean	200µg/m^3 not to be exceeded more than 8 times a year
	Annual mean	40µg/m^3
Particulate Matter (PM_{10})	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40µg/m^3

12.2.4 The NAQO's for NO_2 and PM_{10} were to have been achieved by 2005 and 2004, respectively, but also continue to apply in all future years thereafter.

12.2.5 In relation to $PM_{2.5}$, the Air Quality Strategy 2007 (Defra, 2007) includes an exposure reduction target comprising an annual mean target of 25 µg/m^3 by 2020 and an average urban background exposure reduction target of 15% between 2010 and 2020.

12.2.6 The EU Directive (2008/50/EC) also includes a national exposure reduction target, a target value and a limit value for $PM_{2.5}$, shown in **Table 12.2.** The UK Government transposed this new directive into national legislation in June 2010.

Table 12.2: $PM_{2.5}$ Objectives

	Time Period	Objective/Obligation	To be Achieved by
UK Objectives	Annual mean	25µg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background sites	Between 2010 and 2020
European obligations	Annual mean	Target value of 25µg/m^3	2010
	Annual mean	Limit value of 25µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20µg/m^3	2020
	3 year Average Exposure Indicator (AEI) [(a)]	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020

	Time Period	Objective/Obligation	To be Achieved by
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20µg/m^3	2015

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

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

12.2.8 Part IV of the Environment Act 1995 (Environment Act, 1995) introduced a system of Local Air Quality Management (LAQM) which requires local authorities to regularly and systematically review and assess air quality within their boundary, and appraise development and transport plans against these assessments.).

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

12.2.10 The Local Air Quality Management Technical Guidance 2016[2] (LAQM.TG(16); Defra, 2016), issued by the Department for Environment, Food and Rural Affairs (Defra) for Local Authorities provides advice as to where the NAQOs apply. These include outdoor locations where members of the public are likely to be regularly present for the averaging period of the objective (which vary from 15 minutes to a year) as summaries in **Table 12.3**.

Table 12.3 Relevant Public Exposure

Averaging Period	Relevant Locations	AQO's should apply at:	AQO's don't apply at:
Annual mean	Where individuals are exposed for a cumulative period of 6 months in a year	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
1-hour mean	Where individuals might reasonably expected to spend one hour or longer	As above together with locations of regular access, car parks, bus stations etc.	Locations not publicly accessible or where occupation is not regular

2 Local Air Quality Management Technical Guidance (LAQM.TG(16)). Defra, 2016

15-minute mean	All locations where members of the public might reasonably be regularly exposed for a period of 15-minutes or longer	

12.2.11 The Clean Air Strategy[3] aims to lower national emissions of pollutants, thereby reducing background pollution and minimising human exposure to harmful concentrations of pollution. The Strategy will create a stronger and more coherent framework for action to tackle air pollution.

Habitats Legislation

12.2.12 Sites of national importance may be designated as Sites of Special Scientific Interest (SSSIs). Originally notified under the National Parks and Access to the Countryside Act 1949, SSSIs have been re-notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs (in England and Wales) were introduced by the Countryside and Rights of Way (CROW) Act 2000. If a development is "likely to damage" a SSSI, the CROW Act requires that a relevant conservation body (i.e. Natural England) is consulted. The CROW Act also provides protection to local nature conservation sites, which can be particularly important in providing 'stepping stones' or 'buffers' to SSSIs and European sites. In addition, the Environment Act (1995) and the Natural Environment and Rural Communities Act (2006) both require the conservation of biodiversity.

Ecological Habitats

12.2.13 Objectives for the protection of vegetation and ecosystems have been set by the UK Government and were to have been achieved by 2000. They are summarised in Table 12.3 and are the same as the EU limit values. The objectives only strictly apply a) more than 20km from an agglomeration (about 250,000 people), and b) more than 5km from Part A industrial sources, motorways and built up areas of more than 5,000 people. However, Natural England has adopted a more precautionary approach and applies the objective to all internationally designated conservation sites and SSSIs. For the assessment of road schemes, Highways England follows this approach and requires an assessment of the impacts of road traffic emissions on conservation sites (Designated Sites) within 200m of a road[4]. When pollutant concentrations exceed a critical level it is considered that there is a risk of harmful effects.

Table 12.3: Vegetation and Ecosystems Objectives (Critical Levels)

Pollutant	Time Period	Objective
Nitrogen Oxides (expressed as NO_2)	Annual Mean	30µg/m^3

12.2.14 Critical loads for nitrogen deposition onto sensitive ecosystems have been specified by United Nations Economic Commission for Europe

[3] Clean Air Strategy, Defra (2019)

(UNECE). They are defined as the amount of pollutant deposited to a given area over a year, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Exceedance of a critical load is used as an indication of the potential for harmful effects to occur.

12.2.15 Statutory designated ecological sites (SACs, SPAs, SSSIs and RAMSAR sites) have been included in this assessment where they are within 200m of a road that has an increase in traffic of more than 1000 AADT resulting from the Development. This is in line with the Highway's Agency Design Manual for Roads and Bridges (DMRB)[4]. Following this criteria, the Ardley Cutting and Quarry SSSI has been identified as a site where assessment of impacts on ecological receptors is deemed necessary. The Ardley Cutting and Quarry SSSI is the nearest statutory designated site to the Application Site, approximately 120m west from the Site boundary. The SSSI borders the B430 Station Road to the east and west.

12.2.16 **Table 12.4** below shows the habitats within the SSSI most likely to be affected by road traffic emissions from Station Road and describes the critical loads for each of these habitats.

Table 12.4: Ecological Habitats and Critical Loads

Habitat	Critical Load	
	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Calcareous grassland (Bromus erectus- Brach podium pinnatum lowland calcareous grassland)	15 - 25	0.856 – 4.856
Calcareous grassland (Bromus erectus- lowland calcareous grassland)	15 - 25	0.856 – 4.856
Hamearis Lucina – Duke of Burgundy[a]	-	-
Invertebrate assemblage – Invertebrate Assemblage[b]	-	-

(a) No critical load for nitrogen deposition or acid deposition has been assigned for this habitat. Information retrieved from the Air Pollution Information System (APIS) website (2019).

(b) The habitat is sensitive to nitrogen deposition and acid deposition, however there is no comparable habitat with established critical load estimate available or acid class.

National Policy

12.2.17 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how they are expected to be applied[5]. The following paragraphs are considered relevant from and air quality perspective.

12.2.18 Paragraph. 102 on promoting sustainable transport states:

[4] The Highways Agency (2019). 'Design Manual for Roads and Bridges, Volume 11, Section 3, Part I, LA 105 Air Quality'. Available at: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20105%20Air%20quality-web.pdf

5 Ministry of Housing, Communities & Local Government, 2019. 'National Planning Policy Framework'

"Transport issues should be considered from the earliest stages of plan-making and development proposals, so that:

…

d) the environmental impacts of traffic and transport infrastructure can be identified, assessed and taken into account – including appropriate opportunities for avoiding and mitigating any adverse effects, and for net environmental gains; …"

12.2.19 Paragraph 103 continues to state:

"Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."

12.2.20 Paragraph 170 on conserving and enhancing the natural environment states:

"Planning policies and decisions should contribute to and enhance the natural and local environment by: …

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land stability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans, and…"

12.2.21 Paragraph 180 within ground conditions and pollution states:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development."

12.2.22 Paragraph 181 states that:

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

12.2.23 Paragraph 182 states that:

"Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed".

Planning Policy Guidance

12.2.24 Planning Practice Guidance[6] (PPG) was first published in March 2014 to support the National Planning Policy Framework.

12.2.25 Paragraph 005, Reference 32-005-20191101 (revision date 01.11.2019), of the PPG provides guidance on how considerations regarding air quality can be relevant to the development management process as follows:

"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity.

Where air quality is a relevant consideration the local planning authority may need to establish:

- **The 'baseline' local air quality, including what would happen to air quality in the absence of the development;**
- **Whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and**
- **Whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.**

12.2.26 Paragraph 006, Reference 32-006-20191101 (revision date 01.11.2019), of the PPG identifies what specific air quality issues need to be considered in determining a planning application:

[6] Planning Policy Guidance (2019). 'Air Quality'

"Considerations that may be relevant to determining a planning application include whether the development would:

- **Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the proposed development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; and significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;**

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

- **Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality;**

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

- **Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value."**

12.2.27 Paragraph 007, Reference 32-007-20191101 (revision date 01.11.2019), of the PPG provides guidance on how detailed an assessment needs to be;

"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific."

and

"The following could form part of assessments:

- **A description of baseline conditions and any air quality concerns affecting the area, and how these could change both with and without the proposed development;**

- **Sensitive habitats (including designated sites of importance for biodiversity);**

- **the assessment methods to be adopted and any requirements for the verification of modelling air quality;**
- **The basis for assessing impacts and determining the significance of an impact;**
- **Where relevant, the cumulative or in-combination effects arising from several developments;**
- **Construction phase impacts;**
- **Acceptable mitigation measures to reduce or remove adverse effects; and**
- **Measures that could deliver improved air quality even when legally binding limits for concentrations of major air pollutants are not being breached."**

12.2.28 Paragraph 008, Reference 32-008-20140306 (revision date 01.11.2019), of the PPG provides guidance on how an impact on air quality can be mitigated;

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met.

Examples of mitigation include:

- **Maintaining adequate separation distances between sources of air pollution and receptors;**
- **Using green infrastructure, trees, where this can create a barrier or maintain separation between sources of pollution and receptors;**
- **Appropriate means of filtration and ventilation;**
- **Including infrastructure to promote modes of transport with a low impact on air quality (such as electric vehicle charging points);**
- **Controlling dust and emissions from construction, operation and demolition; and**
- **Contributing funding to measures, including those identified in air quality action plans and low emission strategies, designed to offset the impact on air quality arising from new development."**

Local Planning Policy

12.2.29 The Cherwell Local Plan (2011 – 2031), adopted in 2016, sets out the local development policies for the Council[7]. It considers Policy ESD 10 'Protection and Enhancement of Biodiversity and the Natural Environment', which states:

"Development which would result in damage to or loss of a site of biodiversity or geological value of national importance will not be permitted unless the benefits of the development clearly outweigh the harm it would cause to the site and the wider national network of SSSI's, and the loss can be mitigated to achieve a net gain in biodiversity/geodiversity…Air quality assessments will also be required for development proposals that would be likely to have a significantly adverse impact on biodiversity by generating an increase in air pollution"

12.2.30 The Cherwell District Council (CDC) Draft Planning Obligations Supplementary Planning Document (SPD)[8] provides guidance on the level of contribution which will be required in order to compensate for loss or damage created by a development, or to mitigate a development's impact. It sets out the range of mitigation measures which may be required, as well as the means of calculating financial contributions towards measures or monitoring, based on the cost of Air Quality Action Plan measures. An AQMA comprising North Bar Street, Horse Fair Street, South Bar, Oxford Street, High Street, Bloxham Road, Warwick Road and Southam Road was declared 29th October 2014; Cherwell District Council has not yet prepared an Air Quality Action Plan for its existing AQMAs (Hennef Way and North Bar/Horse Fair/South Bar Street). None of the mentioned AQMAs are in close proximity to the Application Site.

12.2.31 In March 2017 the Council approved an Air Quality Action Plan (AQAP) as part of its statutory duties required by the Local Air Quality framework. It outlines the actions to be taken to improve air quality in the District between 2017 and 2020[9].

12.3 ASSESSMENT METHODOLOGY

Study Area

Construction

12.3.1 The Construction Study Area extends to 350m from the Application Site boundary, shown in **Figure 12.1**.

Operation

Residential Receptor Locations

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[7] Cherwell District Council (2015) *'Cherwell Local Plan (2011-2031)'*. Available at: https://www.cherwell.gov.uk/info/83/local-plans/376/adopted-cherwell-local-plan-2011-2031-part-1

[8] Cherwell District Council (2011) *'Planning Obligations Draft Supplementary Planning Document'*. Available at: https://www.cherwell.gov.uk/downloads/download/458/planning-obligationsdeveloper-contributions-in-preparation

[9] Cherwell District Council (2017) ' *Air Quality Action Plan'* Available at https://www.cherwell.gov.uk/downloads/download/1069/air-quality-management

12.3.2 The assessment covers the air quality impacts at existing properties along the road links provided in **Appendix 12.2** that might be affected by an increase in road traffic.

12.3.3 The Operational Study Area extends to where there are significant changes in traffic (more than 500 vehicle movements per day outside of an Air Quality Management Area (AQMA), and more than 100 vehicle movements per day within an AQMA). The roads modelled in this assessment are shown in **Figure 12.1a**.

12.3.4 Within the study area, relevant sensitive locations have been identified. These locations are described in **Table 12.4**,and shown in **Figure 12.2a**. The method used to identify these locations is described in **Paragraph 12.3.24**.

Ecological Receptor Locations

12.3.5 The Ardley Cutting and Quarry SSSI has been included in this assessment in accordance with the DMRB guidance criteria[4]. The SSSI is within 200m of Station Road which has an increase in traffic of more than 1000 AADT resulting from the Application. Therefore, the Ardley Cutting and Quarry SSSI has been identified as a site where assessment of impacts on ecological receptors is deemed necessary.

Surveys

Baseline Data Collection

12.3.6 Information on existing air quality has been obtained by collating the results of monitoring carried out by CDC. Background concentrations for the study area have been defined using the national pollution maps published by Defra. These cover the whole country on a 1x1 km grid[10].

12.3.7 Existing nitrogen and acid deposition rates for habitats within the study area were determined from the Air Pollution Information System (APIS) website[11].

Significance Criteria and Methodology

Construction

12.3.8 During pre-construction demolition and construction the main potential effects are dust annoyance and locally elevated concentrations of PM10.

12.3.9 The suspension of particles in the air is dependent on surface characteristics, weather conditions and on-site activities. Impacts have the potential to occur when dust generating activities coincide with dry, windy conditions, and where sensitive receptors are located downwind of the dust source.

10 Department of the Environment, Food and Rural Affairs (Defra) (2019). 2017 Based Background Maps for NOx, NO2, PM10 and PM2.5. Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2017

11 Air Pollution Information System (APIS) (2019). Available at: http://www.apis.ac.uk/

12.3.10 Separation distance is also an important factor. Large dust particles (greater than 30 µm), responsible for most dust annoyance, will largely deposit within 100 m of sources. Intermediate particles (10-30 µm) can travel 200-500 m. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (less than 10µm) are deposited slowly and may travel up to 1 km; however, the impact on the short-term concentrations of PM10 occurs over a shorter distance. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

12.3.11 The assessment of the risk of potential construction dust impacts has been undertaken with reference to IAQM 'Guidance on the assessment of dust from construction and demolition'.[12] Within the IAQM guidance, an 'impact' is described as a change in pollutant concentrations or dust deposition and an 'effect' is described as the consequence of an impact.

12.3.12 The assessment methodology considers three separate potential dust impacts with account being taken of the sensitivity of the area that may experience these effects:

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM10; and
- harm to ecological receptors.

12.3.13 The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme; defined as the study area. No further assessment is required if there are no receptors within the study area.

12.3.14 The assessment of potential risk is determined by considering the risk of dust impacts arising from four activities in the absence of mitigation:

- demolition;
- earthworks;
- construction; and
- track-out.

12.3.15 The dust emission class (or magnitude) for each activity is determined on the basis of the guidance, indicative thresholds and professional judgement. The risk of dust impacts arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the mitigation requirements.

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

12 IAQM, 2014. ' Guidance on the assessment of dust from construction and demolition

12.3.17 In accordance with the IAQM 2016 guidance, the dust emission magnitude is defined as either large, medium or small (**Table 12.5**) taking into account the general activity descriptors on site and professional judgement.

12.3.18 The sensitivity of the study area to construction dust impacts is defined based on the examples provided within the IAQM 2016 guidance (**Table 12.6**), taking into account professional judgement.

Table 12.5: Risk Criteria for Dust Emission Magnitude

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

Table 12.6: Area Sensitivity Definitions

Area Sensitivity	People and Property Receptors
High	>100 dwellings, hospitals, schools, care homes within 50m 10 – 100 dwellings within 20m Museums, car parks, car showrooms within 50m PM_{10} concentrations approach or are above the daily mean objective.
Medium	>100 dwellings, hospitals, schools, care homes within 100m 10 – 100 dwellings within 50m Less than 10 dwellings within 20m Offices/shops/parks within 20m PM_{10} concentrations below the daily mean objective.
Low	>100 dwellings, hospitals, schools, care homes 100 - 350m away 10 – 100 dwellings within 50 – 350m Less than 10 dwellings within 20 - 350m Playing fields, parks, farmland, footpaths, short term car parks, roads, shopping streets PM_{10} concentrations well below the daily mean objective.

12.3.19 Based on the dust emission magnitude and the area sensitivity, the risk of dust impacts is then determined (**Table 12.7**), taking into account professional judgement.

Table 12.7: Risk of Dust Impacts

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

12.3.20 Based on the risk of dust impacts, appropriate mitigation is selected from the IAQM 2014 guidance using professional judgement.

12.3.21 The guidance recommends that no assessment of the significance of effects is made without mitigation in place, as mitigation is assumed to be secured by planning conditions, legal requirements or required by regulations. By determining the risk of dust impacts, appropriate mitigation can then be selected which corresponds to the level of risk. As noted in **paragraph 12.3.11**, with appropriate mitigation in place, and in accordance with the IAQM guidance, the residual effect of construction activities on air quality is assessed as not significant.

Operation

12.3.22 Predictions have been carried out using the ADMS-Roads dispersion model (v4.1.1). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of heavy duty vehicles (HDVs), road characteristics (including road width and street canyon height, where applicable), and the vehicle speed. It also requires meteorological data suitable for the area of the study.

12.3.23 Existing AADT flows, and the proportions of HDVs have been derived from the TA (see ES Chapter 6). Traffic data has been provided for the following scenarios:

- Base Year 2018 (Baseline Scenario);
- Reference Case 2031:
  - includes consented development;
  - includes committed Local Plan/third party development sites;
- Application Test Case 2031:
  - includes consented Heyford Park development;
  - includes committed Local Plan/third party development sites;
  - 1,110 residential units and 1,500 jobs from the Heyford Park application.
- Allocation Test Case 2031 (cumulative scenario):
  - As above in the Application Test Case but includes the full Heyford Park allocation (1,600 residential units, 1,500 jobs).

12.3.24 More detailed information about the traffic data used in this assessment is provided in **Chapter 6 – Transport and Access**. Traffic data used in this assessment are summarised in **Appendix 12.2**. This data has not been updated for this SEI.

12.3.25 Meteorological data for 2018 from the Brize Norton monitoring station was used in the assessment, as it is considered suitable for this area and is the closest meteorological station to the Application Site, approximately 28km away.

12.3.26 In comparison to the original ES, emissions were calculated using the recently released Emission Factor Toolkit (EFT) v9.0, which utilises NO_x emission factors taken from the European Environment Agency COPERT 5 emission tool. The traffic data was entered into the EFT, along with speed data to provide combined emission rates for each of the road links entered into the model. . Road vehicular emissions are primarily associated with the exhaust emissions but also include particles generated from abrasion (of tyres, brakes and road). The EFT allows users to calculate road vehicle pollutant emission rates for NOx, PM_{10}, (exhaust and brake, tyre and road wear) and $PM_{2.5}$ (exhaust and brake, tyre and road wear) for a specified year, road type, vehicle speed and vehicle fleet composition.

12.3.27 The EFT provides pollutant emission rates for 2017 through to 2030 and takes into consideration the following information available from the National Atmospheric Emissions Inventory (NAEI):

- fleet composition data for motorways, urban and rural roads in London and rest of the UK;

- fleet composition based on European emission standards from pre-Euro I to Euro 6(a-d)/VI;

- scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting; and

- technology conversions in the national fleet.

12.3.28 As a result of this the road vehicle exhaust emissions are projected to decrease year-on-year due to technological advances and improvements to the fleet mix i.e. penetration of Euro VI HGVs, which recent research suggests are performing well. Whilst there is current uncertainty over NOx emissions from vehicle exhausts (particularly from Euro 5 and 6 LGVs) it is important to note the EFT is not based on the Euro emission standards. Specifically, the latest version of the EFT (v9.0) includes updated NOx and PM speed emission coefficient equations for Euro 5 and 6 vehicles taken from the European Environment Agency (EEA) COPERT 4 v11 emission calculation tool, reflecting emerging evidence on the real-world emission performance of these vehicles.

12.3.29 The first year of occupation of the Application Site is anticipated to be 2021, with approximately 6% occupation in this year. Therefore, the future year assessment has been carried out using 2031 full development traffic flows for the Application Test Case and Allocation Test Case, combined with 2021 emission factors and background concentrations as a worst-case assessment.

12.3.30 An additional scenario has also been assessed which uses the same 2031 Application and Allocation Test Case traffic but is combined with 2022 emission factors and background concentrations. This additional scenario has been used to assess the effect of a change in emission factors on predicted concentrations, and to judge the likelihood of the predicted impacts occurring.

12.3.31 Nitrogen deposition has been calculated from the predicted nitrogen dioxide concentrations using a deposition velocity of 1.5mm/s for grassland habitats.

Human Health Receptors – Sensitive Locations

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

12.3.33 Based on the above criteria, eighteen existing properties have been identified as receptors for the assessment. These locations are described in **Table 12.8** and shown in **Figure 12.2a**. Receptors were modelled at a height of 1.5m representing ground floor exposure.

12.3.34 Concentrations have also been predicted at the roadside diffusion tubes located in close proximity to the Application Site, in order to verify the modelled results (see **Appendix 12.1** for further details on the verification method).

Table 12.8: Description of Receptor Locations

Receptor	Location
R1	The White House, A4260, Hopcrofts Holt
R2	20 Bromeswell Close, Lower Heyford
R3	143 Freehold Street, Lower Heyford
R4	Cosie Cotte, Somerton Road, Upper Heyford
R5	Cotswold Lodge, Orchard Lane, Upper Heyford
R6	1 Ardley Road, Middleton Stoney
R7	Stonecroft, Station Road, Ardley
R8	2 Jersey Cottages, Station Road, Ardley
R9	Old Post Office, Heyford Road, Middleton Stoney
R10	Tinkers, Bicester Road, Middleton Stoney
R11	Corner Cottage Ardley Road, Middleton Stoney
R12	West of Ardley Road, Middleton Stoney
R13	2 Knowle Lane, Weston the Green
R14	The Darling, Rousham
R15	2, The Cottages, Oxford Road, North Aston
R16	The Fox, Oxford Road, North Aston
R17	Oxford Lodge, Tusmore
R18	66 Shannon Road, Bicester

Ecological Receptors – Sensitive Locations

12.3.35 The Ardley Cutting and Quarry SSSI is located adjacent to, and either side of the B430 Station Road north east of the Application Site. Two transects of receptors representing increasing distances (50-200m) from the B430 have been modelled, one to the east (E1) and one to the west (E2) of the road. These receptor locations are shown in **Figure 12.2a.**

12.3.36 Concentrations of nitrogen oxides are predicted, and deposition calculated, at a range of receptors at increasing distances from the B430 (**Figure 12.2a**) in order to indicate whether or not critical level and critical loads are being exceeded in the habitat.

12.3.37 The Critical Load Function Tool available in APIS was used to determine whether the acid deposition loads are exceeded.

Human Health Receptors – Significance

12.3.38 There is no official guidance in the UK on how to assess the significance of air quality impacts of existing sources on a new development. The approach developed by the Institute of Air Quality Management[13], and

[13] Institute of Air Quality Management, 2017. IAQM EPUK (2017). 'Land-use Planning & Development Control: Planning for Air Quality'. The IAQM is the professional body for air quality practitioners in the UK.

incorporated in Environmental Protection UK's guidance document on planning and air quality[14], has therefore been used.

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

12.3.40 **Table 12.9** sets out the impact magnitude descriptors, whilst **Table 12.10** sets out the impact descriptors.

Table 12.9: Impact Magnitude for Changes in Ambient Pollutant Concentrations

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

[14] EPUK, 2017. Development Control: Planning for Air Quality (2017 Update)

Table 12.10: Impact Descriptor for Changes in Concentrations at a Receptor

Long term average Concentration at receptor in assessment year	Change in concentration with development in relation to the Objective/ Limit Value			
	1*	2-5	6-10	**>10**
> 110 % (a)	Moderate	Substantial	Substantial	Substantial
>102% - ≤110% (b)	Moderate	Moderate	Substantial	Substantial
>95% - ≤102% (c)	Slight	Moderate	Moderate	Substantial
>75% - ≤95% (d)	Negligible	Slight	Moderate	Moderate
≤75% (e)	Negligible	Negligible	Slight	Moderate

Where concentrations increase the impact is described as adverse and where it decreases as beneficial.

(a) NO_2 or PM_{10}: >44 μg/m^3 annual mean; $PM_{2.5}$ >27.5 μg/m^3 annual mean; PM_{10} >35.2 μg/m^3 annual mean (days)

(b) NO_2 or PM_{10}: >40.8 – ≤ 44 μg/m^3 annual mean; $PM_{2.5}$ > 25.5 – ≤27.5 μg/m^3 annual mean; PM_{10} >32.6 – ≤35.2 μg/m^3 annual mean (days)

(c) NO_2 or PM_{10}: >38 – 40.8 μg/m^3 annual mean; $PM_{2.5}$ >23.75 – ≤25.5 μg/m^3 of annual mean; PM_{10} >30.4 – ≤32.6 μg/m^3 annual mean (days)

(d) NO_2 or PM_{10}: >30 - ≤38 μg/m^3 annual mean; $PM_{2.5}$ >18.75 - ≤23.6 μg/m^3 annual mean; PM_{10} <24 - ≤ 30.4 μg/m^3 annual mean (days)

(e) NO_2 or PM_{10}: ≤30 μg/m^3 annual mean; $PM_{2.5}$ ≤18.75 μg/m^3; annual mean; PM_{10} ≤24 μg/m^3 annual mean (days)

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

- Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance.
- The magnitude of the changes and the descriptions of the impacts at the receptors i.e. **Tables 12.10** findings;
- Whether or not an exceedance of an objective or limit value is predicted to arise in the study area where none existed before or an exceedance area is substantially increased;
- Whether or not the study area exceeds an objective or limit value and this exceedance is removed or the exceedance area is reduced;
- Uncertainty, including the extent to which worst-case assumptions have been made; and
- The extent to which an objective or limit value is exceeded.

12.3.42 Where impacts can be considered in isolation at an individual receptor, moderate or substantial impacts (i.e. per **Table 12.10**) may be considered to be a significant environmental effect, whereas negligible or minor impacts would not be considered significant. The overall effect however, needs to be considered in the round taking into account the changes at all of the modelled receptor locations, with a judgement made as to whether the overall air quality effect of the development is 'significant' or 'not significant', which is a binary judgement.

12.3.43 The significance of impacts within the development site is based on whether the NAQOs for each pollutant are exceeded or not.

Ecological Receptors – Significance

12.3.44 Where critical loads are already exceeded, an increase of more than 1% of the critical load is an indication of potentially significant effects which would trigger the need for further, more detailed assessment. It should be noted that an increase in deposition of more than 1% is not, per se, an indication that a significant effect exists, only the possibility of one. Depending on a more detailed assessment which would take account of the actual ecological conditions at the location under consideration and the dose response relationship of the habitat, an increase of more than 1% can be acceptable.

Assumptions and Limitations

12.3.45 There are many components that contribute to the uncertainty in predicted concentrations. The model used in this assessment is dependent upon the traffic data that have been input which will have inherent uncertainties associated with them. There is then additional uncertainty as the model is required to simplify real-world conditions into a series of algorithms.

12.3.46 A disparity between the national road transport emission projections and measured annual mean concentrations of nitrogen oxides and NO_2 has been identified in recent years[15]. Whilst projections suggest that both annual mean nitrogen oxides and nitrogen dioxide concentrations from road traffic emissions should have fallen by around 15-25% over the past 6 to 8 years, at many monitoring sites levels have remained relatively stable, or have even shown a slight increase. The monitoring carried out by CDC shows a relatively slow decline in concentrations in Ardley and a relatively stable concentration in Middleton Stoney and Camp Road during the 2014-2018 period; the fact that concentrations have not fallen as rapidly as was previously anticipated is likely to be due to the real world performance of emissions from diesel cars.

12.3.47 The real-world performance of diesel cars in terms of NO_x emissions has now been incorporated into the latest version of the Defra Emission Factor Toolkit. The uncertainty regarding future emissions therefore surrounds how successful real-world emissions testing will be in improving the performance of Euro 6 diesel cars in the future. There is a residual uncertainty regarding this point, and some degree of caution is required in the assessment process.

12.3.48 The first year of occupation of the Application Site is anticipated to be 2021, with approximately 6% occupation in this year. The traffic flows for the Application Site have been predicted for 2031 when the development is expected to be fully built out and occupied. The future year traffic modelling has been based on 2021 emission factors and background concentrations whilst utilising 2031 traffic flows. The assessment is therefore considered conservative, which is further illustrated by the sensitivity test carried out using 2022 background concentrations and emission factors. Further information on the selection of future year emission factors is provided in **Appendix 12.3.**

[15] Carslaw, D., Beevers, S., Westmoreland, E. and Williams, M. (2011). Trends in NO_x and NO_2 emissions and ambient measurements in the UK. Available: http://uk-air.defra.gov.uk/library/reports?report_id=645

12.4 BASELINE CONDITIONS

Baseline Survey Information

LAQM

12.4.1 Cherwell District Council has investigated air quality within its area as part of its responsibilities under the LAQM regime. To date, four AQMAs have been declared within the district. None of them are in close proximity to the Application Site, the closest being located approximately 16km away.

Monitoring

12.4.2 The Council operates an automatic monitoring station alongside Hennef Way, which is not in close proximity to the Application Site. The Council also deploys NO_2 diffusion tubes at a number of locations, the closest ones being located in Ardley, Middleton Stoney and Camp Road. Data for these sites are presented in **Table 12.11a** and locations are shown in **Figure 12.3a**.

Table 12.11a: Measured Nitrogen Dioxide Concentrations, 2014-2018

Site ID	Site Type	Within AQMA	Annual Mean (μg/m³)				
			2014	2015	2016	2017	2018
Ardley*	Roadside	N	30.7	29.6	28.7	27.2	26
Middleton Stoney*	Kerbside	N	34.1	32.4	33.3	33.6	33.1
Camp Road*	Kerbside	N	15.8	14.1	14.9	14.6	14.4
Objective			40				

2014 – 2018 Data taken from the 2019 Air Quality Progress Report Cherwell District Council[16].
2014 and 2015 data taken from the 2016 Annual Status Report[17]
* Used in model verification

12.4.3 The measured concentrations of NO_2 have been below the objectives at all three sites during the 2014-2018 period.

12.4.4 There is no PM_{10} monitoring carried out in close proximity to the Application Site.

Background Concentrations

12.4.5 In addition to measured concentrations, estimated background concentrations for the Application Site and surrounding area have been obtained from the national maps published by Defra (**Table 12.12a**). The background concentrations were all well below the relevant objectives in 2018.

16 Cherwell District Council (2019) 'Air Quality Progress Report for Cherwell District Council'.

17 Cherwell District Council (2019). *'Annual Air Quality Status Report for 2018'*. Available at: https://www.cherwell.gov.uk/downloads/69/pollution

Table 12.12a: Estimated Annual Mean Background Concentrations

Grid Square	NO_x		NO_2		PM_{10}		$PM_{2.5}$	
	2018	2021[b]	2018	2021[b]	2018	2021[b]	2018	2021[b]
455_230	16.5	14.0	12.0	10.4	16.3	15.8	10.0	9.6
446_228	10.7	9.4	8.1	7.2	14.6	14.1	9.1	8.7
446_229	10.5	9.3	8.0	7.1	14.7	14.2	9.1	8.7
447_223	10.8	9.6	8.1	7.3	14.5	13.9	9.1	8.6
449_224	12.5	11.1	9.3	8.3	15.1	14.6	9.3	8.8
449_225	12.3	10.9	9.1	8.2	14.2	13.7	9.0	8.6
450_225*	12.2	10.9	9.1	8.2	14.8	14.3	9.3	8.8
451_225*	12.4	10.9	9.2	8.2	14.9	14.3	9.3	8.9
452_226*	12.4	10.9	9.2	8.2	14.1	13.6	9.1	8.6
453_218	15.6	13.6	11.4	10.1	14.6	14.1	9.5	9.0
453_223	14.1	12.2	10.4	9.2	14.6	14.0	9.3	8.8
454_227	23.2	19.4	16.4	14.0	17.2	16.7	10.6	10.1
Objective	**30[a]**		**40**		**40**		**25**	

[a)] NO_x objective in relation to ecological receptors only;
[b)] 2021 data has been used for the assessment of the impact of full development traffic in 2031;
* within Application Site.

<u>Baseline Deposition</u>

12.4.6 The three-year average (2015 – 2017) nitrogen and acid deposition rates for Ardley Cutting and Quarry SSSI sensitive to either nitrogen or acid deposition are presented in **Table 12.13a**; data have been taken from the APIS website. The APIS data does not include future year predictions and therefore in a conservative basis, the APIS baseline is assumed constant for the future year assessments.

Table 12.13a: Baseline Deposition Rates

Habitat	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition	
		keqN/ha/yr	keqS/ha/yr
Calcareous grassland (Bromus erectus- Brach podium pinnatum lowland calcareous grassland)	29.08	1.58	0.22
Calcareous grassland	29.08	1.58	0.22

(Bromus erectus- lowland calcareous grassland)			
Critical Level	**15 - 25**	**0.856 – 4.856**	**4.0**

Predicted Baseline Concentrations

Existing Residential Receptors

12.4.7 The ADMS-Roads model has been run to predict NO_2, PM_{10} and $PM_{2.5}$ concentrations at each of the existing and proposed receptor locations identified in **Table 12.4a** (see also **Table 12.8** and **Figure 12.2a** for receptor locations) for baseline years 2018 and 2031. The results are presented in **Table 12.14a**.

Table 12.14a: Predicted Baseline Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Existing Receptor Locations in 2018 and 2021

Receptor	Baseline 2018			Future Baseline 2031		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R1	18.6	15.9	9.9	16.7	15.4	9.5
R2	14.2	15.1	9.6	13.0	14.6	9.1
R3	14.4	15.1	9.6	13.1	14.6	9.2
R4	14.6	15.1	9.6	13.8	14.7	9.2
R5	13.6	14.9	9.7	12.2	14.4	9.2
R6	29.6	16.9	10.6	29.0	16.9	10.4
R7	18.4	16.2	10.1	17.7	16.0	9.8
R8	17.9	16.1	10.0	17.3	15.9	9.7
R9	27.6	18.4	11.4	26.7	18.4	11.2
R10	26.1	16.8	10.9	27.3	17.1	10.9
R11	35.6	18.2	11.2	35.8	18.4	11.2
R12	23.4	17.0	10.5	22.9	16.9	10.2
R13	13.6	14.8	9.4	12.7	14.4	9.0
R14	10.0	14.3	9.1	9.5	13.8	8.7
R15	20.9	15.9	10.1	19.0	15.5	9.7
R16	25.0	18.4	11.3	22.1	17.9	10.9
R17	38.5	20.1	12.5	34.7	19.8	12.0

Receptor	Baseline 2018			Future Baseline 2031		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R18	17.2	15.4	9.8	18.2	15.3	9.6
Obj	**40**	**40**	**25**	**40**	**40**	**25**

Annual mean expressed in µg/m³
Obj=Objective
Exceedances highlighted in bold.

12.4.8 The annual mean objective for NO_2 is not predicted to be exceeded at any of the existing receptors locations in 2018 and 2031.Predicted baseline concentrations of PM_{10} and $PM_{2.5}$ are well below the objectives at all receptor locations for both years.

Ecological Receptors

12.4.9 The results for the predicted baseline concentrations at ecological receptors are provided in **Table 12.15a**. The location of the ecological receptors are shown in **Figure 12.2a**.

Table 12.15a: Predicted Baseline Concentrations at Ecological Receptors in 2018 and 2031

Receptor and Distance in Habitat	Distance from Kerb (m)	Total NO_x (µg/m³)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
		2018	2031	2018	2031	2018	2031
Ardley Cutting and Quarry SSSI Transect E1							
E1 0m	0	**30.2**	26.3	**29.5**	**29.5**	1.831	1.832
E1 5m	5	**30.6**	26.6	**29.5**	**29.6**	1.833	1.834
E1 10m	10	**30.9**	27.0	**29.6**	**29.6**	1.835	1.836
E1 15m	15	**31.1**	27.2	**29.6**	**29.6**	1.835	1.837
E1 20m	20	**31.1**	27.2	**29.6**	**29.6**	1.835	1.837
E1 30m	30	**30.8**	26.9	**29.6**	**29.6**	1.834	1.836
E1 40m	40	**30.4**	26.5	**29.5**	**29.5**	1.832	1.833
E1 50m	50	**30.0**	26.1	**29.5**	**29.5**	1.830	1.831
E1 75m	75	29.2	25.2	**29.4**	**29.5**	1.825	1.826
E1 100m	100	28.5	24.6	**29.4**	**29.4**	1.822	1.823
E1 125m	125	28.1	24.1	**29.4**	**29.4**	1.819	1.820

Receptor and Distance in Habitat	Distance from Kerb (m)	Total NO_x (µg/m³)		Nitrogen Deposition (kgN/ha/yr)		Acid Deposition (keqN/ha/yr)	
		2018	2031	2018	2031	2018	2031
E1 150m	150	27.7	23.7	**29.3**	**29.3**	1.818	1.818
E1 175m	175	27.5	23.4	**29.3**	**29.3**	1.816	1.817
E1 200m	200	27.2	23.2	**29.3**	**29.3**	1.815	1.816
Critical Level /Load		**30**		**15 – 25**		0.856 – 4.856	
Ardley Cutting and Quarry SSSI Transect E2							
E2 0m	0	29.9	25.9	**29.5**	**29.5**	1.829	1.830
E2 5m	5	29.8	25.9	**29.5**	**29.5**	1.829	1.830
E2 10m	10	29.8	25.9	**29.5**	**29.5**	1.829	1.830
E2 15m	15	29.7	25.7	**29.5**	**29.5**	1.828	1.829
E2 20m	20	29.5	25.5	**29.4**	**29.5**	1.827	1.828
E2 30m	30	29.1	25.1	**29.4**	**29.4**	1.825	1.826
E2 40m	40	28.7	24.7	**29.4**	**29.4**	1.823	1.824
E2 50m	50	28.3	24.3	**29.3**	**29.4**	1.821	1.822
E2 75m	75	27.6	23.6	**29.3**	**29.3**	1.817	1.818
E2 100m	100	17.1	15.3	**29.3**	**28.5**	1.815	1.761
E2 125m	125	16.8	15.0	**29.2**	**29.3**	1.813	1.814
E2 150m	150	16.6	14.8	**29.2**	**29.3**	1.812	1.812
E2 175m	175	26.4	22.4	**29.2**	**30.0**	1.811	1.865
E2 200m	200	16.2	14.4	**29.2**	**29.2**	1.810	1.810
Critical Level /Load		**30**		**15 - 25**		**0.856 – 4.856**	

12.4.10 For Transect E1, to the east of Station Road (see **Figure 12.2a**), the NO_x critical level is predicted to be exceeded from 0m up to 50m from Station Road in 2018, whilst in 2031 the NO_x critical level is not predicted to be exceeded. The nitrogen deposition critical load is predicted to be exceeded at all receptor locations in 2018 and 2031. There are no predicted breaches of acidic range due to acid deposition within the habitat in 2018 or 2031.

12.4.11 For Transect E2, to the west of Station Road, the NO_x critical level is not predicted to be exceeded in 2018 and in 2031 the NO_x critical level is also not predicted to be exceeded. The nitrogen deposition critical load is predicted to be exceeded at all distances from Station Road in 2018 and 2031. There are no predicted exceedances of the critical loads of acid deposition within the habitats in 2016 and 2031.

12.4.12 The decrease in concentrations and deposition between 2018 and 2031 is a result of vehicle emissions reducing at a greater rate than baseline traffic levels increase over the same time period, notwithstanding the fact that vehicle emission factors for 2021 have been used for the full year assessment.

12.5 ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

Effects During Construction

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

- site preparation including delivery of construction material, erection of fences and barriers;
- demolition of existing buildings on site;
- earthworks including digging foundations and landscaping;
- materials handling such as storage of material in stockpiles and spillage;
- construction and fabrication of units; and
- disposal of waste materials off-site.

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

12.5.3 Based on the IAQM criteria (**Table 12.5**), the risk of dust emissions is considered to be large due to the size of the Application Site. The study area is considered to be of high sensitivity (**Table 12.6**), due to existing adjacent residential receptors and automobile business on land next to the Application Site. Appropriate mitigation corresponding to a high risk site is therefore required during the construction phase when work is being undertaken close to existing receptors. Mitigation is discussed later in this ES chapter.

12.5.4 During the construction period, the increase in HDV movements on the road network is predicted to be 8 AADT. This is below the threshold of 100 movements per day outside an AQMA for an assessment to be necessary according to the EPUK and IAQM guidance. The construction traffic impacts are therefore considered to be insignificant, and have been scoped out of this assessment.

Effect Significance

12.5.5 In accordance with the IAQM criteria, with the mitigation in place, the effect of construction phase dust is not significant.

Effects During Operation

Existing Receptors

12.5.6 Predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at existing receptors in 2031 both with and without the Application in place are presented in **Table 12.16a**. The 2031 future year Application assessment has been carried out using the 2031 Application Test Case traffic data described in **Paragraph 12.3.18** combined with 2021 vehicle emission factors.

Table 12.16a: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Existing Receptors in 2031.

Receptor	2031 Without Development			2031 With Development		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R1	16.7	15.4	9.5	17.3	15.5	9.5
R2	13.0	14.6	9.1	14.7	14.9	9.3
R3	13.1	14.6	9.2	14.7	14.9	9.3
R4	13.8	14.7	9.2	17.6	15.3	9.6
R5	12.2	14.4	9.2	13.2	14.5	9.3
R6	29.0	16.9	10.4	30.1	17.0	10.5
R7	17.7	16.0	9.8	21.6	16.6	10.2
R8	17.3	15.9	9.7	21.0	16.5	10.1
R9	26.7	18.4	11.2	30.2	19.0	11.5
R10	27.3	17.1	10.9	29.0	17.3	11.0
R11	35.8	18.4	11.2	38.5	18.8	11.4
R12	22.9	16.9	10.2	23.6	17.0	10.3
R13	12.7	14.4	9.0	13.3	14.5	9.1
R14	9.5	13.8	8.7	10.8	14.0	8.8
R15	19.0	15.5	9.7	20.1	15.7	9.8
R16	22.1	17.9	10.9	22.9	18.0	11.0
R17	34.7	19.8	12.0	36.0	20.0	12.2
R18	18.2	15.3	9.6	18.9	15.4	9.6
Obj	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold
Annual mean expressed in $\mu g/m^3$
(Obj=Objective)

12.5.7 **Table 12.16a** shows that predicted concentrations are below the objectives in 2031 with and without the Application in place at all receptor locations including R11 which was previously shown as exceeding in the original ES.

12.5.8 The changes in annual mean concentrations between no development and the Application being built are presented in **Table 12.17a**.

Table 12.17a: Change in Predicted Concentration brought about by the Application in 2031

Receptor	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
R1	0.61	0.08	0.05
R2	1.79	0.27	0.16
R3	1.58	0.24	0.15
R4	3.80	0.57	0.35
R5	1.01	0.14	0.09
R6	1.08	0.17	0.10
R7	3.81	0.65	0.39
R8	3.66	0.63	0.38
R9	3.54	0.60	0.37
R10	1.70	0.27	0.17
R11	2.66	0.42	0.26
R12	0.75	0.12	0.07
R13	0.61	0.10	0.06
R14	1.31	0.20	0.12
R15	1.11	0.16	0.10
R16	0.87	0.13	0.08
R17	1.32	0.18	0.11
R18	0.77	0.11	0.07

12.5.9 Based on the impact magnitude descriptors in **Table 12.9**, the changes in annual mean NO_2 concentrations range from medium to very large. The following receptors are predicted to have a very large change in NO_2 concentrations: R4 and R7, whilst a large change in concentrations is predicted at R11. For the remaining receptors, a medium change in annual mean NO_2 concentrations is predicted.

12.5.10 The changes in PM_{10} concentrations range from imperceptible to medium. A medium change in PM_{10} concentrations is predicted at the following receptors: R7, R8 and R9. Receptors R2, R3, R6, R10, R11, R14, R15 and R17 are all predicted to experience a small change in concentrations. An imperceptible change in concentrations is predicted at the remaining receptors.

12.5.11 Changes in $PM_{2.5}$ concentrations are predicted to range from imperceptible to medium. A medium change is predicted at R7, R8 and R9 and a small change at R2, R3, R4, R10, R11, R14. An imperceptible change is predicted at the remaining receptors.

12.5.12 Using the criteria set out in **Table 12.10**, the impacts on NO_2 concentrations at R4, R7, R9 and R11 are described as Moderate adverse due to the exceedance of the objective as a result of full Application traffic. The impacts at R8 and R17 are described as slight adverse. Impacts on the remaining receptors are described as negligible. Impacts on PM_{10} and $PM_{2.5}$ concentrations at all receptor locations are all described as negligible.

12.5.13 As shown in **Appendix 12.3**, NO_x emissions from the vehicle fleet will reduce very significantly in the future due to a higher proportion of lower emission vehicles. The selection of the vehicle emission year therefore has a very significant impact on the predicted concentrations. An additional set of modelling has been undertaken as a sensitivity test to assess this effect.

12.5.14 The sensitivity test modelling uses the same 2031 Application Test Case traffic data but applies 2022 emission factors and background concentrations instead of 2021 emission factors and background concentrations. In essence, this illustrates the sensitivity of the results to the emission factor year, but also how rapidly the reductions in vehicle emissions counteract the effect of the development traffic. The results of the 2022 sensitivity test modelling are shown in **Table 12.18a**, compared to the 2021 baseline concentrations.

Table 12.18a: Effect of Change in Emission Factor Years

Receptor	2031 Without Development (2021 Emission factors)			2031 With Development (2022 Emission Factors)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R1	16.7	15.4	9.5	17.1	15.5	9.5
R2	13.0	14.6	9.1	14.4	14.9	9.3
R3	13.1	14.6	9.2	14.3	14.9	9.3
R4	13.8	14.7	9.2	17.2	15.3	9.6
R5	12.2	14.4	9.2	12.8	14.5	9.3
R6	29.0	16.9	10.4	29.8	17.0	10.5
R7	17.7	16.0	9.8	21.3	16.6	10.2
R8	17.3	15.9	9.7	20.7	16.5	10.1
R9	26.7	18.4	11.2	29.8	19.0	11.5
R10	27.3	17.1	10.9	28.6	17.3	11.0
R11	35.8	18.4	11.2	38.1	18.8	11.4
R12	22.9	16.9	10.2	23.4	17.0	10.3

Receptor	2031 Without Development (2021 Emission factors)			2031 With Development (2022 Emission Factors)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R13	12.7	14.4	9.0	13.1	14.5	9.1
R14	9.5	13.8	8.7	10.5	14.0	8.8
R15	19.0	15.5	9.7	19.7	15.7	9.8
R16	22.1	17.9	10.9	22.2	18.0	10.9
R17	34.7	19.8	12.0	35.4	19.9	12.1
R18	18.2	15.3	9.6	18.6	15.4	9.6
Obj	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold
Annual mean expressed in µg/m^3
Obj=Objective

12.5.15 **Table 12.18a** shows that with the Application in place the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the objectives in 2031 at all receptor locations assuming 2022 vehicle emission factors.

Proposed Receptors

12.5.16 Concentrations at proposed receptor locations within the Application Site in place in 2021 are presented in **Table 12.19a**. The locations of these proposed receptors are shown on **Figure 12.2a.**

Table 12.19a: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Proposed Receptors in 2031.

Receptor	2031 With Development		
	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean[a]	Annual Mean[a]	Annual Mean[a]
PR1	13.5	15.5	9.5
PR2	24.1	17.9	10.9
PR3	14.3	14.9	9.4
Obj	**40**	**40**	**25**

Exceedances highlighted in bold
Annual mean expressed in µg/m^3
Obj=Objective

12.5.17 Predicted concentrations in 2031 at proposed receptor locations within the Application Site are well below the relevant objectives. The

Application Site is therefore considered suitable for the proposed mixed-use development.

Effect Significance

12.5.18 The predicted full Application traffic NO_2 concentrations with emission factors one year later than the opening year are lower than the opening year baseline concentrations at a number of receptor locations, and in particular at R11. Taking into account the temporary nature of the effect, and the use of traffic for the full Application for the opening year of the assessment, the air quality effects of road traffic generated by the Application are considered to be not significant. This judgement is also based upon the assessment criteria set out in **paragraph 12.3.34**, in particular, that a conservative assessment has been carried out.

Ecological Receptors

12.5.19 Predicted concentrations and deposition rates without and with the Application in place in 2031 are contained in **Table 12.20a**.

Table 12.20a: Predicted Concentrations at Ecological Receptors in 2031 With and Without the Application in Place

Receptor and Distance in Habitat	2031 Without Development			2031 With Development		
	Total NO_x (µg/m^3)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m^3)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	26.3	**29.5**	1.832	29.1	29.7	1.848
E1 5m	26.6	**29.6**	1.834	29.6	29.8	1.850
E1 10m	27.0	**29.6**	1.836	**30.2**	29.8	1.853
E1 15m	27.2	**29.6**	1.837	**30.4**	29.8	1.854
E1 20m	27.2	**29.6**	1.837	**30.4**	29.8	1.854
E1 30m	26.9	**29.6**	1.836	**30.0**	29.8	1.852
E1 40m	26.5	**29.5**	1.833	29.4	29.8	1.849
E1 50m	26.1	**29.5**	1.831	28.8	29.7	1.846
E1 75m	25.2	**29.5**	1.826	27.5	29.6	1.839
E1 100m	24.6	**29.4**	1.823	26.6	29.6	1.834
E1 125m	24.1	**29.4**	1.820	25.9	29.5	1.830
E1 150m	23.7	**29.3**	1.818	25.4	29.5	1.827
E1 175m	23.4	**29.3**	1.817	25.0	29.4	1.825
E1 200m	23.2	**29.3**	1.816	24.6	29.4	1.823

Receptor and Distance in Habitat	2031 Without Development			2031 With Development		
	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Critical Level / Load	**30**	**15 - 25**	**0.856 – 4.856**	**30**	**15 - 25**	**0.856 – 4.856**
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	25.9	**29.5**	1.830	28.7	**29.7**	1.843
E2 5m	25.9	**29.5**	1.830	29.2	**29.7**	1.842
E2 10m	25.9	**29.5**	1.830	29.7	**29.7**	1.842
E2 15m	25.7	**29.5**	1.829	29.9	**29.7**	1.841
E2 20m	25.5	**29.5**	1.828	29.9	**29.6**	1.840
E2 30m	25.1	**29.4**	1.826	29.5	**29.6**	1.836
E2 40m	24.7	**29.4**	1.824	28.9	**29.5**	1.833
E2 50m	24.3	**29.4**	1.822	28.4	**29.5**	1.830
E2 75m	23.6	**29.3**	1.818	27.2	**29.4**	1.825
E2 100m	15.3	**28.5**	1.761	26.3	**28.6**	1.768
E2 125m	15.0	**29.3**	1.814	25.6	**29.4**	1.820
E2 150m	14.8	**29.3**	1.812	25.1	**29.3**	1.818
E2 175m	22.4	**30.0**	1.865	24.7	**30.1**	1.870
E2 200m	14.4	**29.2**	1.810	24.4	**29.3**	1.815
Critical Level / Load	**30**	**15 - 25**	**0.856 – 4.856**	**30**	**15 - 25**	**0.856 – 4.856**

12.5.20 The changes in the total NO_x nitrogen deposition and acid deposition brought about by the Application are presented in **Table 12.21a**.

Table 12.21a: Predicted Application Contribution in 2031

Receptor and Distance in Habitat	2031 Development Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	(µg/m³)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	2.4	**8.1**	0.19	**1.3**	0.014	0.3

Receptor and Distance in Habitat	2031 Development Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	(µg/m³)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
E1 5m	2.5	**8.5**	0.18	**1.2**	0.013	0.3
E1 10m	2.7	**8.9**	0.19	**1.3**	0.014	0.3
E1 15m	2.7	**9.1**	0.20	**1.3**	0.014	0.3
E1 20m	2.7	**9.1**	0.20	**1.4**	0.015	0.3
E1 30m	2.6	**8.7**	0.20	**1.4**	0.015	0.3
E1 40m	2.5	**8.2**	0.19	**1.3**	0.014	0.3
E1 50m	2.3	**7.7**	0.18	**1.2**	0.013	0.3
E1 75m	2.0	**6.6**	0.17	**1.2**	0.012	0.3
E1 100m	1.7	**5.7**	0.15	**1.0**	0.011	0.2
E1 125m	1.5	**5.1**	0.13	0.9	0.009	0.2
E1 150m	1.4	**4.7**	0.12	0.8	0.008	0.2
E1 175m	1.3	**4.3**	0.11	0.7	0.008	0.2
E1 200m	1.2	**4.0**	0.10	0.7	0.007	0.1
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	2.3	**7.6**	0.17	**1.1**	0.013	0.3
E2 5m	2.3	**7.6**	0.17	**1.1**	0.013	0.2
E2 10m	2.3	**7.5**	0.17	**1.1**	0.013	0.2
E2 15m	2.2	**7.3**	0.17	**1.1**	0.012	0.2
E2 20m	2.1	**7.1**	0.16	**1.1**	0.012	0.2
E2 30m	1.9	**6.5**	0.15	**1.0**	0.011	0.2
E2 40m	1.8	**5.9**	0.13	0.9	0.010	0.2
E2 50m	1.6	**5.4**	0.12	0.8	0.009	0.2
E2 75m	1.4	**4.5**	0.10	0.7	0.008	0.2
E2 100m	1.2	**3.9**	0.09	0.6	0.007	0.1
E2 125m	1.0	**3.5**	0.08	0.5	0.006	0.1
E2 150m	0.9	**3.1**	0.07	0.5	0.006	0.1

Receptor and Distance in Habitat	2031 Development Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	(μg/m³)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
E2 175m	0.9	**2.9**	0.07	0.4	0.005	0.1
E2 200m	0.8	**2.7**	0.06	0.4	0.005	0.1

12.5.21 For both transects E1 and E2, the nitrogen deposition critical load is predicted to be exceeded at all distances from Station Road with the Application in place. For transect E1, the increase in nitrogen deposition is above 1% of the critical load from 0-100m from the road. For transect E2, the increase in nitrogen deposition is 1% of the critical load from 0-30m from the road. Therefore, the increase in nitrogen deposition is potentially significant across these short distances for E1 and E2. However, the maximum increase in deposition is only 1.4% of the critical load and the area across E1 and E2 combined where the increase is above 1% of the critical load is only approximately <2.4% of the total area of the habitat in the SSSI.

12.5.22 There are no predicted exceedances of the critical level for NO_x or critical load for acid deposition within the habitat in 2031 with the Application in place.

12.5.23 The assessment has been undertaken assuming that background deposition rates remain unchanged from current rates. Future reductions in vehicle emissions are expected to reduce background deposition rates more than the predicted development contributions.

Effect Significance

12.5.24 On ecological habitats, air quality effects of road traffic generated by the Application are considered to be **potentially significant** as the increase of nitrogen deposition is a maximum of 1.4% of the critical load. The deposition is dominated by the assumed baseline rate. An assessment of the effects of the development in terms of nitrogen deposition should be undertaken by a trained ecologist.

Summary of Significance of Effects (Before Mitigation)

12.5.25 A summary of the significance of effects is provided in **Table 12.22**. For the air quality assessment, all of the assessed receptor locations are sensitive receptors.

Table 12.22: Significance of Effects (before Mitigation)

Environmental Effect	Sensitivity of Receptor	Impact Magnitude	Nature of Impact (Permanent / Temporary)	Significance of Effect
Construction Dust	NA	NA	Temporary	NA
Road traffic emissions on human health receptors	NA	Not significant	Permanent	Not significant
Road traffic emissions on Ardley Cutting and Quarry SSSI	NA	Not significant	Permanent	Not significant

12.5.26 Following the assessment, there have been minor changes to traffic internal to the site. These changes in traffic are not significant and will not affect the results or significance of the effects outlined above.

12.6 SCOPE OF MITIGATION AND ENHANCEMENT

Construction

12.6.1 A Construction Environmental Management Plan (CEMP) will be prepared in advance of construction (as described in Chapter 2 of the ES) that sets out measures to manage the construction works. The following standard mitigation measures from the IAQM 2016 guidance to address potential high risk effects are recommended, and would be included within the CEMP and agreed with CDC.

Communication

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

Management

- Develop and implement a dust management plan.
- Record all dust and air quality complaints, identify causes and take measures to reduce emissions.
- Record exceptional incidents and action taken to resolve the situation.
- Carry out regular site inspections to monitor compliance with the dust management plan and record results.
- Increase site inspection frequency during prolonged dry or windy conditions and when activities with high dust potential are being undertaken.
- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary at least as high as any stockpile on site.

- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site run off of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove potentially dusty materials from site as soon as possible.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure all vehicles switch off engines when stationary.
- Avoid the use of diesel or petrol powered generators where possible.
- Produce a Construction Logistics Plan to manage the delivery of goods and materials.
- Only use cutting, grinding and sawing equipment with dust suppression equipment.
- Ensure an adequate supply of water on site for dust suppressant.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use water sprays on such equipment where appropriate.
- Ensure equipment is readily available on site to clean up spillages of dry materials.
- No on-site bonfires and burning of waste materials on site.

Demolition

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

Earthworks

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

Trackout

- Use water assisted dust sweepers on the site access and local roads.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials.
- Record inspection of on-site haul routes and any subsequent action, repairing as soon as reasonably practicable.
- Install hard surfaced haul routes which are regularly damped down.
- Install a wheel wash with a hard-surfaced road to the site exit where site layout permits.
- The site access gate to be located at least 10m from receptors where possible.

12.6.2 With these mitigation measures in place, construction effects are considered to be not significant.

Operation

12.6.3 The effects of Application traffic on residential receptors are judged to be not significant. No further traffic mitigation above and beyond that described in **Chapter 6: Transport and Access** is therefore proposed to control the direct effects of the development.

12.6.4 Transport mitigation will be incorporated within the Application Site as outlined in **Chapter 6: Transport and Access**. This will reduce the traffic generation that has been assessed in the ES and therefore the predicted impacts, as well as reducing emissions from the Application.

Table 12.23: Mitigation

Ref	Measure to avoid, reduce or manage any adverse effects and/or to deliver beneficial effects	How measure would be secured		
		By Design	By S.106	By Condition
1	Construction Phase Mitigation in CEMP	-	-	X
2	Operational Phase Mitigation	-	-	X

12.7 RESIDUAL EFFECTS ASSESSMENT

12.7.1 Both the construction and operational effects of the Application pre-mitigation are not significant. The residual effects of the Application are therefore also not significant. The residual effects are summarised in **Table 12.24**.

Table 12.24: Residual Significance of Effects Assessment

Effect	Sensitivity of Receptor	Impact Magnitude	Nature of Impact (Permanent / Temporary)	Mitigation	Geographical Importance	Residual Effect
Construction Dust	NA	NA	Temporary	CEMP	Local	Not Significant
Road traffic emissions on human health receptors	NA	Not significant	Permanent	Travel Plan	Local	Not significant
Road traffic emissions on Ardley Cutting and Quarry SSSI	NA	Not significant	Permanent	Travel Plan	Local	Not significant

12.8 CUMULATIVE AND IN-COMBINATION EFFECTS

12.8.1 The cumulative developments included in the assessment of cumulative and in-combination effects are described in **Table 2.5a** of **Chapter 2** of the ES.

Construction Effects

12.8.2 Cumulative construction dust effects could potentially occur should construction of the cumulative schemes in the vicinity of the Application Site occur at the same time. However, significant cumulative effects are unlikely to occur as each development is anticipated to employ similar dust mitigation techniques such that the individual construction phase effect is not significant, alone or in combination with other schemes.

Road Traffic Effects

12.8.3 The 2031 Application Test Case traffic data, used in the future year air quality assessment for the Application, takes into account cumulative development in the area. However, an additional traffic scenario has been used to assess the cumulative air quality effects of the full Heyford Park Allocation, in addition to the Application Site. Modelling of the effects of the Allocation has been based on the cumulative 2031 Allocation Test Case traffic data which includes the following:

- Appropriate levels of background growth;
- Consented Heyford Park development (1,178 residential units and 1,700 jobs);
- Committed Local Plan/third party development sites (North West Bicester, Kingsmere, Network Bicester, and Bicester Gateway); and
- The full Site Allocation (1,600 residential units, 1,500 jobs).

Existing Receptors

12.8.4 Concentrations have been predicted at existing receptor locations in 2031 with the Allocation in place and without either the Allocation or the Application in place (2031 without development). The results are presented in **Table 12.25a**.

Table 12.25a: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$

Receptor	2031 Without Development			2031 With Allocation		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R1	16.7	15.4	9.5	17.4	15.5	9.5
R2	13.0	14.6	9.1	15.1	14.9	9.3
R3	13.1	14.6	9.2	14.9	14.9	9.3
R4	13.8	14.7	9.2	18.3	15.4	9.6
R5	12.2	14.4	9.2	13.4	14.5	9.3
R6	29.0	16.9	10.4	30.4	17.1	10.6
R7	17.7	16.0	9.8	22.3	16.8	10.3
R8	17.3	15.9	9.7	21.7	16.6	10.2
R9	26.7	18.4	11.2	31.1	19.2	11.6
R10	27.3	17.1	10.9	29.4	17.4	11.1
R11	35.8	18.4	11.2	39.1	18.9	11.5
R12	22.9	16.9	10.2	23.8	17.1	10.3
R13	12.7	14.4	9.0	13.5	14.5	9.1
R14	9.5	13.8	8.7	11.1	14.1	8.9
R15	19.0	15.5	9.7	20.3	15.7	9.8
R16	22.1	17.9	10.9	23.1	18.0	11.0
R17	34.7	19.8	12.0	36.3	20.0	12.2
R18	18.2	15.3	9.6	19.1	15.4	9.6
Obj[b]	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold
Annual mean expressed in µg/m^3
Obj=Objective

12.8.5 The changes in annual mean concentrations between no development and Allocation being in place are presented in **Table 12.26a**, based on unrounded numbers.

Table 12.26a: Change in Predicted Concentration brought about by the Allocation

Receptor	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean (μg/m^3)	Annual Mean (μg/m^3)	Annual Mean (μg/m^3)
R1	0.7	0.1	0.9
R2	2.1	0.3	0.5
R3	1.9	0.3	0.5
R4	4.6	0.7	0.8
R5	1.2	0.2	0.3
R6	1.4	0.2	1.9
R7	4.5	0.8	1.6
R8	4.4	0.7	1.5
R9	4.4	0.8	2.0
R10	2.1	0.3	1.8
R11	3.3	0.5	2.7
R12	0.9	0.1	1.5
R13	0.8	0.1	0.5
R14	1.7	0.3	0.3
R15	1.3	0.2	1.0
R16	1.0	0.2	0.8
R17	1.5	0.2	2.0
R18	0.9	0.1	0.8

12.8.6 Based on the impact magnitude descriptors in **Table 12.9**, the changes in annual mean NO_2 concentrations range from medium to very large. R4, R7, R8 and R9 are predicted to experience a very large change. R11 is predicted to have a large effect. All other receptors are expected to have a medium effect.

12.8.7 The changes in PM_{10} concentrations range from imperceptible to medium. A medium change in PM_{10} concentrations is predicted at the following receptors: R4, R7, R8, R9. Receptors R2, R3, R6, R10, R11, R14, R15 and R17 are predicted to experience a small change in PM_{10} concentrations. The remaining receptors are predicted to experience an imperceptible change in PM_{10} concentrations.

12.8.8 Changes in $PM_{2.5}$ concentrations are predicted to range from small to very large. A very large change is predicted at R11, large changes at R6-10, R12 and R17 and small at R14. A medium change is predicted at the remaining receptors.

12.8.9 Using the criteria set out in **Table 12.10,** the impacts on NO_2 concentrations at R4, R7, R8, R9 and R11 are described as **moderate** adverse. The impacts at R6 are described as slight and all other impacts described as negligible. Impacts on PM_{10} concentrations at all receptor locations are all described as negligible. $PM_{2.5.}$ concentrations show a moderate impact at R11, slight impacts at R6-9, R12 and R17 and negligible at all others.

12.8.10 An additional set of modelling has been undertaken as part of the sensitivity test to illustrate the effects of changes in vehicle emission factors on the predicted concentrations. The sensitivity test modelling uses the same 2031 Allocation Test Case traffic data, but instead uses 2022 emission factors and background concentrations. The results of the cumulative scenario sensitivity test are shown in **Table 12.27a**.

Table 12.27a: Effect of Change in Emission Factor Years

Receptor	2031 Without Development (2021 Emission Factors)			2031 With Allocation (2022 Emission Factors)		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean	Annual Mean
R1	17.2	15.5	9.5	16.7	15.4	9.4
R2	12.3	15.2	9.2	13.8	15.4	9.3
R3	12.5	15.3	9.2	13.6	15.4	9.3
R4	13.1	14.4	9.0	16.8	15.0	9.3
R5	10.5	14.0	8.8	11.2	14.0	8.8
R6	31.8	17.1	10.7	30.8	17.2	10.7
R7	24.9	18.6	11.3	27.6	19.2	11.6
R8	24.4	18.5	11.2	26.9	19.1	11.6
R9	26.3	16.8	10.5	28.9	17.4	10.8
R10	27.2	16.8	10.5	27.4	17.0	10.5
R11	37.8	18.0	11.3	38.3	18.4	11.4
R12	24.4	16.5	10.3	23.6	16.4	10.2
R13	14.8	14.8	9.5	14.8	14.8	9.4
R14	8.6	14.1	8.7	9.8	14.3	8.8
R15	17.5	15.7	9.6	17.6	15.8	9.6
R16	15.8	15.4	9.5	15.9	15.4	9.4
R17	32.3	19.1	11.6	31.5	19.1	11.5
R18	19.5	15.8	10.1	19.3	15.7	10.0
Objective	**40**	**40**	**25**	**40**	**40**	**25**

Exceedances highlighted in bold
Annual mean expressed in µg/m^3

12.8.11 **Table 12.27a** shows that with the Allocation in place the predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ are below the objectives in 2031 at all receptor locations assuming 2022 vehicle emission factors.

12.8.12 As with the assessment of Application traffic, no predicted exceedance occurs with 2022 emission factors, and this is a more likely scenario to occur in practice as all of the Allocation traffic will not be on the road network in 2021.

Proposed Receptors

12.8.13 Concentrations at proposed receptor locations within the Application Site in 2031 are presented in **Table 12.28a**.

Table 12.28a: Predicted Concentrations of NO_2, PM_{10} and $PM_{2.5}$ at Proposed Receptors with the Allocation in Place

Receptor	2031 with Allocation		
	NO_2	PM_{10}	$PM_{2.5}$
	Annual Mean[a]	Annual Mean[a]	Annual Mean[a]
PR1	13.8	15.5	9.5
PR2	24.8	18.1	11.0
PR3	14.6	15.0	9.4
Obj[b]	**40**	**40**	**25**

Exceedances highlighted in bold

a) Annual mean expressed in $\mu g/m^3$

b) Obj=Objective

12.8.14 Predicted concentrations in 2031 at receptor locations within the Application Site are well below the relevant objectives with the Allocation in place. The Application Site is therefore considered suitable for the proposed mixed-use development.

Effect Significance

12.8.15 The predicted full Allocation traffic NO_2 concentrations with emission factors one year later than the opening year are all lower than the air quality objectives. Taking into account the temporary nature of the effect, and the use of full Allocation traffic for the opening year of the assessment, the air quality effects of road traffic generated by the Allocation are considered to be not significant. This judgement is also based upon the assessment criteria set out in **paragraph 12.3.37**, in particular, that a conservative assessment has been carried out.

Ecological Receptors

12.8.16 Predicted concentrations and deposition rates without the development in place, and with the Allocation in place, are contained in **Table 12.29a**.

Table 12.29a: Predicted Concentrations at Ecological Receptors in 2031

Receptor and Distance in Habitat	2031 Without Development			2031 with Allocation		
	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	26.6	**29.6**	1.834	29.6	**29.8**	1.850
E1 5m	27.0	**29.6**	1.836	**30.2**	**29.8**	1.853
E1 10m	27.4	**29.6**	1.838	**30.7**	**29.9**	1.856
E1 15m	27.5	**29.6**	1.839	**31.0**	**29.9**	1.857
E1 20m	27.5	**29.6**	1.839	**31.0**	**29.9**	1.857
E1 30m	27.2	**29.6**	1.837	**30.5**	**29.8**	1.855
E1 40m	26.8	**29.6**	1.835	29.9	**29.8**	1.851
E1 50m	26.4	**29.5**	1.833	29.2	**29.8**	1.848
E1 75m	25.4	**29.5**	1.828	27.9	**29.7**	1.841
E1 100m	24.8	**29.4**	1.824	26.9	**29.6**	1.836
E1 125m	24.3	**29.4**	1.821	26.2	**29.5**	1.832
E1 150m	23.9	**29.4**	1.819	25.6	**29.5**	1.829
E1 175m	23.6	**29.3**	1.818	25.2	**29.5**	1.826
E1 200m	23.4	**29.3**	1.816	24.8	**29.4**	1.824
Critical Level / Load	**30**	**15 - 25**	**0.856 – 4.856**	**30**	**15 - 25**	**0.856 – 4.856**
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	26.2	**29.5**	1.832	29.1	**29.7**	1.847
E2 5m	26.2	**29.5**	1.832	29.0	**29.7**	1.847
E2 10m	26.1	**29.5**	1.832	29.0	**29.7**	1.847
E2 15m	26.0	**29.5**	1.831	28.8	**29.7**	1.846
E2 20m	25.8	**29.5**	1.830	28.5	**29.7**	1.844
E2 30m	25.3	**29.5**	1.827	27.8	**29.6**	1.840
E2 40m	24.9	**29.4**	1.825	27.1	**29.6**	1.837
E2 50m	24.5	**29.4**	1.823	26.6	**29.6**	1.834

Receptor and Distance in Habitat	2031 Without Development			2031 with Allocation		
	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)	Total NO_x (µg/m³)	Nitrogen Deposition (kgN/ha/yr)	Acid Deposition (keqN/ha/yr)
E2 75m	23.8	**29.3**	1.819	25.5	**29.5**	1.828
E2 100m	23.3	**29.3**	1.816	24.7	**29.4**	1.824
E2 125m	15.1	**29.3**	1.814	16.4	**29.4**	1.822
E2 150m	14.9	**29.3**	1.813	16.0	**29.4**	1.819
E2 175m	14.7	**29.2**	1.812	15.7	**29.3**	1.818
E2 200m	14.5	**29.2**	1.811	15.5	**29.3**	1.816
Critical Level / Load	**30**	**15 - 25**	**0.856 – 4.856**	**30**	**15 - 25**	**0.856 – 4.856**

12.8.17 The changes in the total NO_x nitrogen deposition and acid deposition brought about by the Allocation are presented in **Table 12.30a**.

Table 12.30a: Predicted Allocation Contribution in 2031

Receptor and Distance in Habitat	2031 Allocation Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	($\mu g/m^3$)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
Ardley Cutting and Quarry SSSI Transect E1						
E1 0m	3.0	**10.1**	0.23	**1.5**	0.016	0.3
E1 5m	3.2	**10.6**	0.24	**1.6**	0.017	0.3
E1 10m	3.4	**11.2**	0.25	**1.7**	0.018	0.4
E1 15m	3.4	**11.5**	0.26	**1.7**	0.018	0.4
E1 20m	3.4	**11.4**	0.25	**1.7**	0.018	0.4
E1 30m	3.3	**10.9**	0.24	**1.6**	0.017	0.4
E1 40m	3.1	**10.3**	0.23	**1.5**	0.016	0.3
E1 50m	2.9	**9.6**	0.22	**1.4**	0.015	0.3
E1 75m	2.5	**8.2**	0.19	**1.2**	0.013	0.3
E1 100m	2.2	**7.2**	0.16	**1.1**	0.012	0.2
E1 125m	1.9	**6.4**	0.15	**1.0**	0.010	0.2
E1 150m	1.7	**5.8**	0.13	0.9	0.010	0.2
E1 175m	1.6	**5.4**	0.12	0.8	0.009	0.2
E1 200m	1.5	**5.0**	0.11	0.7	0.008	0.2
Ardley Cutting and Quarry SSSI Transect E2						
E2 0m	2.9	**9.6**	0.21	**1.4**	0.015	0.3
E2 5m	2.8	**9.5**	0.21	**1.4**	0.015	0.3
E2 10m	2.8	**9.4**	0.21	**1.4**	0.015	0.3
E2 15m	2.8	**9.2**	0.21	**1.4**	0.015	0.3
E2 20m	2.7	**8.9**	0.20	**1.3**	0.014	0.3
E2 30m	2.4	**8.1**	0.18	**1.2**	0.013	0.3
E2 40m	2.2	**7.4**	0.17	**1.1**	0.012	0.2
E2 50m	2.0	**6.8**	0.15	**1.0**	0.011	0.2
E2 75m	1.7	**5.6**	0.13	0.9	0.009	0.2
E2 100m	1.5	**4.9**	0.11	0.7	0.008	0.2

Receptor and Distance in Habitat	2031 Allocation Contribution					
	Total NO_x		Nitrogen Deposition		Acid Deposition	
	(µg/m³)	%	(kgN/ha/yr)	%	(keq/ha/yr)	%
E2 125m	1.3	**4.3**	0.10	0.7	0.007	0.1
E2 150m	1.2	**3.9**	0.09	0.6	0.007	0.1
E2 175m	1.1	**3.6**	0.08	0.6	0.006	0.1
E2 200m	1.0	**3.3**	0.08	0.5	0.006	0.1

12.8.18 For transects E1 (Eastward), the nitrogen deposition critical load is predicted to be exceeded at distances from station road up to 125 m and for E2 (Westward), the exceedance is seen up to 50 m with the Allocation in place. For transect E1, the increase in nitrogen deposition is 1% of the critical load from 0-150m from the road. For transect E2, the increase in nitrogen deposition is greater than 1% of the critical load from 0-50m from the road. Therefore, the increase in nitrogen deposition is potentially significant across these distances for E1 and E2. However, the maximum increase in deposition is only 1.7% of the critical load, and the area across E1 and E2 combined where the increase is above 1% of the critical load is approximately no more than 3.4% of the total area of the habitat.

12.8.19 There are no predicted exceedances of the critical level for NO_x or critical load for acid deposition within the habitat in 2031 with the Allocation in place.

12.8.20 The assessment has been undertaken assuming that background deposition rates remain unchanged from current rates. Future reductions in vehicle emissions are expected to reduce background deposition rates.

Effect Significance

12.8.21 On ecological habitats, air quality effects of road traffic generated by the Allocation are considered to be potentially significant as the increase of nitrogen deposition is a maximum of 1.7% of the critical load, and only more than 1% for less than 3.4% of the total habitat area. In addition, the deposition is dominated by the assumed baseline rate. This judgement is made based on the assessment criteria set out in **paragraph 12.3.38**, in particular, that a conservative assessment has been carried out.

12.9 MONITORING

12.9.1 No monitoring is deemed necessary to ensure that effective mitigation is maintained.

12.10 CONCLUSIONS

12.10.1 The assessment has demonstrated that with the use of appropriate mitigation measures, the Application Site is still suitable for development and would not result in any significant air quality effects.

12.10.2 The ecological exceedance of critical load shown by this assessment could be potentially significant and should be assessed by a trained ecologist.

Table 12.31: Summary of Effects

Receptor / Receiving Environment	Description of Effect	Nature of Effect	Sensitivity Value	Magnitude of Effect	Geographical Importance	Significance of Effects	Mitigation / Enhancement Measures	Residual Effects
Construction								
Existing residential receptors	Dust deposition and elevated PM_{10} concentrations.	Temporary	NA	NA	L	NA	Standard high risk mitigation measures from the IAQM 2016 guidance to be applied	Not significant
Operation								
Existing and proposed residential receptors	Elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant
Ecological receptors	Elevated NO_x and acid deposition from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant
Cumulative and In-combination								
Operational								
Emissions of NO_2, PM_{10} and $PM_{2.5}$ from operational traffic	Elevated NO_2, PM_{10} and $PM_{2.5}$ concentrations from operational traffic	Permanent	NA	Not significant	L	Not significant	Mitigation as per Transport Chapter	Not significant
Ecological	Elevated NO_x and acid deposition	Permanent	NA	Not	L	Not	Mitigation as per Transport	Not

receptors	from operational traffic			significant		significant	Chapter	significant

APPENDIX 12.1 – VERIFICATION

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emission of nitrogen oxides (NO_x = NO + NO_2). The model has been run to predict the 2018 annual mean road-NOx contribution at two roadside diffusion tubes (identified in **Table 12.10**).

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

A primary adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (**Figure 12.1.1**). This factor was then applied to the modelled road-NO_x concentration for each monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentrations were then determined by combining the adjusted modelled road-NO_x concentrations with the predicted background NO_2 concentration within the NO_x from NO_2 calculator. A secondary adjustment factor was finally calculated as the slope of the best fit line applied to the adjusted data and forced through zero (**Figure 12.1.2**).

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

Primary adjustment factor: 2.131122

Secondary adjustment factor: 1.0000

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

Figure 12.1.3 compares final adjusted modelled total NO_2 at each of the monitoring sites, to measured total NO_2, and shows the 1:1 relationship, as well as ±10% and ±25% of the 1:1 line. All of the monitoring sites lie within the ±25% line.

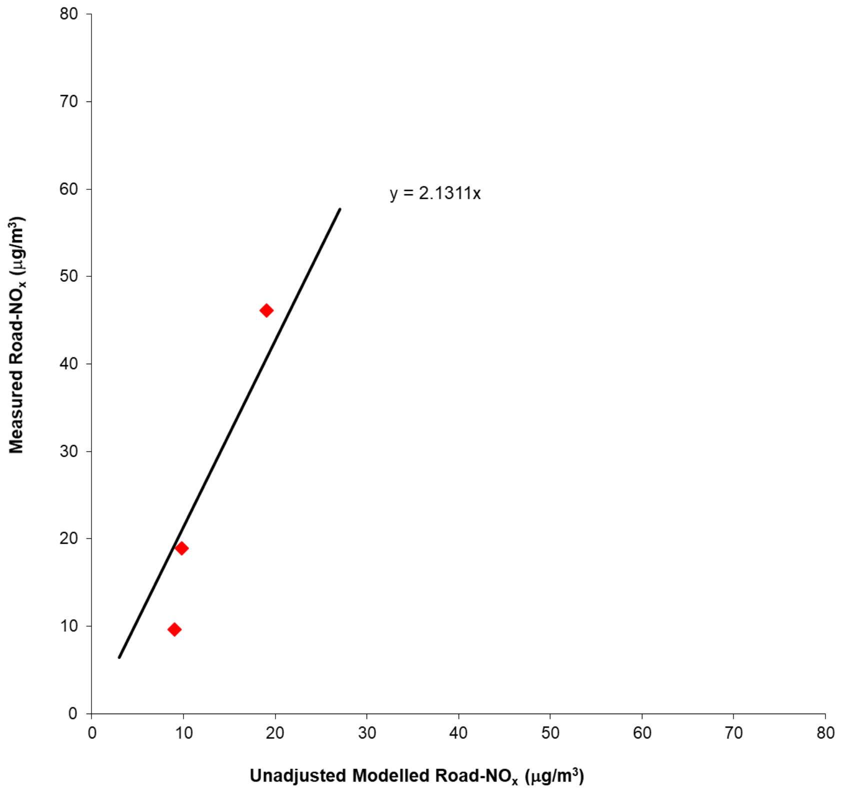


Figure 12.1.1: Comparison of Measured Road-NOx with Unadjusted Modelled Road-NO_x Concentrations

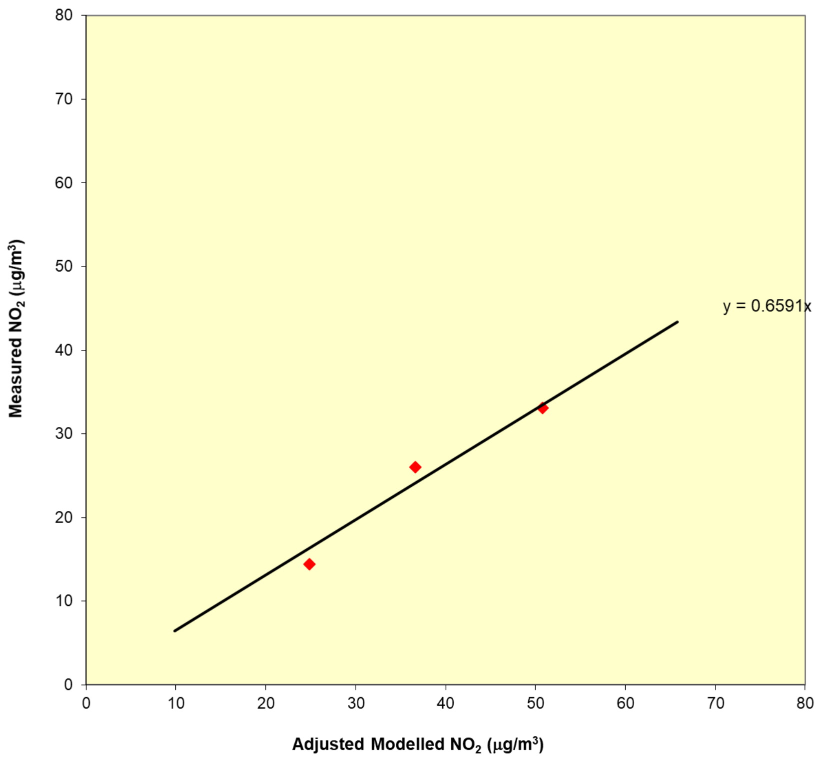


Figure 12.1.2: Comparison of Measured Road-NO_x with Adjusted Modelled Road-NO_x Concentrations

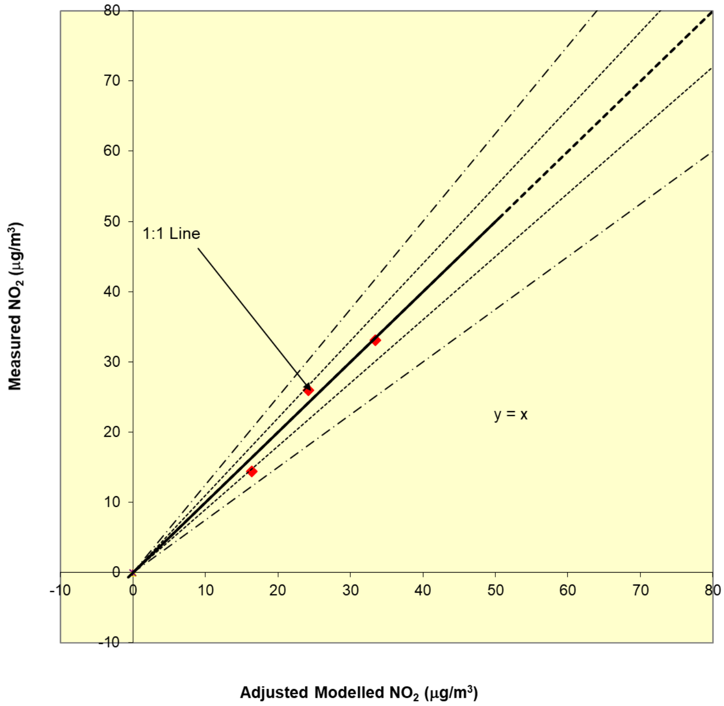


Figure 12.1.3: Comparison of Final Adjusted NO_2 with Measured NO_2 Concentrations

<u>PM_{10} and $PM_{2.5}$</u>

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

APPENDIX 12.2 – TRAFFIC DATA

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
1	A260 Oxford Road	10169	4.64%	11931	4.55%	13454	4.25%	13716	4.19%
2	B430	4400	2.85%	5155	2.81%	5859	2.67%	5959	2.64%
3	Station Road	5460	5.45%	6847	5.10%	9745	4.05%	10222	3.91%
4	A260 Banbury Road	10511	4.42%	11988	4.41%	11997	4.41%	11999	4.41%
5	Station Road	3078	5.90%	4625	4.82%	9184	3.15%	10126	2.94%
6	B4030 Lower Heyford Road (west)	4708	3.57%	5368	3.56%	5368	3.56%	5368	3.56%
7	Water Street	2459	5.35%	2806	5.34%	2891	5.22%	2891	5.22%
8	Camp Road (west of Kirtlington Road)	2333	7.94%	3457	6.56%	6784	4.29%	7455	4.02%
9	Kirtlington Road	566	1.34%	717	1.33%	969	1.33%	1034	1.31%
10	Port Way	2356	1.97%	2759	1.95%	3004	1.90%	3069	1.88%
12	B4030 Lower Heyford Road (east)	4401	3.25%	5017	3.24%	5021	3.24%	5021	3.24%
15	Unnamed Road (north of	3791	3.70%	5400	3.20%	8437	2.60%	9243	2.45%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
	B4030)								
16	B4030 (south)	8524	3.01%	11286	2.88%	14338	2.55%	15143	2.46%
17	Unnamed Road (west of B430)	2153	8.57%	4050	5.89%	9223	4.10%	10249	3.79%
18	M40 Junction 10 Northbound Slip A	32558	10.42%	39344	9.89%	45108	8.85%	46158	8.67%
19	M40 Junction 10 Northbound Slip B	26703	12.55%	31218	12.47%	33129	11.85%	33590	11.70%
20	B430 Ardley Road North	13302	5.02%	17580	4.67%	24590	3.77%	25968	3.62%
118	B430 Ardley Road South	8760	5.55%	12230	4.56%	12230	4.56%	12230	4.56%
22	B4030 Bicester Road	8281	4.95%	13905	4.22%	15444	3.94%	15783	3.88%
23	B430 Oxford Road	9848	3.97%	11990	3.77%	13487	3.49%	13954	3.40%
24	B4030 South of Lower Heyford Road	8239	3.50%	10277	3.31%	13329	2.85%	14134	2.74%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
27	Camp Road (east of Kirtlington Road)	2558	7.34%	3827	5.91%	7270	4.19%	7988	3.93%
29	Unnamed Road (East of A4260 Banbury Road)	718	1.20%	1286	1.21%	2795	1.25%	3232	1.21%
37	A4260 (north of Somerton / North Ashton Roads)	10830	4.44%	12686	4.37%	14209	4.10%	14471	4.04%
38	North Ashton Road	1518	1.26%	1730	1.26%	1730	1.26%	1730	1.26%
39	Somerton Road	1429	3.02%	1629	3.01%	1629	3.01%	1629	3.01%
47	B430 Northampton Road	8105	3.88%	10502	3.47%	11999	3.19%	12465	3.11%
60	A43 east of B4110	46407	10.94%	55418	10.47%	59368	9.89%	60014	9.80%
67	Middleton Stoney Road	8822	2.22%	14762	1.54%	16114	1.53%	16405	1.52%
70	Camp Road (east of gate	3586	8.77%	5235	7.24%	7847	4.89%	8745	4.52%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
	7)								
71	Development Access 2	0	0.00%	0	0.00%	424	1.24%	897	1.24%
72	Camp Road (west of Development Access 2a)	4024	8.73%	5589	7.75%	8362	5.26%	9440	4.80%
73	Development Access 2a	0	0.00%	0	0.00%	281	1.24%	281	1.24%
74	Camp Road (east of Development Access 2a)	4024	8.74%	5583	7.76%	8473	5.21%	9551	4.77%
75	Development Access 3 South	348	1.24%	346	0.91%	346	0.91%	818	1.10%
76	Camp Road (East of Development Access 3 South)	4157	8.48%	5717	7.60%	8608	5.14%	9865	4.65%
77	Access 3a	0	0.00%	0	0.00%	281	1.24%	281	1.24%
78	Camp Road (East of Development	4155	8.47%	5720	7.59%	8718	5.09%	9975	4.61%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
	Access 3a)								
86	Development Access 7	1269	1.24%	1963	0.89%	1963	0.89%	1963	0.89%
87	Development Access 8	575	4.10%	1157	2.66%	5061	0.88%	5219	0.89%
88	Camp Road (East of Development Access 8)	4999	7.60%	7251	6.34%	10821	4.40%	12139	4.06%
90	Camp Road (East of Development Access 9)	5174	7.34%	7464	6.18%	11063	4.32%	12380	3.99%
91	Development Access 10	970	0.00%	1404	0.38%	2341	0.23%	2498	0.29%
92	Camp Road (East of Development Access 10)	5413	7.00%	7895	5.56%	11481	3.97%	12859	3.68%
93	Development Access 11	512	0.50%	445	0.39%	445	0.39%	445	0.39%
96	Camp Road (East of Development Access 11a)	5695	6.65%	8168	5.68%	11751	4.09%	13128	3.79%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
97	Development Access 11b	72	1.24%	63	0.63%	211	1.06%	211	1.06%
98	Camp Road (East of Development Access 11b)	5721	6.64%	8260	5.62%	11899	4.05%	13276	3.76%
99	Development Access 12 North	386	1.24%	349	0.78%	349	0.78%	349	0.78%
100	Camp Road (East of Development Access 12 North and South)	5893	6.47%	8419	5.53%	12058	4.00%	13435	3.72%
101	Development Access 12 South	72	1.24%	63	0.63%	63	0.63%	63	0.63%
102	Development Access 13 North	105	1.24%	350	1.08%	373	1.09%	607	1.15%
103	Camp Road (East of Development Access 13 North and South)	6024	6.31%	8665	5.38%	12369	3.92%	13835	3.63%

Link Number	Location	2018 Baseline		2031 Baseline		2031 With Development		2031 Cumulative Scenario	
		AADT	%HDV	AADT	%HDV	AADT	%HDV	AADT	%HDV
104	Development Access 13 South	258	1.24%	226	0.63%	374	0.87%	374	0.87%
106	Camp Road (East of Development Access 14)	6033	6.28%	8697	5.35%	12401	3.90%	13867	3.62%
108	Camp Road (East of Development Access 15)	4889	5.62%	7824	4.52%	11528	3.41%	13134	3.12%
109	Chilgrove Drive	0	0.00%	0	0.00%	10665	4.88%	10665	4.88%
110	Unnamed Road South of Chilgrove Drive	3791	3.70%	5400	3.20%	8437	2.60%	9243	2.45%

APPENDIX 12.3 – FUTURE YEAR EMISSIONS CALCULATIONS

Atmospheric dispersion modelling is used to determine the effect of future development traffic on local air quality. The modelling utilises predictions of the composition and emissions profile of the vehicle fleet which are produced by Defra in the emissions factor toolkit (EFT) with the fleet composition and emissions profiles provided on a year by year basis; the most recent update is V9.0 and includes data from 2017 to 2030.

The EFT contains estimates of the future composition of the vehicle fleet in terms of the age and type of vehicles and emissions are primarily related to the age of the vehicles (in terms of their emissions class) and the fuel that they use (i.e. petrol, diesel or electric). In general terms, as new vehicles replace older vehicles, and as the emissions performance of vehicles is generally taken to improve over time.

The modelling of future traffic impacts therefore requires consideration of uncertainty as to the accuracy of the emission factors, as well as uncertainty introduced by the modelling process and the traffic data on which the predictions are based. This has become more important in recent years as it has been realised that previous versions of the EFT were likely to have significantly underestimated the real-world NOx emissions of the vehicle fleet primarily resulting from diesel vehicles.

Emissions in the EFT

The EFT database was updated in May 2019 to v9.0. It now uses NO_x emissions factors for the vehicles taken from the European Environment Agency's COPERT 5 database and the 2019 update included changes to the fleet mix due largely to reflect the London Low Emissions Zone.

The emissions performance of the vehicles in the EFT is classified in terms of Euro type approval testing; Euro 1 to 6 (with Euro 6 vechielce split into 6a, 6b, 6c and 6d) concerning light duty vehicles and Euro I to VI heavy duty vehicles. Whilst the introduction of each Euro class has generally seen a tightening of emission standards, the standards up until 2017 were based on laboratory testing of vehicles. The emissions performance of the vehicles in real world driving conditions has been higher than the laboratory testing results, especially for diesel vehicles. This factor was not recognised in earlier versions of the EFT, and combined with the fact that diesel vehicles have much higher NO_x emissions than petrol vehicles and there has been a very large increase in the number of diesel vehicles on the road, has meant that the NO_x emissions and NO_2 concentrations did not reduce as was anticipated.

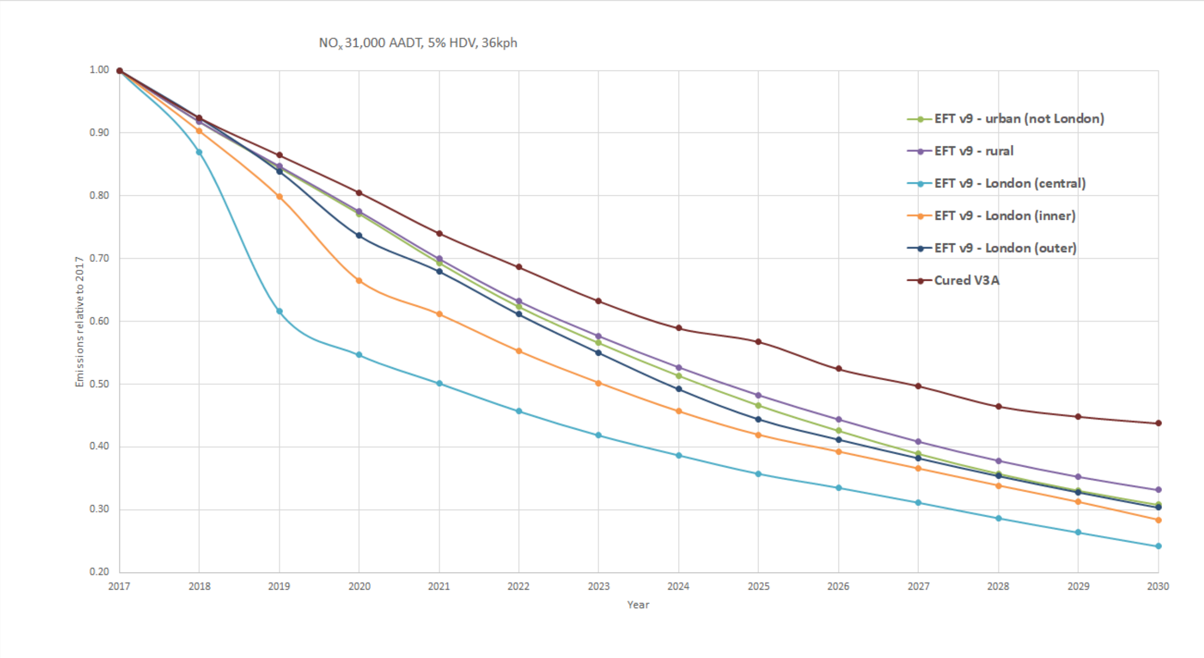
The EFT considers the real-world performance of Euro 6ab diesel cars, applying a high conformity factor to these vehicles. For Euro 6c and Euro 6d vehicles, it assumes that the RDE is effective in bringing down vehicle emissions, but does not assume that vehicle emissions will be as low as the conformity factors in the RDE testing. The EFT therefore incorporates an assumption that diesel car NO_x emissions will be higher in real world driving conditions than the testing standards allow.

Given ucertainity as to the effectiveness of RDE testing, AQC reviewed their approach to vehicle emissions[18] following publication of EFT v8.0. CURED v3A was formulated assuming that light duty vehicle emissions are as per EFT v8.0 up until Euro 6c. Euro 6d

[18] Development of the CURED V3A Emissions Model

vehicles are assumed to have the same emissions as Euro 6c. Emissions from HDVs are assumed to be as per the EFT v8.0. Vehicle emissions using CURED v3A can be considered to be a worst-case sensitivity test post 2020. CURED v3A has not been revised following the publication of EFT v9.0.

The following graph shows the relative decline in vehicle NO_x emissions predicted for an urban road (outside London) with 5% Heavy Duty Vehicle traffic, travelling at 36kph.



For emission years prior to 2021, outside of London the CURED v3A methodology is likely to give similar results to using the EFT v9.0 data. Post 2021, when the introduction of Euro 6d begins to take effect, then CURED v3A and the EFT v9.0 begin to diverge particularly in central London as a result of the ULEZ.

Future Year Assessment Methodology

For developments outside of London up until 2021, the current EFT is considered to be appropriate and precautionary as to NO_x emissions from diesel vehicles has been recognised. As such, one is justified in using the emission factors for the year of the assessment as the uncertainty in the emission factors is taken account of by using the verification factor.

Developments post 2021 will increasingly be influenced by the assumption that the RDE testing of diesel vehicles is effective and in essence, the result is likely to lie between the EFT and CURED curves of the previous graph. If a conservative approach is warranted, one could follow the CURED curve, the effect of which is outlined in the table below.

Traffic Data year	**EFT v9 year**				
	Central London	**Inner London**	**Outer London**	**Urban (not London**	**Rural**

Traffic Data year	**EFT v9 year**				
	Central London	**Inner London**	**Outer London**	**Urban (not London**	**Rural**
2017	2017	2017	2017	2017	2017
2018	2018	2018	2018	2018	2018
2019	2018	2019	2019	2019	2019
2020	2018	2019	2019	2020	2020
2021	2018	2019	2020	2020	2020
2022	2018	2020	2021	2021	2021
2023	2018	2020	2022	2022	2022
2024	2019	2021	2022	2022	2022
2025	2020	2021	2023	2023	2023
2026	2021	2022	2024	2024	2024
2027	2021	2023	2024	2024	2024
2028	2022	2023	2025	2025	2025
2029	2022	2024	2025	2025	2025
2030	2022	2024	2026	2026	2026
Beyond 2030	2022	2024	2026	2026	2026

In the case of a large development with a completion year a long time into the future, then if only completion year traffic data is available, it is likely to be appropriate to assume that the completed year traffic data occurs at the opening year of the development. As appropriate, a change in emission year in accordance with the above table may be considered; however, one must be careful not to be too conservative in that scenario.