Kier Ventures Ltd

Land West of Thaxted Road, Saffron Walden

Air Quality Assessment

WSP Environment & Infrastructure Solutions UK Limited – November 2022

Report for

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Executive summary

This Air Quality Assessment (AQA) has been prepared by WSP Environment and Infrastructure Solutions UK Ltd (WSP) on behalf of Noise Solutions to support the planning application at Land West of Thaxted Road, Saffron Walden.

The Proposed Development has the potential to cause impacts at sensitive locations. These may include fugitive dust emissions associated with construction works and road traffic exhaust emissions from vehicles travelling to and from the Proposed Development during the operational phase. Further to this, the proposals may introduce future occupants to any existing air quality issues at the Site. An Air Quality Assessment (AQA) was therefore undertaken to determine baseline conditions, consider location suitability for the proposed end-use and consider potential effects because of the proposals.

During the construction phase of the development there is the potential for air quality impacts because of fugitive dust emissions from the Site. These were assessed in accordance with the Institute of Air Quality Management (IAQM) methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and trackout was predicted to be **not significant**.

During the operational phase of the development there is the potential for air quality impacts because of traffic exhaust emissions associated with vehicles travelling to and from the Proposed Development. Dispersion modelling was undertaken using ADMS-Roads to predict pollutant concentrations resulting from emissions from the local highway network. Results were then verified using local monitoring data. Impacts were assessed against the criteria provided within IAQM guidance. Due to the size and nature of the proposals, road vehicle exhaust emissions impacts were predicted to be **not significant**.

The Proposed Development has the potential to expose future users to elevated pollution levels in the vicinity of the Site during operation. Model results indicates that future users are **unlikely** to be exposed to pollutant concentrations that exceed Air Quality Objectives (AQOs).

Table of Abbreviations

Abbreviation	Full Text
AADT	Annual Average Daily Traffic
AQA	Air Quality Assessment
AQAP	Air Quality Action Plan
AQOs	Air Quality Objectives
AQMA	Air Quality Management Areas
AQS	Air Quality Strategy
ASR	Annual Status Report
CC	Correlation Coefficient
CERC	Cambridge Environmental Research Consultants
DEFRA	Department of Environment, Food and Rural Affairs
DM	Do Minimum Scenario
DMP	Dust Management Plan
DMRM	Design Manual for Roads and Bridges
DS	Do Something Scenario
EFT	Emission Factor Toolkit
EPUK	Environmental Protection UK
EU	European Union
FB	Fractional Bias
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
IGCB	Interdepartmental Group on Costs and Benefits
LA	Local Authority
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
NGR	National Grid Reference
NOx	Nitrogen Oxide

Abbreviation	Full Text
NO_2	Nitrogen Dioxide
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
NTS	National Travel Survey
PM_{10}	Particulate Matter (<10micrograms)
$PM_{2.5}$	Particulate Matter (<2.5micrograms)
RMSE	Root Mean Square Error
SSSI	Site of Special Scientific Interest Site
UK	United Kingdom
WSP	WSP Environment and Infrastructure Solutions UK Ltd

Contents

1. Introduction

1.1 Background

This Air Quality Assessment (AQA) has been prepared by WSP Environment and Infrastructure Solutions UK Ltd (WSP) on behalf of Noise Solutions to support the planning application at Land West of Thaxted Road, Saffron Walden.

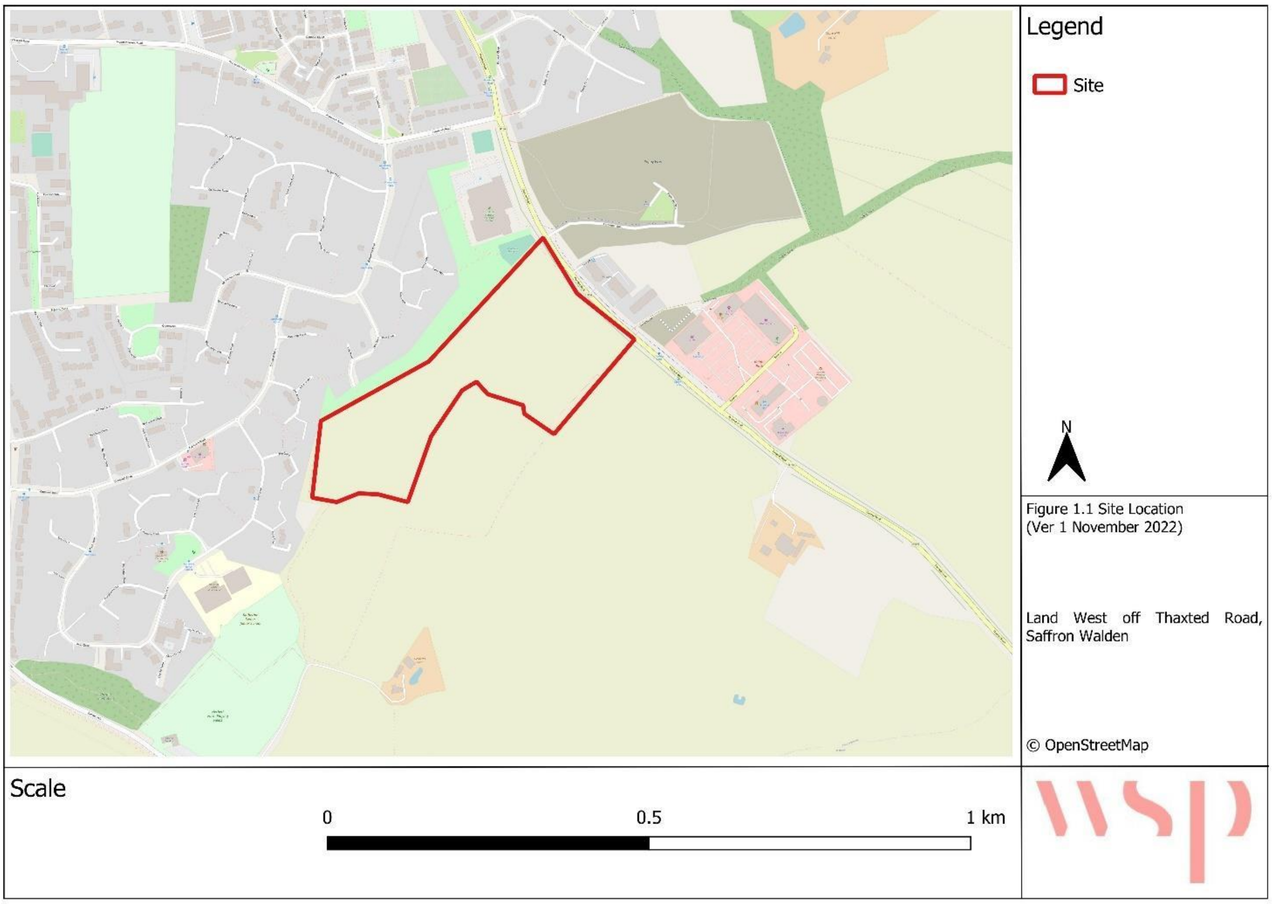
The Proposed Development has the potential to affect air quality at sensitive receptor locations. These may include fugitive dust emissions associated with construction works and road traffic exhaust emissions from vehicles travelling to and from the Site during the operational phase. Further to this, the air quality to which future occupants would be exposed needs to be considered. This AQA has therefore been undertaken to determine baseline conditions, consider location suitability for the proposed end-use and consider potential effects because of the proposals.

1.2 Site Location and Context

The current plans comprise a residential development of up to 170 dwellings and amenity areas ("The Proposed Development") on land formerly known as Land West of Thaxted Road, Saffron Walden ("the Site") located in Uttlesford District Council.

The Site is situated to the west of Thaxted Road, Saffron Walden, at approximate National Grid Reference (NGR): 554748, 237409. The Site is surrounded to the north and west by existing residential settlement including dwellings, open space, a leisure centre and a skatepark, to the east by Thaxted Road, and to the south hedgerow field boundaries along arable agricultural land. Reference should be made to Figure 1.1 for a map of the Site and surrounding areas. The Site is situated east of the Uttlesford town, on the edge of the urban area.

Figure 1.1 Site Location



The Proposed Development includes up to 170 dwellings, associated landscaping and open space, with access from Thaxted Road. In summary, the key elements of the Proposed Development are:

- 170 dwellings (class C3), as set out below:
  - 102 private dwellings
    17 x 1 bed flat
    2 x 2 bed flat
    32 x 2 bed house
    43 x 3 bed house
    8 x 4 bed house
  - 68 affordable dwelling
    20 x 1 bed flat
    14 x 2 bed flat
    12 x 2 bed house
    14 x 3 bed house
    4 x 4 bed house
- Green infrastructure to include public open and amenity spaces (including equipped children's play area)

As shown in Figure 1.2, new build homes would be located throughout the development parcel with designated informal green space dotted around.

Figure 1.2 Land Use for the Site

Figure 1.2 Land Use for the Site
(Ver 1 November 2022)

Land West of Thaxted Road, Saffron Walden

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1.3 Report Structure

This report presents the findings of an assessment of the potential air quality impacts of the Proposed Development during the construction and operational phases. The type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these described.

The structure of the report is summarised below:

- A brief description of the legislation, policy and guidance governing air quality in the United Kingdom (UK) and Uttlesford District Council (UCC);
- Details of the method and the input data used for the following assessments;
- Construction Phase Dust Impact Assessment;
- Operational Phase Impact Assessment;
- Operational Phase Future Exposure Assessment;
- Site Specific Mitigation Measures; and
- Conclusions.

2. Legislation, Policy and Guidance

2.1 International Legislation and Policy

The legislative framework for air quality consists of legally enforceable EU Limit Values that are transposed into UK legislation as Air Quality Standards[1] (AQS) that must be at least as challenging as the EU Limit Values. Action in the UK is then driven by the UK's Air Quality Strategy that sets the Air Quality Objectives (AQOs).

The EU Limit Values are set by the European directive on air quality and cleaner air for Europe (2008/50/EC)[2] and the European directive relating to arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons in ambient air (2004/107/EC)[3] as the principal instruments governing outdoor ambient air quality policy in the EU. The Limit Values are legally binding levels for concentrations of pollutants for outdoor air quality.

The two European directives, as well as the Council's decision on exchange of information were transposed into UK Law via the Air Quality Standards Regulations 2010[4] and amended via the Air Quality Standards (Amendment) Regulations 2016[5]. Air Quality Standards are concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment. The Air Quality Strategy sets the AQOs, which give target dates and some interim target dates to help the UK move towards achievement of the EU Limit Values. The AQOs are a statement of policy intentions or policy targets and as such, there is no legal requirement to meet these objectives except in as far as they mirror any equivalent legally binding Limit Values in EU legislation. The most recent UK Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in July 2007.

Table 2.1 sets out the AQOs that are relevant to this assessment, and the dates by which they are to be achieved.

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Department of Environment, Food and Rural Affairs (Defra) in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland (2007)
[2] Directive 2008/50/EC of the European Parliament and of The Council of 21 May 2008 on Ambient Air Quality and Cleaner Air in Europe. Official Journal of the European Union (2008)
[3] Directive 2004/107/EC of the European Parliament and of The Council of 15b December 2004 relating to Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air. Official Journal of the European Union (2004)
[4] Statutory Instrument 2010 No. 1001 Environmental Protection – The Air Quality Standards Regulations 2010. The Stationery Office (2010)
[5] Statutory Instrument 2016 No. 1184 Environmental Protection – The Air Quality Standards (Amendment) Regulations 2016. The Stationary Office (2016)

Table 2.1 Summary of Relevant Air Quality Standards and Objectives

Pollutant	Objective (UK)	Averaging period	Date to be achieved by and maintained thereafter (UK)
Nitrogen dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
	40 μgm^{-3}	Annual mean	31 Dec 2005
Particulate matter – PM_{10}	50 μgm^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
	40 μgm^{-3}	Annual mean	31 Dec 2004
Particulate matter – $PM_{2.5}$	20 μgm^{-3}	Annual mean	1 Jan 2020
	Target of 15% reduction in concentration at urban background locations	3 year mean	Between 2010 and 2020

Table 2.2 sets out where the objective should, and should not apply.

Table 2.2 Locations Where Air Quality Objectives Apply

Averaging Period	Objectives Should Apply at	Objectives Should Not Apply at
Annual Mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
24-hour Mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.

1-hour Mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. Kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-minute Mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes.	

2.1 National Legislation and Policy

Table 2.3 lists the national level policy and guidance relevant to the assessment of the effects on air quality, and the issues included in the policy/ guidance that needed to be considered when determining the scope of this assessment.

Table 2.3 National Policy, Legislation and Guidance

Policy Reference	Policy
National Planning Policy Framework (NPPF)[6]	The National Planning Policy Framework (NPPF) was published in July 2021 and sets out the Government's planning policies for England and how these are expected to be applied. Paragraph 181 states: *"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".*
National Planning Practice Guidance (NPPG) [7]	The National Planning Practice Guidance (NPPG) was launched by the Department for Communities and Local Government in March 2014 and updated in November 2019 to support the NPPF and make it more accessible. It is stated in the guidance that air quality is relevant to planning applications when the development could: *"Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality".*

[6] National Planning Policy Framework, Ministry of Housing, Communities and Local Government (2021)
[7] National Planning Practice Guidance – Air Quality, Department for Communities and Local Government (2019)

Policy Reference	Policy
Clean Air Strategy 2019[8]	This document describes the Governments overarching approach to tackling air pollution in the UK.
Environment Act 1995[9]	Part IV of the Environment Act (1995) requires UK Government to produce a national Air Quality Strategy (AQS) which contains standards, objectives, and measures for improving ambient air quality (see Table 2.3). The most recent AQS was produced by Defra and published in 2007. Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This Review and Assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure[10], as summarised in **Error! Reference source not found.**, are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.
Environment Act 2021[11]	The Environment Act 1995 was amended in 2021 to establish a legally binding duty on government to bring forward at least two new $PM_{2.5}$ air quality targets in secondary legislation by 31 October 2022. This duty sites within the environmental targets framework outlined in the Environment Act (Part 1).
Control of Dust and Particulates Associated with Construction[12]	Section 79 of the Environmental Protection Act (1990) states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as: *"Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance"*.
Local Air Quality Management Review and Assessment Technical Guidance[13]	Defra has published technical guidance for use by local authorities in their review and assessment work. This guidance, referred to in this document as LAQM.TG22, has been used where appropriate in the assessment presented herein.
Land-Use Planning & Development Control: Planning for Air Quality[14]	Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance that offers comprehensive advice on: when an AQA may be required; what should be included in the assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures that may be implemented to minimise these impacts.
Guidance on the Assessment of Dust from Demolition and Construction[15]	Guidance on the Assessment of Dust from Demolition and Construction published by the Institute of Air Quality Management (IAQM) was produced to provide guidance to developers, consultants and environmental heath officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological

[8] Clean Air Strategy, Defra (2019)
[9] Environment Act, HMSO (1995)
[10] Local Air Quality Management Technical Guidance (TG22) Defra (2022)
[11] Environment Act, HMSO (2021)
[12] Control of Dust and Particulates Associated with Construction, Environmental Protection Act, (1990)
[13] Local Air Quality Management Technical Guidance (TG16) Defra (2018)
[14] Land-Use Planning & Development Control: Planning For Air Quality, Guidance from EPUK and IAQM for the consideration of air quality within the land-use planning and development control processes, (2017)
[15] Guidance on the Assessment of Dust From Demolition and Construction, IAQM (2014)

Policy Reference	Policy
	receptors) and to identify mitigation measures appropriate to the level of risk identified.

2.2 Local Legislation and Policy

Table 2.4 lists the local level policy and guidance relevant to the assessment of the effects on air quality, and the issues included in the policy/ guidance that needed to be considered when determining the scope of this assessment.

Table 2.4 Local Policy, Legislation and Guidance

Policy Reference	Policy
Uttlesford Local Plan[16]	The Uttlesford Local Plan was adopted in 2005 and sets out some requirements for air quality considerations in local planning. The relevant policies include: *Policy ENV12 – Exposure to Air Quality: 'Development that would involve users being exposed on an extended long-term basis to poor air quality outdoors near ground level will not be permitted.'* However, this document precedes the declaration of UDC's only AQMA in Saffron Walden. Furthermore, this publication has since been superseded by more recent documents relating to air quality. UDC is currently in the process of issuing a new local plan. The previous draft Local Plan was withdrawn in 2019.
Regulation 19 Local Plan[17]	UDC is currently undergoing the process of wring a new local plan, due for submission in 2023. The most recent document to come out of this is the Regulation 19 Local Plan, which sets out UDC's most recent thinking on the proposed planning requirements. In particular, two policies relate directly to air quality: *EN14 – Pollutants: '…where possible development should contribute to improvements in air quality'* *EN15 – Air Quality: '…no adverse effects on air quality in an Air Quality Management Area from the Development… Development within or affecting an AQMA will also be expected to contribute to a reduction in levels of air pollutants within the AQMA… The development promotes sustainable transport measures and use of low emission vehicles.*
UDC AQ Technical Guidance[18]	This document summarises the important air quality considerations for planning within Uttlesford district. Policy EN15 from the Regulation 19 Local Plan is reiterated within this document. Two further policies relating to transport are also included due to their relevance to air quality: *Policy TA1: highlights the need to increase public transport use and active travel* *Policy TA3: sets out the need for provision of EV charging points, with requirements differing per size of development.* Section 4 of this document sets out the threshold criteria for requirement of a full AQA as part of the planning process (>75 dwellings; and/ or change in traffic >100 AADT within the AQMA or >1000 elsewhere.
Uttlesford Air Quality Action Plan[19]	This document lays out UDC's plan for improving air quality within the Saffron Walden AQMA in line with the National AQOs. There is also detail on air quality

[16] Uttlesford Local Plan, Uttlesford District Council (2005)
[17] Regulation 19, Local Plan, Uttlesford District Council (2018)
[18] Air Quality Technical Planning Guidance, Uttlesford District Council (2018)
[19] Air Quality Action Plan 2017 – 2022, Uttlesford District Council (2017)

Policy Reference	Policy
	guidance and requirements issued to several developments which applied for planning between 2015-2017
Saffron Walden Neighbourhood Plan[20]	Saffron Walden Neighbourhood Plan was designed by UDC in 2012, drawn up at a community level. It aims to give the community the direct power to develop a vision for its neighbourhood and shape the development and growth of the local area between 2021-2036. This document includes text on UDC's plan for improving air quality by improving sustainable modes of transport, including public transport and electric vehicle charging points. Neighbourhood plans provides early guidelines on what the community expects from developers.

The implications of the above policies, legislations and guidance were taken into consideration throughout the undertaking of the assessment.

[20] Saffron Walden Neighbourhood Plan, (2012)

3. Assessment Methodology

3.1 Construction Phase Impact Assessment

There is the potential for fugitive dust emissions to occur because of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction V1.1'[21].

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

- Demolition;
- Earthworks;
- Construction; and
- Vehicle movements that cause trackout.

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

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

The assessment steps are detailed in Appendix A.

3.2 Operational Phase Road Vehicle Exhaust Emissions Assessment

AQA Screening

The road traffic generated by the Proposed Development has been considered with reference to the IAQM indicative criteria[22] for requiring an AQA.

- A change in Light-Duty Vehicle (LDV) traffic flows on local roads with relevant receptors
  - More than 100 Annual Average Daily Traffic (AADT) within or adjacent to an AQMA
  - More than 500 AADT elsewhere
- A change in Heavy Duty Vehicle (HDV) traffic flows on local roads with relevant receptors
  - More than 25 AADT within or adjacent to an AQMA
  - More than 100 AADT elsewhere
- A change in the alignment of roads by 5m or more and the road is within an AQMA

[21] Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM (2016)
[22] Land Use Planning & Development Control: Planning for Air Quality, IAQM (2017)

- Introduction of a new junction or remove an existing junction near to relevant receptors
  - Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts
- Introduce or change a bus station where bus flows will change
  - More than 25 AADT within or adjacent to an AQMA
  - More than 100 AADT elsewhere
- Has an underground car park with an extraction system within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out)
- Has one or more substantial combustion processes, where there is a risk of impacts at relevant receptors

As traffic flows are predicted to increase by volumes in excess of these criteria, impacts have been quantified using ADMS-Roads dispersion modelling.

Where necessary, locations sensitive to potential changes in pollutant concentrations were identified within 200m of the highway network. The criteria provided within Defra guidance[23] on where the AQOs apply, as summarised in **Error! Reference source not found.** was utilised to determine a ppropriate receptor positions. The location of receptors is shown in Appendix B.

Dispersion Modelling Input Data

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (Version 5.0.0.1). ADMS-Roads was developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and Defra.

Modelling of pollutants was carried out for the following scenarios:

- Base year (2019) – 2019 traffic data, 2019 emission factors and 2019 background concentrations. This scenario was used for the model verification. The verification is shown in Appendix D;
- Do minimum (DM) (2025) – 2025 traffic data, 2025 emission factors and 2025 background concentrations. This scenario was used to show the forecast pollutant concentration for 2025 (first expected full year of occupancy); and
- Do something (DS) (2025) – 2025 traffic data with development flow included, 2025 emission factors and 2025 background concentrations. This scenario was used to show the forecast pollutant concentration for 2025 with the development flows included (first expected full year of occupancy).

The model needs input data that details the following parameters:

- Assessment area;
- Sensitive Receptors;
- Traffic flow data;
- Vehicle emission factors;

[23] Local Air Quality Management Technical Guidance (TG22), Defra, (2018)

- Spatial co-ordinates of emissions;
- Street canyon parameters;
- Street width;
- Meteorological data;
- Roughness length; and
- Monin-Obukhov length

These are detailed in Appendix B.

Impact Significance

The significance of predicted air quality impacts was determined following the guidance provided within the IAQM document 'Land-Use Planning & Development Control: Planning for Air Quality'[24]. Using this methodology impacts were defined based on the interaction between the predicted pollutant concentration in the Do Something (DS) or With Development scenario and the magnitude of change between the Do Minimum (DM) or Without Development and DS scenarios, as outlined in Table 3.1.

Table 3.1 Significance of Road Vehicle Exhaust Emissions Impact

Concentration at Receptor in Assessment Year	Predicted Concentration Change as a Proportion of AQO (%)			
	1	2-5	6-10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76-94% of AQO	Negligible	Slight	Moderate	Moderate
95-102% of AQO	Slight	Moderate	Moderate	Moderate
103-109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial

The matrix shown in Table 3.1 is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which makes it clearer which cell the impact falls within. It should be noted that changes of 0%, i.e., less than 0.5%, are described as negligible.

Following the prediction of impacts at discrete receptor locations, the IAQM document provides guidance on determining the overall air quality impact significance of the operation of a development. The following factors are identified for consideration by the assessor:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and,
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

[24] Land-Use Planning & Development Control: Planning for Air Quality, IAQM, (2017)

The IAQM guidance states that an assessment must conclude the likely significance of the predicted impact. It should be noted that this is a binary judgement of either it is significant, or it is not significant.

The determination of significance relies on professional judgement, and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts. The IAQM guidance[25] suggests the provision of details of the assessor's qualifications and experience. These can be provided upon request.

Operational Phase Exposure Assessment

The proposal has the potential to expose future occupants to poor air quality. To assess pollutant concentrations across the Site, consideration was made of the proximity of the Site to major roads and background pollution concentrations.

Likely pollution concentrations at the Site were compared against the relevant AQOs to determine the potential for exposure of future occupants to elevated pollutant concentrations and identify any appropriate mitigation, if necessary.

[25] Land-Use Planning & Development Control: Planning for Air Quality, IAQM, (2017)

4. Baseline Air Quality

4.1 Local Air Quality Management

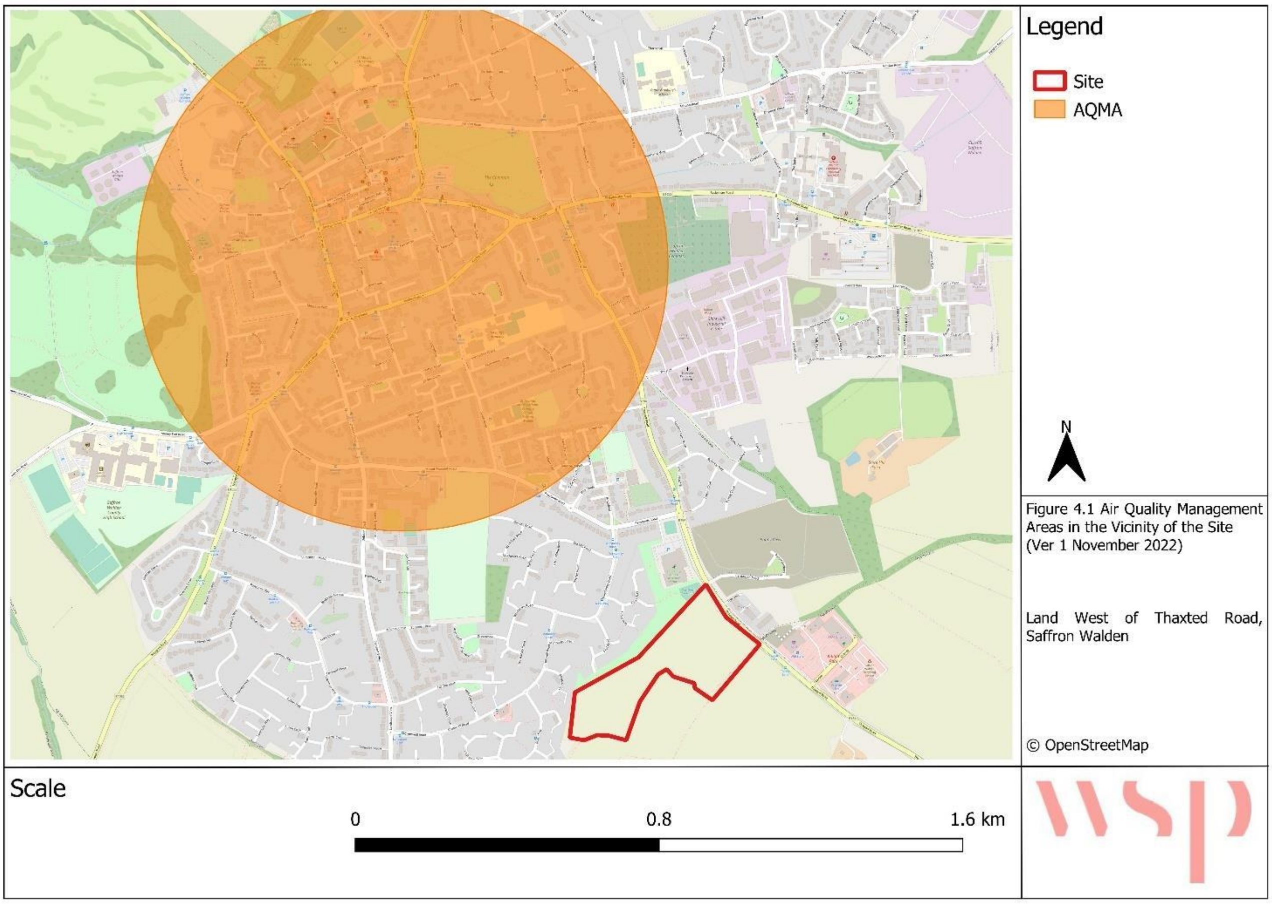
As required by the Environment Act (1995), UDC has undertaken Review and Assessment of air quality within its area of jurisdiction. This process has identified that annual mean concentrations of nitrogen dioxide (NO_2) are above the AQO within the borough. As such, one AQMA has been declared. This is described in Table 4.1.

Table 4.1 Air Quality Management Area

AQMA	Description	Date	Distance from Site (km)
Uttlesford AQMA No.1	An area extending 75m in all directions from the centre of the junction of High Street and George Street in Saffron Walden	01/08/2007	0.44

The Site is located approximately 0.44km from the nearest AQMA (see Figure 4.1). As such, there is the potential for vehicles travelling to and from the Proposed Development to increase pollution in this sensitive area. The exposure of future residents to poor air quality is also an important consideration. These issues have been considered in the assessment.

Figure 4.1 Air Quality Management Area in the Vicinity of the Site



UDC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

4.2 Air Quality Monitoring

Dust Deposition

Dust deposition rates are not monitored extensively in the UK. Monitoring that is undertaken, is usually connected with specific activities such as mining and mineral extraction operations and major infrastructure projects. Dust monitoring may also be undertaken to investigate specific complaints received by LAs who are then empowered to investigate dust nuisance under the Environmental Protection Act (1990). No dust measurement data have been obtained from the area surrounding the Site.

Continuous Monitoring

UDC operates two continuous monitors within its jurisdiction. The nearest automatic monitor to the Site located at UTT2, situated 1.02 km north west (see Figure 4.2).

Figure 4.2 Location of Continuous Monitors in the Vicinity of the Site

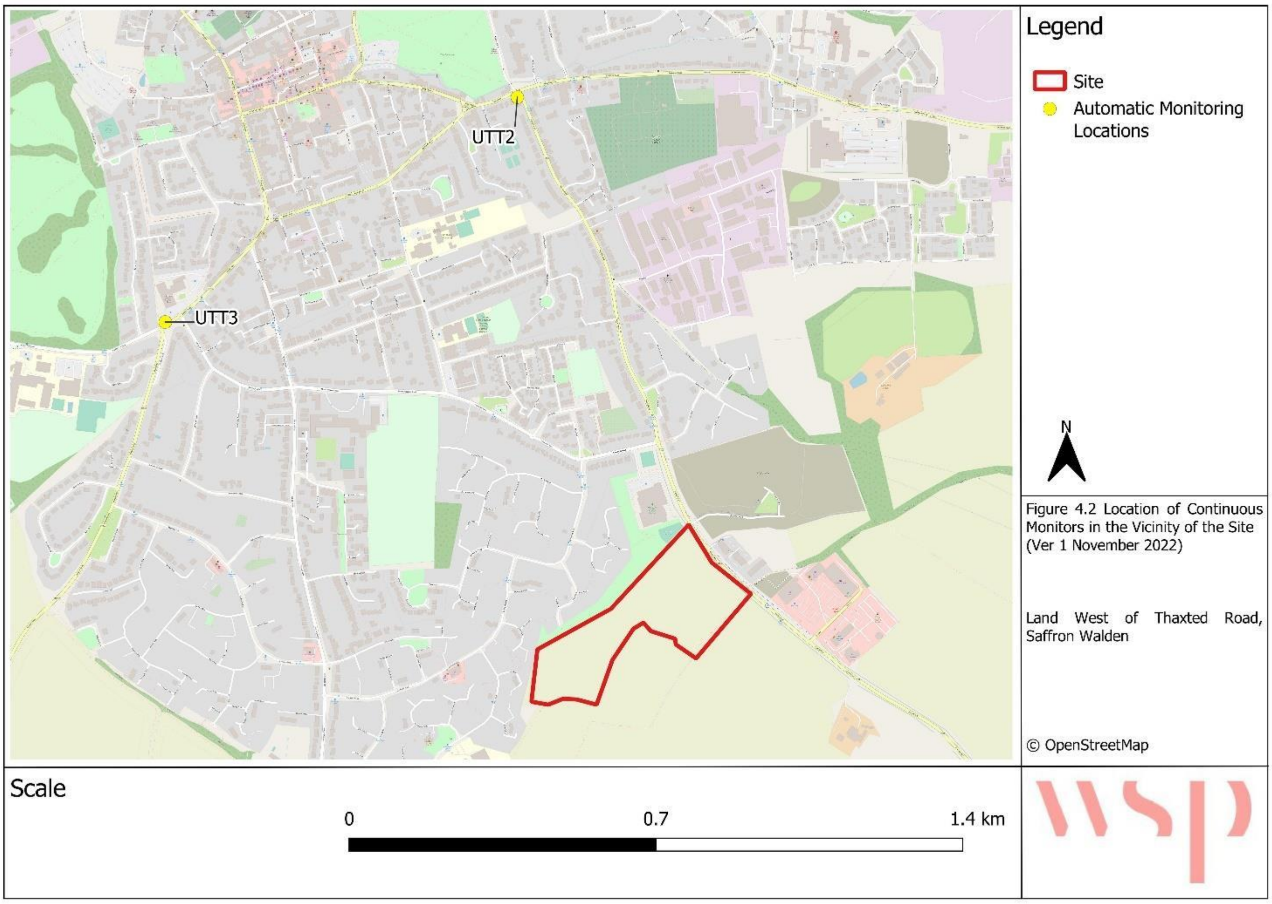


Table 4.2 shows the location of the automatic monitoring sites, the classification type and the distance from the Site.

Table 4.2 Automatic Monitoring Sites Operated by Uttlesford District Council

Site ID	Site name	Classification	X	Y	Distance to Road (m)	Inlet Height (m)	Distance to Site (m)
UTT2	Thaxted Road & Radwinter Road	Roadside	554357	238444	2	1.0	1.02
UTT3	London Road	Roadside	553570	237908	3	2.8	1.14

Table 4.3 shows the monitored concentrations of NO_2. The data was obtained from the most recently available Annual Status Report[26].

Table 4.3 Summary of Automatic NO_2 Monitoring Data: Annual Mean (μgm^{-3})

Site ID	2017	2018	2019	2020	2021
UTT2	-	35.3	32.7	25.0	30.9

[26] Air Quality Annual Status Report 2022, Canterbury City Council (2022)

Site ID	2017	2018	2019	2020	2021
UTT3	18.3	21.2	19.6	11.5	12.5

Table Notes:
Exceedances are shown in **bold**
(–) indicates no data

The data in Table 4.3 shows that annual mean NO_2 concentration were below the 40µgm^{-3} AQO between 2017 and 2021 and concentrations have been decreasing in recent years. Low annual mean NO_2 concentrations in 2020 and 2021 may be due to the Covid-19 pandemic.

Table 4.4 shows the monitored concentrations of PM_{10}. The data was obtained from the most recently available Annual Status Report[27].

Table 4.4 Summary of Automatic PM_{10} Monitoring Data: Annual Mean (µgm^{-3})

Site ID	2017	2018	2019	2020	2021
UTT3	24.2	25.5	24.7	27.1	28.1

Table Notes:
Exceedances are shown in **bold**
(–) indicates no data

The data in Table 4.4 shows that annual mean PM_{10} concentration were below the 40µgm^{-3} AQO between 2017 and 2021 and concentrations have been decreasing in recent years.

Passive Monitoring

UDC operates an extensive network of passive diffusion tubes to monitor annual mean NO_2. As of 2021, there are 39 passive monitoring locations in the Borough. The nearest passive diffusion tube is UT031, situated 0.62 km west from the Site (see Figure 4.3).

[27] Air Quality Annual Status Report 2022, Uttlesford District Council (2022)

Figure 4.3 Location of Passive Monitors in the Vicinity of the Site

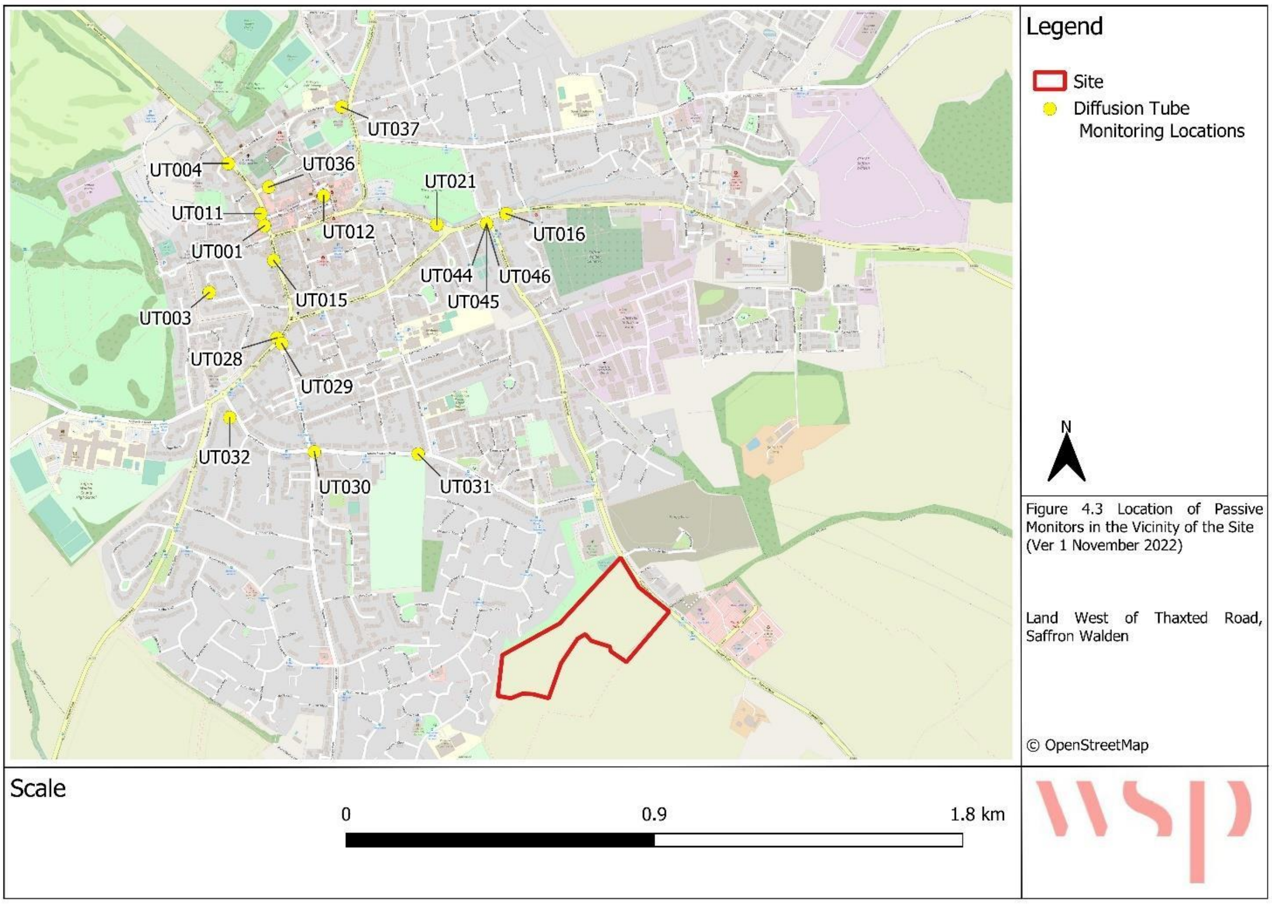


Table 4.5 shows the location of the diffusion tube monitoring sites, the classification type and the distance from the Site. Monitoring sites located within 2 km of the Site boundary are included.

Table 4.5 Diffusion Tube Monitoring Sites Operated by Uttlesford District Council

Site ID	Site name	Classification	X	Y	Distance to Road (m)	Inlet Height (m)	Distance to Site (m)
UT001	High Street	Urban Centre	553709	238417	1.5	2	1.4
UT003	Gibson Gardens	Urban Background	553554	238218	1.5	2	1.3
UT004	YHA	Kerbside	553598	238595	0.4	2	1.6
UT011	33 High Street	Urban Centre	553697	238452	2.7	2	1.4
UT012	Town Hall	Urban Background	553879	238510	0.1	2	1.3
UT015	57 High Street	Roadside	553739	238317	4.0	2	1.3
UT016	Radwinter Road	Roadside	554413	238474	1.6	2	1.0
UT021	41 East Street	Roadside	554212	238436	2.0	2	1.1

Site ID	Site name	Classification	X	Y	Distance to Road (m)	Inlet Height (m)	Distance to Site (m)
UT028	London Rd	Roadside	553755	238092	2.0	2	1.1
UT029	Debden Road	Roadside	553770	238076	0.5	2	1.1
UT030	Friends School	Kerbside	553875	237764	0.5	2	0.8
UT031	Mount Pleasant Road	Roadside	554178	237767	1.5	2	0.6
UT032	Borough Lane	Roadside	553625	237856	7.0	2	1.0
UT036	Church Street	Urban Centre	553718	238530	1.0	2	1.4
UT037	Castle Street	Kerbside	553923	238770	1.0	2	1.5
UT044, UT045, UT046	Thaxted Road	Roadside	554357	238443	2.0	2	1.0

Table 4.6 shows the monitored concentrations of NO_2. The data was obtained from the most recently available Annual Status Report[28].

Table 4.6 Summary of Diffusion Tube NO_2 Monitoring Data: Annual Mean (μgm^{-3})

Site ID	2017	2018	2019	2020	2021
UT001	34.0	29.8	30.0	23.9	23.1
UT003	13.4	12.0	11.1	9.1	8.5
UT004	38.0	35.5	35.1	26.9	27.1
UT011	31.0	29.0	26.3	19.9	21.7
UT012	16.2	15.4	15.5	11.0	10.8
UT015	-	25.8	24.9	20.7	18.9
UT016	-	32.1	30.7	23.1	24.7
UT021	-	27.0	24.0	17.6	18.4
UT028	37.4	33.4	31.2	24.8	25.0
UT029	21.4	20.5	20.1	15.9	15.1
UT030	26.1	27.2	25.0	19.6	19.7
UT031	21.4	19.8	20.7	15.2	15.8
UT032	17.4	15.2	15.0	11.5	11.1

[28] Air Quality Annual Status Report 2022, Canterbury City Council (2022)

Site ID	2017	2018	2019	2020	2021
UT036	20.9	19.2	18.4	14.3	13.6
UT037	24.0	22.0	22.4	16.8	15.7
"UT044, UT045,	-	-	37.0	31.6	30.7

Table Notes:
Exceedances are shown in **bold**
(–) indicates no data

The data in Table 4.6 shows that annual mean NO_2 concentration have not exceeded the 40 µgm^{-3} AQO at roadside locations between 2015 and 2019. The reduction in annual mean NO_2 concentrations in 2020 and 2021 may be due to the Covid-19 pandemic. The nearest monitoring sites to the Site is UT031 which is in compliance of the NO_2 annual mean AQO. UT031 is also located within the Saffron Walden AQMA. It is expected to have higher exposure to NO_2 concentrations than the Site. Concentrations at this site have been reducing year-on-year since 2017 and it is expected that this trend will continue in future years.

4.3 Estimated Background Concentrations

Predictions of background pollutant concentration on a 1km-by-1km grid basis have been produced by Defra for the entire of the UK to assist Las in their Review and Assessment of air quality. The Site is located in grid square NGR: 554500, 237500. Data for this location was downloaded from the Defra website for the purpose of this assessment and summarised in Table 4.7.

Table 4.7 Estimated Background Concentrations (µgm^{-3})

	2019	2021	2023	2025
Nitrogen Dioxide (NO_2)	9.5	8.8	8.3	7.6
Oxides of Nitrogen (NO_x)	12.5	11.5	10.7	9.8
Particulate Matter (PM_{10})	15.5	15.0	14.7	14.4
Particulate Matter ($PM_{2.5}$)	9.8	9.4	9.1	8.8

As shown in Table 4.7, predicted background NO_2, NO_x, PM_{10} and $PM_{2.5}$ concentrations are below the relevant AQOs at the Site and are expected to reduce in future years.

5. Assessment

5.1 Construction Phase Impact Assessment

Sensitivity

Receptors sensitive to potential dust impacts during demolition, earthworks and construction were identified from a desk top study of the area up to 350m from the development boundary. These are summarised in Table 5.1.

Table 5.1 Demolition, Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Less than 20	1-10	0
Less than 50	10-100	0
Less than 100	10-100	-
Less than 350	More than 100	-

Receptors sensitive to potential dust impacts from trackout were identified from a desk top study of the area up to 50m from the road network within 500m of the Site access. These are summarised in Table 5.2.

Table 5.2 Trackout Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Less than 20	1-10	0
Less than 50	10-100	0
Less than 100	10-100	-
Less than 350	10-100	-

The nearest ecological receptor is Debden Water of Special Scientific Interest (SSSI) approximately 3.5 km to the south of the Site and West Wood, Little Sampford SSSI located approximately 7.8 km to the southeast of the Site. Given that the distance from the Site is greater than 500 m and there are no other ecologically sensitive sites within 50 m, there are unlikely to be any significant impacts due to dust emission, therefore it has not been considered further in this assessment.

Based on the criteria shown in Table A.2, the sensitivity of the receiving environment to potential dust impacts was determined to be 'high'. This was because the identified receptors included residential properties. It should be noted that all receptors were assumed to be of high sensitivity to provide a robust assessment.

The estimated annual average background concentration PM_{10} concentration is 14.9 µgm^{-3} for 2022 (current year of assessment). Therefore, the sensitivity of the area to human health impacts from dust emission is considered to be 'Low' with reference to the IAQM criteria.

The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria above, is shown in Table 5.3.

Table 5.3 Sensitivity of the Surrounding Area to Potential Dust Impacts

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological Impacts	N/A	N/A	N/A	N/A

The potential risk of dust impacts at the identified receptors is considered in the following sections.

Potential Risk Magnitude

Demolition

There will be no demolition activities undertaken for this scheme, and therefore the potential risk of dust impacts at the identified receptors owing to demolition activities will not be further assessed.

Earthworks

The total Site is less than 2,500 m^2. It is expected there will be between 5 to 10 heavy earth moving vehicles active at any one time and the total material moved will be less than 100,000 tonnes. In accordance with the criteria outlined in Table A.1, the potential magnitude of construction impacts from earthworks activities is estimated to be medium.

Table 5.3 indicates the sensitivity of the area to dust soiling effects on people and property is medium. In accordance with the criteria outlined in Table A.7, the development is a **medium** risk site for dust soiling because of earthworks.

Table 5.3 indicates the sensitivity of the area to human health impacts is low. In accordance with the criteria outlined in Table A.7 is a **low** risk site for human health impacts because of earthworks.

Construction

The total building volume is less than 100,000 m^3 and there may be potentially dusty construction material; thus the potential magnitude of construction impacts from construction activities, following the criteria outlined in Table A.1, is large.

Table 5.3 indicates the sensitivity of the are to dust soiling effects on people and property is medium. In accordance with the criteria outlined in Table A.7, the development is a **medium** risk site for dust soiling because of construction activities.

Table 5.3 indicates the sensitivity of the area to human health impacts is low. In accordance with the criteria outlined in Table A.7, the development is a **low** risk site for human health impacts because of construction activities.

Trackout

In accordance to the criteria outlined in Table A.1, the potential magnitude of impacts from trackout is estimated to be large. Unpaved road length will more than 100 m and there will be less than 10 Heavy Goods Vehicles (HGV) trips per day. Table 5.3 indicates the sensitivity of the area to dust soiling effects on people and property is medium. In accordance with the criteria outlined in Table A.8, the development is a **medium** risk site for dust soiling because of trackout activities.

Table 5.3 indicates the sensitivity of the area to human health impacts is low. In accordance with the criteria outlined in Table A.8, the development is a **low** risk site for human health impacts because of trackout activities.

Summary

A summary of the risk from each dust generating activity is provided in Table 5.4.

Table 5.4 Summary of Potential Unmitigated Dust Risk

Potential Impact	Risk				
	Demolition	Earthworks	Construction	Trackout	
Dust Soiling	NA	Medium	Medium	Medium	Medium
Human Health	N/A	Low	Low	Low	Low
Overall					**Medium**

As indicated in Table 5.4, the potential unmitigated risk of dust soiling is **medium** from earthworks, construction activities and trackout activities. The potential unmitigated dust risk to human health is **low** from earthworks, construction activities and trackout activities. The potential unmitigated dust risk from demolition activities was not assessed. The overall potential unmitigated dust risk from the Proposed Development is **medium**.

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

Mitigation

The IAQM guidance provides potential mitigation measures to reduce impacts because of fugitive dust emissions during the construction phase. These have been adapted for the Proposed Development as summarised in Table 5.5. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan or similar if required by the LA.

Table 5.5 Site Specific Dust Emission Mitigation Measures

Issue/ Control Measure
Communication

Issue/ Control Measure
Develop and implement a stakeholder communications plan that includes community engagement before work commences on Site
Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary. This may be the environment manager/engineer or the site manager
Display the head or regional office contact information
Dust Management Plan
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the Site. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections
Site Management
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken
Make the complaints log available to the Local Authority when asked
Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook
Hold regular liaison meetings with other high risk construction sites within 500 m of the Site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the offsite transport/ deliveries which might be using the same strategic road network routes
Monitoring
Undertake daily onsite and offsite inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars, and windowsills within 100 m of Site boundary, with cleaning to be provided if necessary
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and inspect log available to the Local Authority when asked
Increase the frequency of site inspections by the person accountable for air quality and dust issues on Site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Preparing and Maintaining the Site
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible
Erect solid screens or barriers around dusty activities or the Site boundary that are at least as high as any stockpiles on Site
Fully enclose site or specific operations where there is a high potential for dust production and the Site is actives for an extensive period
Avoid site runoff of water or mud

Issue/ Control Measure
Keep site fencing, barriers and scaffolding clean using wet methods
Remove materials that have a potential to produce dust from Site as soon as possible, unless being re-used on Site. If they are being re-used on site cover as described below
Cover, seed, or fence stockpiles to prevent wind whipping
Operating Vehicle/Machinery and Sustainable Travel
Ensure all vehicles switch off engines when stationary - no idling vehicles
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the Local Authority, where appropriate)
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)
Operations
Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate
Use enclosed chutes and conveyors and covered skips
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
Ensure equipment is readily available on Site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods
Waste Management
Avoid bonfires and burning of waste materials
Measures Specific to Demolition
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 effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground
Avoid explosive blasting, using appropriate manual or mechanical alternatives
Bag and remove any biological debris or damp down such material before demolition

Issue/ Control Measure
Measures Specific to Earthworks
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable
Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
Only remove the cover in small areas during work and not all at once
Measures Specific to Construction
Avoid scabbling (roughening of concrete surfaces) if possible
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust
Measures Specific to Trackout
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use
Avoid dry sweeping of large areas
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport
Inspect on site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable
Record all inspections of haul routes and any subsequent action in a site logbook.
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits
Access gates to be located at least 10 m from receptors where possible

Residual Impacts

The IAQM guidance provides potential mitigation measures to reduce impacts because of fugitive dust emissions during the construction phase. These have been adapted for the Proposed Development, as summarised in Table 5.5. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan or similar if required by the LA. There will be no residual effects during the construction phase once the mitigation measures have been applied.

5.2 Operational Phase Assessment

This section presents a summary of the modelling assessment in relation to concentrations of NO_2, PM_{10} and $PM_{2.5}$. It concerns the effects of changes in air quality on sensitive human receptors as a result of additional traffic associated with the Proposed Development. Full model results are included in Appendix E.

Operational Phase Impacts Assessment

Nitrogen Dioxide (NO_2)

Table E.1 in Appendix E shows the predicted annual mean concentration of NO_2 at the modelled sensitive receptors in 2025 The 40 μgm^{-3} AQO is not predicted to be exceeded at any modelled receptor in the DM 2027 (first full year of occupancy, operational year baseline) or DS 2025 scenarios. The highest predicted annual mean concentration both with and without the Proposed Development is expected at Receptor 10 at 18.8 μgm^{-3} for the DS scenario. Given that all modelled concentrations are below 60 μgm^{-3}, with regard to the LAQM TG(22), it is unlikely that the short term AQO for NO_2 will be exceeded at any modelled receptors.

The greatest change in predicted annual mean concentration due to additional traffic associated with the Proposed Development is an increase of 0.3 μgm^{-3} at Receptor 2. The significance of predicted air quality impacts was determined following the guidance provided within the IAQM document 'Land-Use Planning and Development Control: Planning for Air Quality (shown in Table 3.1). Results show the impact at all receptors is predicted to be negligible.

Particulate Matter <10 microns (PM_{10})

Table E.2 in Appendix E shows the predicted annual mean concentration of PM_{10} at the modelled sensitive receptors in 2025. The 40 μgm^{-3} AQO is not predicted to be exceeded at any modelled receptor in the DM 2027 (first full year of occupancy, operational year baseline) or DS 2025 scenarios. The highest predicted annual mean concentration both with and without the Proposed Development is expected at Receptor 10 at 16.4 μgm^{-3} for the DS scenario.

The greatest change in predicted annual mean concentration due to additional traffic associated with the Proposed Development is a decrease of 0.1 μgm^{-3} at Receptor 13. The significance of predicted air quality impacts was determined following the guidance provided within the IAQM document 'Land-Use Planning and Development Control: Planning for Air Quality (shown in Table 3.1). Results show the impact at all receptors is predicted to be negligible.

Particulate Matter <2.5 microns ($PM_{2.5}$)

Table E.3 in Appendix E shows the predicted annual mean concentration of $PM_{2.5}$ at the modelled sensitive receptors in 2025. The 40 μgm^{-3} AQO is not predicted to be exceeded at any modelled receptor in the DM 2027 (first full year of occupancy, operational year baseline) or DS 2025 scenarios. The highest predicted annual mean concentration both with and without the Proposed Development is expected at Receptor 10 at 10.1 μgm^{-3} for the DS scenario.

The greatest change in predicted annual mean concentration due to additional traffic associated with the Proposed Development is decrease of 0.1 μgm^{-3} at Receptor 13. The significance of predicted air quality impacts was determined following the guidance provided within the IAQM document 'Land-Use Planning and Development Control: Planning for Air Quality (shown in Table 3.1). Results show the impact at all receptors is predicted to be negligible.

Summary

There are not predicted to be any exceedances of the AQO at any existing receptor when the Proposed Development is fully operational in 2027. Impacts on pollutant concentrations are predicted to be negligible, therefore the impact is considered to be not significant.

Operational Phase Future Exposure Assessment

Receptor points were modelled at the Proposed Development to ensure that future residents would not be exposed to unacceptable levels of air pollution when the Site is occupied. Receptors were chosen at intervals round the site boundary. They are represented by F1-F10.

Nitrogen Dioxide (NO_2)

Predicted annual mean concentrations of NO_2 were well below the 40 μgm^{-3} AO at all modelled proposed receptors. The highest predicted concentration in the DS 2027 scenario is at Receptor F2 at 12.5 μgm^{-3}.

Particulate Matter <10 microns (PM_{10})

In the DS 2027 scenario, the highest predicted annual mean concentration of PM_{10} is expected to be at Receptor F2 at 15.3 μgm^{-3}. This is below the 40 μgm^{-3} AQO.

Particulate Matter <2.5 microns ($PM_{2.5}$)

Annual mean concentrations of $PM_{2.5}$ at the proposed receptors are predicted to be below 20 μgm^{-3} at all modelled receptors, with the highest concentration expected at Receptor F2 at 9.4 μgm^{-3}.

5.3 Mitigation

Construction Phase

Particle generation from construction activities can be substantially reduced through carefully selected mitigation techniques and effective management. The most effective technique is to control at source, as once particles are airborne, it is difficult to prevent them from dispersing into the surrounding area. Pre-project planning, implementation and on-site management issues are an essential requirement for effective dust control. This may include environmental risk assessments; method statements; training and satisfying planning requirements.

Before the start of the project, it is important to identify which construction activities are likely to generate dust and to draw up action plans to minimise emissions to the atmosphere. Dust emissions from construction sites will mainly be the sum of a large number of small activities. Therefore, attention to detail is a critical feature of effective management of the total site emissions.

Site specific dust control mitigation measures should be set up based on the outcome of the consultation with UDC. Potential mitigation measures to be undertaken during the construction phase are set out in Table 5.5.

Operational Phase

Based in the operational phase impacts detailed in Section 5 of this report, no further mitigation measures are considered necessary in terms of the impact of the operation of the Proposed Development on the existing and future sensitive human receptors. However, it is widely acknowledged that there is no safe level of exposure to air pollution, and as such, the developer is encouraged to consider mitigation measures to reduce emissions arising from the Proposed Development.

The NPPF requires new developments to support sustainable travel and air quality improvements. A key theme of the NPPF is that developments should 'ensure that appropriate opportunities to promote sustainable transport can be, or have been, taken up'. It states that developments should be located and designed where practical to:

- Give priority to pedestrians and cycle movements, and have access to high quality public transport facilities;
- Incorporate facilities for charging plug-in and other ultra-low emission vehicles; and
- Produce a Travel Plan.

The IAQM has produced guidance on the principles of good practice which should be applied to all major developments. Examples of good practice include:

- The provision of at least 1 Electric Vehicle "rapid charge" point per 10 residential dwellings. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made;
- Where the development generated significant additional traffic, a detailed travel plan should be implemented; and
- Any individual boilers used within the Proposed Development should meet low NO_x emission standards of 40mg/kWh.

UDC Air Quality Technical Planning Guidance specifies mitigation measures to be included to encourage non car travel and use of low emission vehicles. Mitigation is required to ensure all developments are 'air quality neutral' as far as reasonably practicable. As the results from the operation phase impact assessment show negligible impacts, Type 1 mitigation measures are recommended:

- Secure, well designed cycle storage to an appropriate scale in schemes where more than 10 residential units do not have covered parking;
- Points suitable for charging plug-in vehicles. To reflect changing consumer demand for electric and plug-in hybrid vehicles, it is recommended that points are provided at the rate of:
  - 1 point per unit (dwellings with dedicated parking)
  - 1 point per 10 spaces for unallocated parking
  - In addition, appropriate cable provision should be included in the scheme design to prepare for increased demand in future years.
- A travel pack setting out public transport options, and promoting routes for cycling and walking.

6. Conclusions

This report has been prepared to support the planning application at Land off Thaxted Road, Saffron Walden.

The proposals have the potential to cause air quality impacts because of fugitive dust emissions during construction and road traffic exhaust emissions associated with vehicles travelling to and from the Proposed Development during operation, as well as expose future occupants to any existing air quality issues. As such, an air quality assessment was required to determine baseline conditions and assess potential effects because of the scheme.

During the construction phase of the development there is the potential for air quality impacts because of fugitive dust emissions from the Site. These were assessed in accordance with the IAQM methodology. Assuming good practice dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by demolition, earthworks, construction and trackout was predicted to be **not significant**.

During the operational phase of the development there is the potential for air quality impacts because of traffic exhaust emissions associated with vehicles travelling to and from the Site. These were assessed against the screening criteria provided within IAQM guidance. Due to the size and nature of the proposals, dispersion modelling was undertaken using ADMS-Roads to predict pollutant concentrations for in a DM and DS scenario (without and with the Proposed Development). The model results indicate that the change in pollutant concentrations as a result of additional road traffic from the Proposed Development is negligible and therefore, road vehicle exhaust emissions impacts were predicted to be **not significant**.

The Proposed Development has the potential to expose future users to elevated pollution levels in the vicinity of the Site during operation. Dispersion modelling was therefore undertaken using ADMS-Roads to predict pollutant concentrations because of emissions from the local highway network. Results were then verified using local monitoring data. Model results indicates that future users are unlikely to be exposed to pollutant concentrations that exceed AQOs.

Based on the assessment results, air quality is not considered a constraint to planning consent for the Proposed Development.

Appendix A IAQM Methodology

The following methodology is outlined within the IAQM document 'Guidance on the Assessment of Dust from Demolition and Construction V1.1[29].

Sensitivity

Step 1 (Sensitivity) screens the requirement for a more detailed assessment. Should human receptors be identified within 350 m of the boundary or 50 m from the construction vehicle route up to 500 m from the Site entrance, then the assessment proceeds to Step 2 (Potential Risk Magnitude). Additionally, should ecological receptors be identified within 50 m of the Site or the construction vehicle route, then the assessment also proceeds to Step 2 (Potential Risk Magnitude).

Should sensitive receptors not be present within the relevant distances, then negligible impacts would be expected and further assessment is not necessary.

Potential Risk Magnitude

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

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

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

Step 2A defines the potential magnitude of dust emissions through the construction phase. The relevant criteria are summarised in Table A.1.

Table A.1 Construction Dust – Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	Total volume of building to be demolished greater than 50,000 m^3 Potentially dusty material (e.g., concrete) On site crushing and screening Demolition activities more than 20 m above ground level
	Earthworks	Total site area greater than 10,000 m^2 Potentially dusty soil type (e.g., clay, which will be prone to suspension when dry due to small particle size) More than 10 heavy earth moving vehicles active at any one time Formation of bunds greater than 8m in height More than 100,000 tonnes of material moved
	Construction	Total building volume greater than 100,000 m^3 On site concrete batching Sandblasting

[29] Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM (2016)

	Trackout	More than 50 Heavy-Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g., high clay content) Unpaved road length greater than 100 m
Medium	Demolition	Total volume of building to be demolished between 20,000 m^3 and 50,000 m^3 Potentially dusty construction material Demolition activities 10 m to 20 m above ground level
	Earthworks	Total site area 2,500 m^2 to 10,000 m^2 Moderately dusty soil type (e.g., silt) 5 to 10 heavy earth moving vehicles active at any one time Formation of bunds 4 m to 8 m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	Total building volume 25,000 m^3 to 100,000 m^3 Potentially dusty construction material (e.g., concrete) On site concrete batching
	Trackout	10 to 50 HDV trips per day Moderately dusty surface material (e.g., high clay content) Unpaved road length 50 m to 100 m
Small	Demolition	Total volume of building to be demolished less than 20,000 m^3 Construction material with low potential for dust release (e.g., metal cladding or timber) Demolition activities less than 10 m above ground and during wetter months
	Earthworks	Total site area less than 2,500 m^2 Soil type with large grain size (e.g., sand) Less than 5 heavy earth moving vehicles active at any one time Formation of bunds less than 4 m in height Total material moved less than 20,000 tonnes Earthworks during wetter months
	Construction	Total building volume less than 25,000 m^3 Construction material with low potential for dust release (e.g., metal cladding or timber)
	Trackout	Less than 10 HDV trips per day Surface material with low potential for dust release Unpaved road length less than 50 m

Step 2B defines the sensitivity of the area around the development to potential dust impacts. The influencing factors are shown in Table A.2.

Table A.2 Construction Dust – Examples of Factors Defining Sensitivity of an Area

Receptor Sensitivity	Examples	
	Human Receptors	**Ecological Receptors**
High	Users expect of high levels of amenity High aesthetic or value property People expected to be present continuously for extended periods of time	Internationally or nationally designated site e.g., Special Area of Conservation

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

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

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and,
- Any known specific receptor sensitivities which go beyond the classifications given in the document.

These factors were considered during the undertaking of the assessment.

The criteria for determining the sensitivity of the area to dust soiling effects on people and property is summarised in Table A.3.

Table A.3 Construction Dust – Sensitivity of the Area to Dust Soiling Effects on People and Property

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

Table A.4 outlines the criteria for determining the sensitivity of the area to human health impacts.

Table A.4 Construction Dust – Sensitivity of the Area to Human Health Impacts

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

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
Low	-	More than 1	Low	Low	Low	Low	Low

Table A.5 outlines the criteria for determining the sensitivity of the area to ecological receptors.

Table A.5 Construction Dust – Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C combines the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts. Table A.6 outlines the risk category from demolition activities.

Table A.6 Construction Dust – Dust Risk Category from Demolition Activities

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Low	Low	Negligible

Table A.7 outlines the risk category from earthworks and construction activities.

Table A.7 Construction Dust – Dust Risk Category from Earthworks and Construction Activities

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table A.8 outlines the risk category from trackout activities.

Table A.8 Construction Dust – Dust Risk Category from Trackout Activities

Receptor Sensitivity	Dust Emission Magnitude		
	Large	**Medium**	**Small**
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Mitigation

Step 3 (Mitigation) requires the identification of site-specific mitigation measures within the IAQM guidance[30] to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk, mitigation measures beyond those required by legislation are not required. However, additional controls may be applied as part of good practice.

Residual Impacts

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects using effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be not significant.

[30] Guidance on the Assessment of Dust from Demolition and Construction V1.1, IAQM, (2016)

Appendix B
ADMS-Roads Dispersion Model

Introduction

The ADMS-Roads dispersion model, developed by CERC[6], is a tool for investigating air pollution problems due to small networks of roads that may be in combination with industrial sites, for instance small towns or rural road networks. It calculates pollutant concentrations over specified domains at high spatial resolution (street scale) and in a format suitable for direct comparison with a wide variety of air quality standards for the UK and other countries. The latest version of the model, version 5.0, was used in this study.

ADMS-Roads is referred to as an advanced Gaussian or, new generation, dispersion model as it incorporates the latest understanding of the boundary layer structure. It differs from old generation models such as ISC, R91 and CALINE in two main respects:

- It characterises the boundary layer structure and stability using the boundary layer depth and Monin-Obukhov length to calculate height-dependent wind speed and turbulence, rather than using the simpler Pasquill-Gifford stability category approach; and
- It uses a skewed-Gaussian vertical concentration profile in convective meteorological conditions to represent the effect of thermally generated turbulence.

Model Features

A description of the science used in ADMS-Roads and the supporting technical references can be found in the model's User Guide[31]. The main features of ADMS-Roads are:

- It is an advanced Gaussian, "new generation" dispersion model;
- Includes a meteorological pre-processor which calculates boundary layer parameters from a variety of input data e.g. wind speed, day, time, cloud cover and air temperature;
- Models the full range of source types encountered in urban areas including industrial sources (up to 3 point sources, up to 3 lines sources, up to 4 area sources, up to 25 volume sources) and road sources (up to 150 roads, each with 50 vertices);
- Generates output in terms of average concentrations for averaging times from 15minutes to 1 year, percentile values and exceedances of threshold values. Averages can be specified as rolling (running) averages or maximum daily values;
- The option to calculate emissions from traffic count data, speed and fleet split (light duty/ heavy duty vehicles) using UK emission factors. Alternatively, road emissions may be entered directly as user specified values;
- Models plume rise by solving the integral conservation equations for mass, momentum and heat;
- Models the effect of street canyons on concentrations within the canyon and vehicle–induced turbulence using a formulation based on the Danish OSPM model. It is usually

[31] CERC (2011) ADMS-Roads, an Air Quality Management System, Version 5.0 User Guide,
[redacted]
Date of access: 19th October 2022.

only important to model street canyons when the aspect ratio (ratio of the height of buildings along the road to the width of the road) is greater than 0.5;

- Models the effects of noise barriers on concentrations outside the road;
- Models NO_X chemistry using the 8 reaction Generic Reaction Set plus transformation of SO_2 to sulphate particles, which are added to the PM_{10} concentration;
- Models the effect of a small number of buildings on dispersion from point sources;
- Models the effect of complex terrain (hills) and spatially varying surface roughness. Terrain effects only become noticeable for gradients greater than 1:10, but for ground level sources in a built up area, such as urban roads, low gradients will have a negligible effect;
- Models concentrations in units of $ou_E m^{-3}$ for odour studies;
- Link to MapInfo and ArcGIS for input of source geometry, display of sources, aggregation of emissions and plotting of contours; and
- Link to an emissions inventory in Microsoft Access for input and export of source and emissions data.

In this study, street canyons, noise barriers, buildings and complex terrain were not modelled.

Validation

ADMS-Roads has been validated using UK and US data and has been compared with the DMRB spreadsheet model and the US model, CALINE. Validation of the ADMS and ADMS-Urban models are also applicable to the performance of ADMS-Roads as they test common features: basic dispersion, modelling of roads and street canyons, the effect of buildings and the effect of complex terrain. These validation studies are all reported on the CERC web site[32]. In addition, ADMS-Urban has been validated during its use in modelling many urban areas in the UK for local authorities as part of LAQM, Heathrow Airport for the Department for Transport[33] and all of Greater London for a Defra model inter-comparison exercise[34].

32 [redacted]

33 CERC (2007) Air Quality Studies for Heathrow: Base Case, Segregated Mode, Mixed Mode and Third Runway Scenarios Modelled Using ADMS-Airport, prepared for the Department for Transport, *HMSO* Product code 78APD02904CERC

34 Carslaw, D. (2011), Defra urban model evaluation analysis – Phase 1, a report to Defra and the Devolved Authorities. http://uk-air.defra.gov.uk/library/reports?report_id=654 Date of access: 19 October 2022

Appendix C Dispersion Model Input Data

Assessment Area – Discrete Receptors

A sensitive receptor is defined as any location which may be affected in air quality because of a development. Table C.1 shows the sensitive human receptors considered in this assessment. Table C.2 shows the future human receptors considered in this assessment. Potential existing sensitive receptor locations are shown in Figure C.1 and future receptors are shown in Figure C.2. Potential existing sensitive receptors are located along the modelled road network, receptors at a greater distance from these roads are expected to experience lower pollutant concentrations.

Table C.1 Sensitive Receptors

Receptor ID	Type	X	Y
R1	Residential	554732	237655
R2	Residential	554625	237639
R3	Residential	554607	237371
R4	Residential	554500	237258
R5	Residential	554440	237673
R6	Education	554245	237772
R7	Education	554037	237773
R8	Residential	553883	237763
R9	Residential	553692	237815
R10	Residential	553617	237922
R11	Residential	553561	237767
R12	Education	553413	237803
R13	Residential	553751	238060
R14	Church	553820	238170
R15	Residential	554076	238271
R16	Church	553632	238353
R17	Residential	554016	238478
R18	Residential	554294	238419
R19	Medical	554522	238503
R20	Medical	555059	238483

Receptor ID	Type	X	Y
R21	Residential	553876	238159
R22	Education	553159	237826
R23	Medicine	553820	238406

Figure C.1 Location of Sensitive Receptors

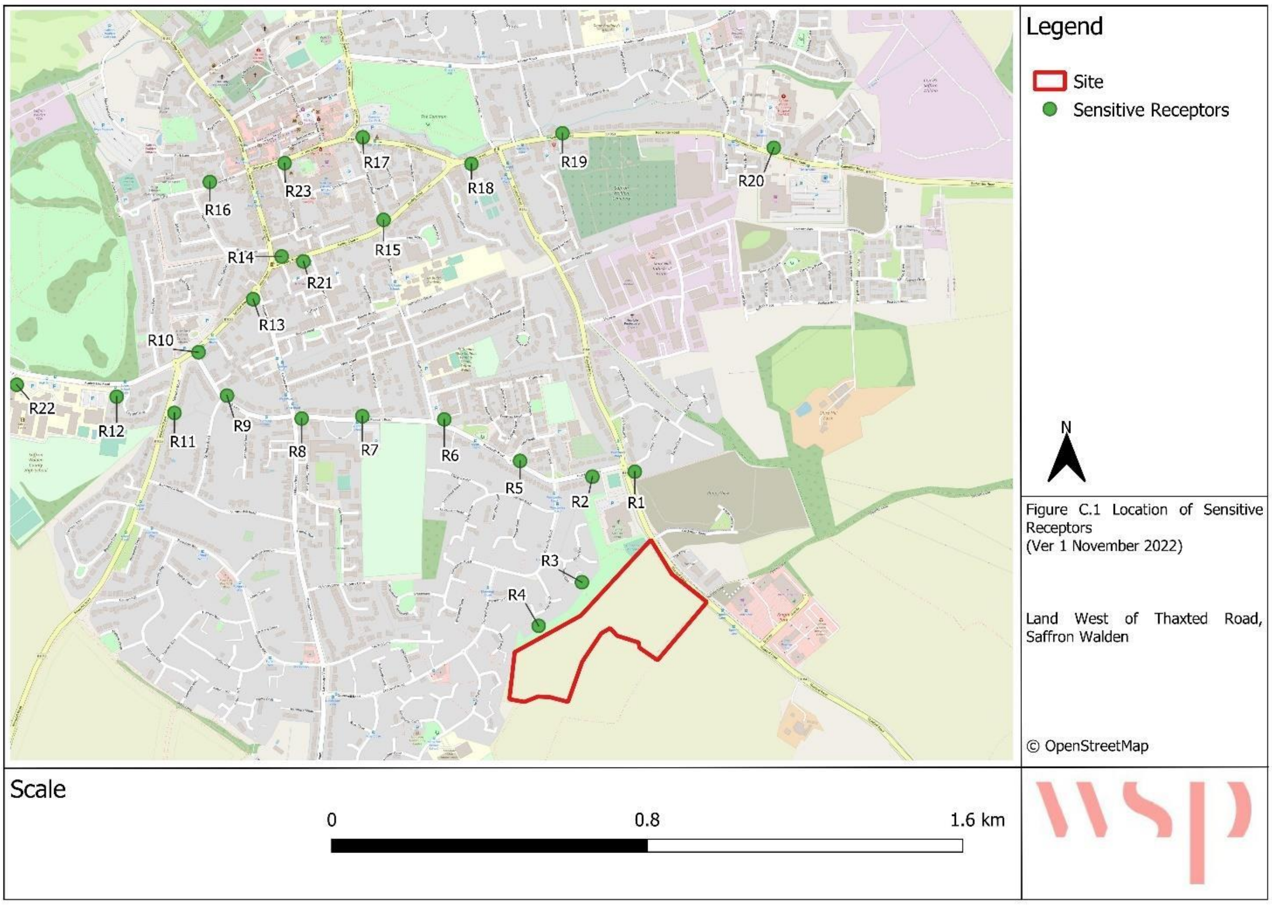
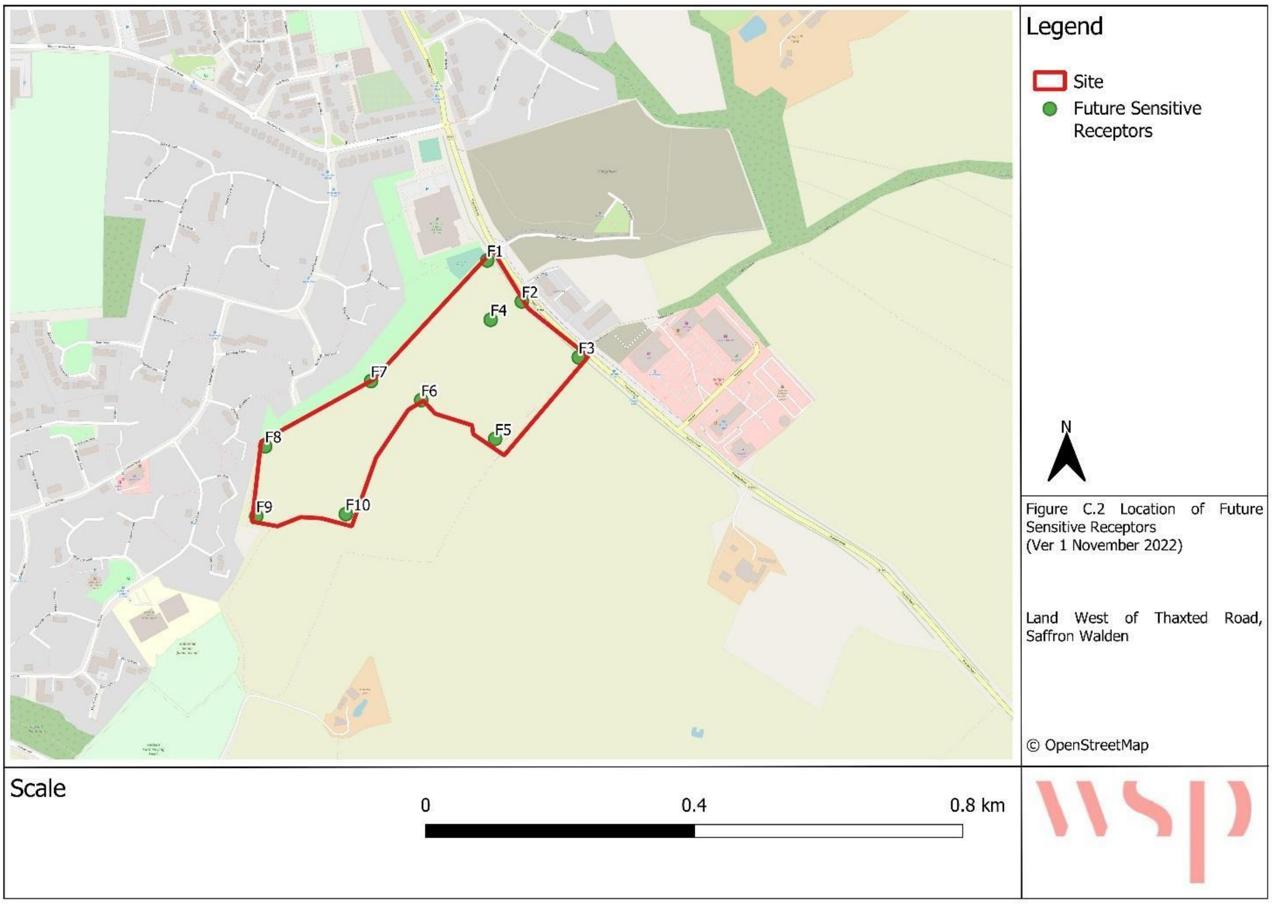


Table C.2 Future Receptors

Receptor ID	Type	X	Y
F1	Residential	554770	237469
F2	Residential	554824	237410
F3	Residential	554911	237329
F4	Residential	554778	237381
F5	Residential	554790	237204
F6	Residential	554678	237259

Receptor ID	Type	X	Y
F7	Residential	554603	237284
F8	Residential	554448	237183
F9	Residential	554438	237079
F10	Residential	554571	237086

Figure C.2 Location of Future Receptors



Traffic Flow Data

Traffic data for use in the assessment, including 24-hour AADT flows and fleet composition, was obtained from the Transport Consultant for this scheme. Traffic surveys were undertaken and therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the Site.

Road widths were estimated from aerial photography and UK highway design standards.

The derived traffic data is summarised in Table C.3.

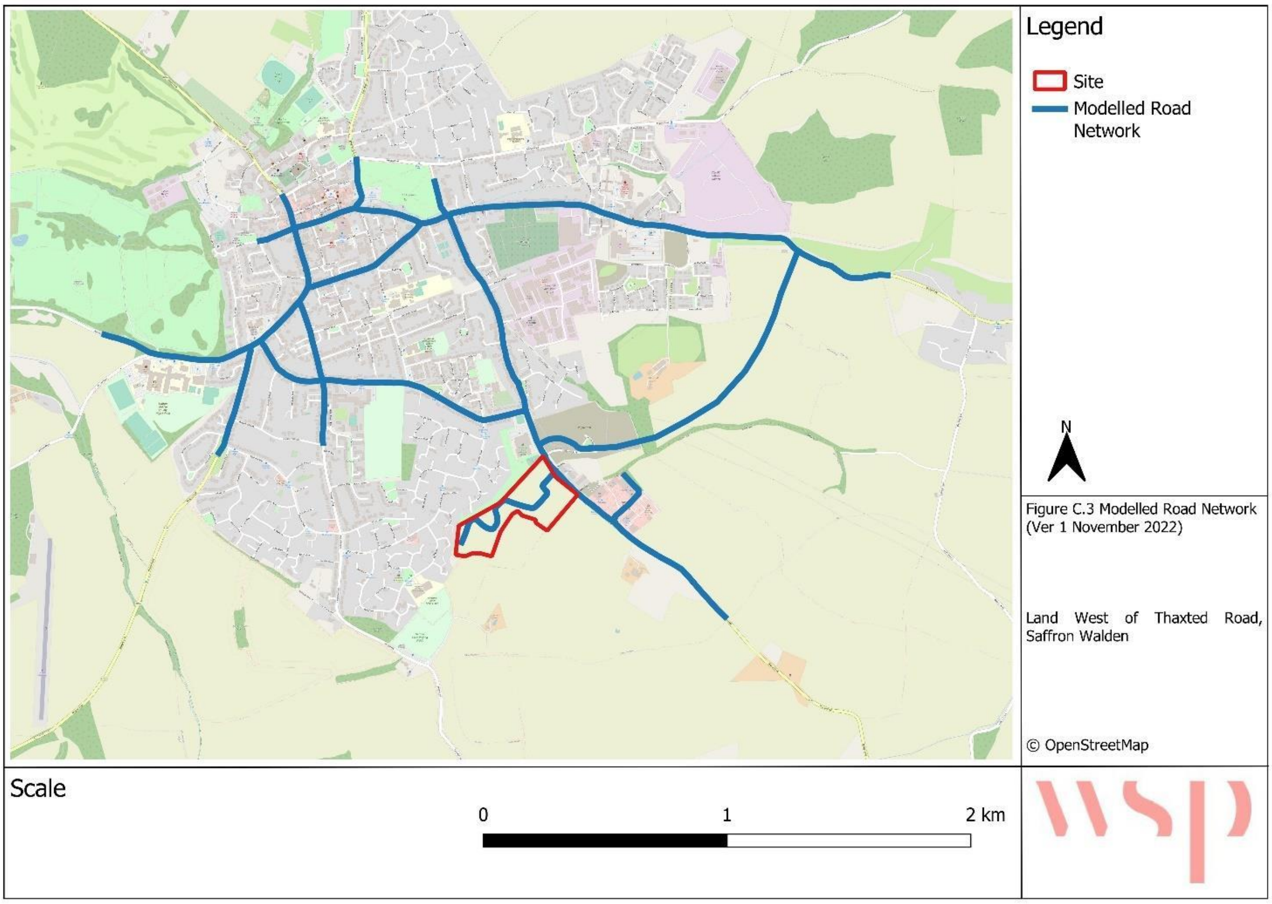
Table C.3 Traffic Data (AADT)

Road Name	2019 LDV	2019 HDV	2025 LDV (DM)	2025 HDV (DM)	2025 LDV (DS)	2025 HDV (DM)
1	9160	186	10352	193	10677	193
2	258	0	268	0	268	0
3	12921	282	14499	293	14716	293
4	7048	186	8104	193	8275	193
5	6580	90	7481	94	7535	94
6	7822	156	8858	162	9021	162
7	7264	138	8153	143	8370	143
8	5309	42	6111	44	6327	44
9	9784	180	11247	187	11628	187
10	1464	42	1632	44	1632	44
11	8398	186	5883	176	6263	176
12	12603	204	10585	195	10585	195
13	0	0	4390	30	4513	30
14	5519	13	7672	13	7795	13
15	11331	228	12274	236	12274	236
16	14373	282	16418	293	17038	293
17	8818	108	9791	112	10073	112
18	10030	234	11268	243	11605	243
19	3401	54	4518	56	5137	56
20	5627	90	6362	93	6362	93
21	3749	36	4036	37	4036	37
22	7030	108	8946	112	9566	112
23	10294	228	12237	240	13237	240
24	229	55	5197	73	5319	73
25	10136	173	11316	180	12438	180
26	0	0	0	0	1307	0
27	10136	173	11150	180	11242	180
28	5853	54	6082	56	6082	56

Road Name	2019 LDV	2019 HDV	2025 LDV (DM)	2025 HDV (DM)	2025 LDV (DS)	2025 HDV (DM)
29	5519	13	7863	13	6480	44

The modelled network is shown in Figure C.3.

Figure C.3 Modelled Road Network



Vehicle Emission Factors

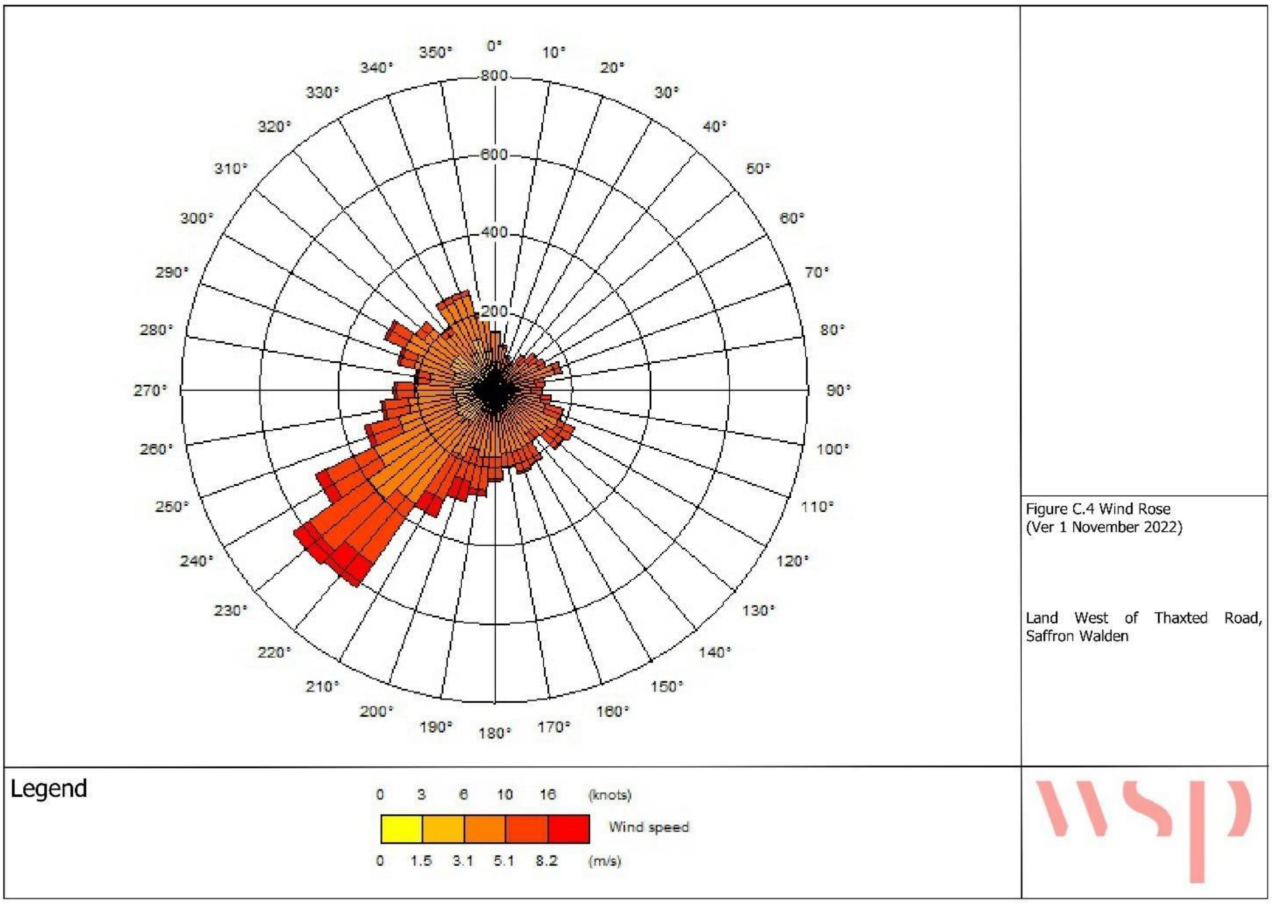
Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 11.0). This has been produced by Defra and incorporates COPERT 5 vehicle emission factors and fleet information.

Meteorological Data

Meteorological data used in the assessment was taken from Stansted meteorological station from 2019. Stansted meteorological station is found at NGR: 631744, 165860, which is approximately 16.9 km north east of the Proposed Development. It is expected that conditions would be similar over this magnitude. The data was therefore considered suitable for an assessment of this nature.

Reference should be made to Figure C.4 for a wind rose of utilised meteorological data.

Figure C.4 Wind Rose



Roughness Length

The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 1 m was used to describe the modelling extents. This value of z_0 is considered right for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.

A z_0 of 0.3 m was used to describe the meteorological site. This value of z_0 is considered right for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'agricultural areas (max)'.

Monin-Obukhov Length

The Monin-Obukhov length supplies a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30 m was used to describe the modelling extents. This value is considered right for the nature of both areas and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

A Monin-Obukhov length of 10 m was used to describe the meteorological site. This value of Monin-Obukhov length is considered right for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'small towns'.

Background Concentrations

Annual mean NO_2 and PM_{10} background concentrations for use in the assessment were obtained from the Defra mapping study for the grid square containing the Site, as shown in Table 4.7.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations were converted to NO_2 concentrations using the spreadsheet (version 8.1) provided by Defra, which is the method detailed within Defra guidance[35].

[35] Defra, Technical Guidance 2022 (LAQM.TG (22)), Defra, (2022)

Appendix D Model Verification

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG (22) identifies several statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. The statistical parameters used in this assessment are:

- Root mean square error (RMSE);
- Fractional Bias (FB); and
- Correlation Coefficient (CC)

A brief explanation of each statistic is provided in Table D.1 and further details can be found in LAQM.TG(22) Box A3.7[36].

Table D.1 Model Performance Statistics

Statistic Parameter	Comments	Ideal Value
RMSE	RMSE is used to define the average error or uncertainty of the model. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited to make improvements. For example, if model predictions are of an annual mean NO_2 objective of 40µgm^{-3} and the RMSE is 10µgm^{-3} or above, it is advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µgm^{-3} for the annual mean NO_2 objective.	0.01
FB	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.	0.00
CC	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing many models and observed data points.	1.00

These parameters estimate how the model results agree or diverge from observations.

These calculations have been conducted prior to, and after, model adjustment and provide information on the improvement of the model predictions because of the application of the adjustment factor. The verification process involves a review of the annual mean modelled pollutant concentrations against corresponding monitoring data to determine how closely the air quality model agrees.

The acceptable limits of model verification are set out in LAQM.TG (22). Depending on the outcome it may be considered that there is no need to adjust any of the modelled results.

[36] DEFRA, Technical Guidance 2016 (LAQM.TG (22)), DEFRA, (2022)

Alternatively, the model may not correlate against the monitoring data. There is then a need to check all the input data to ensure that it is reasonable and accurately represented in the air quality modelling process.

Where all input data, such as traffic data, emissions rates, and background concentrations have been checked and considered reasonable, a model can be adjusted to better agree with locally monitored data. This may either be a single adjustment factor to be applied to modelled concentrations across the study area, or a range of different adjustment factors to account for different zones in the study area e.g., motorways, local roads. 10 suitable monitoring locations were selected and used in the verification process, considering the site types, position of the diffusion tubes and representation of local air quality environment (UTT2, UTT3, UT015, UT016, UT021, UT028, UT029, UT031, UT032, UT044,45,46). These sites were chosen as they are roadside diffusion tubes. Table 4.5 and Table 4.6 shows their location, height and monitored annual mean NO_2.

Table D.2 shows that there was a systematic under prediction of monitored concentrations at the diffusion tubes. It was therefore considered necessary to adjust modelled concentrations.

Table D.2 Verification, Unadjusted Modelled vs. Monitored Data

ID	2019 Monitored Annual Mean NO_2	2019 Modelled Annual Mean NO_2	Unadjusted % (Modelled-Monitored)/ Monitored
UTT2	32.7	17.8	-45.7
UTT3	19.6	14.4	-26.5
UT015	24.9	13.0	-47.6
UT016	30.7	16.8	-45.4
UT021	24.0	17.1	-28.9
UT028	31.2	15.0	-52.0
UT029	20.1	16.5	-17.9
UT031	20.7	13.7	-33.8
UT032	15.0	11.5	-23.3
UT044	37.0	17.0	-53.9

Table D.3 shows the comparison of modelled road-NO_x, a direct output from the ADMS-Roads modelling, with the monitored road-NO_x, determined from the LAQM NO_x to NO_2 conversion tool. A adjustment factor determined by regression, of 3.2516 was used to adjust modelled results.

Table D.3 Comparison of Modelled and Monitored Road-NO_x

ID	2019 Monitored Annual Mean Road-NO_x	2019 Modelled Annual Mean Road-NO_x	Ratio
UTT2	42.2	11.9	3.8

ID	2019 Monitored Annual Mean Road-NO_x	2019 Modelled Annual Mean Road-NO_x	Ratio
UTT3	42.2	8.0	3.6
UT015	17.9	5.6	2.2
UT016	28.6	10.0	5.1
UT021	37.9	10.5	3.8
UT028	24.0	9.3	2.3
UT029	41.7	12.1	4.5
UT031	19.0	7.6	1.6
UT032	20.9	2.7	2.8
UT044	9.1	10.5	3.4
Adjustment Factor			**3.2516**

Table D.4 shows the comparison of the modelled NO_2 concentration calculated by multiplying the modelled road NO_x by the adjustment factor of 3.2516 and using the LAQM NO_x to NO_2 conversion tool to calculate the total adjusted modelled NO_2.

Table D.4 Comparison of Adjusted Modelled NO_2 and Monitored NO_2

ID	2019 Annual Mean Background NO_2 Concentrations	2019 Adjusted Modelled Annual Mean NO_2	2019 Monitored Annual Mean NO_2	% (Modelled-Monitored)/ Monitored
UTT2	11.4	31.0	32.7	-5.1%
UTT3	10.0	23.7	19.6	21.1%
UT015	9.9	19.8	24.9	-20.6%
UT016	11.4	28.1	30.7	-8.5%
UT021	11.4	29.0	24.0	20.8%
UT028	9.9	25.7	31.2	-17.8%
UT029	9.9	30.1	20.1	49.8%
UT031	9.5	22.6	20.7	9.1%
UT032	10.0	14.8	15.0	-1.7%
UT044	11.4	28.9	37.0	-21.8%

The model performance statistics show that after adjustment the residual uncertainty in the predictions of total annual mean NO_2 was less than 25% for 9 of the verification sites (RMSE of 5.2994).

In line with LAQM TG(22), statistical procedures (explained in Table D.1) have been carried out to assess the uncertainties within the model, as shown in Table D.5.

Table D.5 Assessment of Model Uncertainty

Statistical Parameter	Calculated Value
RMSE	5.2704
FB	0.0
CC	0.623

Appendix E ADMS-Roads Results

The results for the assessment of air quality impacts on human receptors during the operational phase of the Proposed Development are report below.

Operational Phase Impacts Assessment

Table E.1 Annual Mean Predicted Concentration of NO_2 (μgm^{-3}) at Existing Receptors

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R1	16.0	11.7	11.8	0.2	0%	Negligible
R2	16.7	12.5	12.7	0.3	1%	Negligible
R3	10.2	8.1	8.2	0.1	0%	Negligible
R4	10.0	7.9	8.1	0.1	0%	Negligible
R5	16.7	12.6	12.8	0.2	1%	Negligible
R6	15.2	11.5	11.6	0.2	0%	Negligible
R7	17.2	12.9	13.1	0.2	1%	Negligible
R8	22.1	16.2	16.5	0.3	1%	Negligible
R9	14.6	11.2	11.4	0.2	1%	Negligible
R10	27.0	18.8	18.8	0.0	0%	Negligible
R11	17.1	12.4	12.5	0.0	0%	Negligible
R12	12.9	9.8	9.9	0.0	0%	Negligible
R13	22.6	15.6	15.4	0.2	1%	Negligible
R14	19.4	13.8	13.7	0.0	0%	Negligible
R15	16.5	12.4	12.4	0.0	0%	Negligible
R16	11.4	8.8	8.8	0.0	0%	Negligible
R17	21.3	15.4	15.3	0.1	0%	Negligible
R18	21.2	15.3	15.3	0.0	0%	Negligible
R19	24.2	15.4	15.3	0.1	0%	Negligible
R20	17.4	11.1	11.0	0.1	0%	Negligible

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R21	16.3	11.9	12.0	0.0	0%	Negligible
R22	12.3	9.4	9.4	0.0	0%	Negligible
R23	18.8	13.4	13.4	0.0	0%	Negligible

Table E.2 Annual Mean Predicted Concentration of PM_{10} (μgm^{-3}) at Existing Receptors

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R1	16.4	15.3	15.3	0.0	0%	Negligible
R2	16.5	15.5	15.5	0.0	0%	Negligible
R3	15.6	14.4	14.5	0.0	0%	Negligible
R4	15.6	14.4	14.4	0.0	0%	Negligible
R5	16.4	15.4	15.4	0.0	0%	Negligible
R6	16.2	15.1	15.2	0.0	0%	Negligible
R7	16.5	15.4	15.5	0.0	0%	Negligible
R8	16.8	15.9	15.9	0.0	0%	Negligible
R9	15.9	14.8	14.9	0.0	0%	Negligible
R10	17.5	16.4	16.4	0.1	0%	Negligible
R11	16.3	15.2	15.1	0.0	0%	Negligible
R12	15.7	14.5	14.5	0.0	0%	Negligible
R13	16.6	15.5	15.4	0.1	0%	Negligible
R14	16.2	15.1	15.1	0.0	0%	Negligible
R15	15.6	14.5	14.5	0.0	0%	Negligible
R16	15.2	14.1	14.0	0.0	0%	Negligible
R17	16.2	15.1	15.0	0.0	0%	Negligible
R18	16.2	15.1	15.0	0.0	0%	Negligible
R19	16.8	15.3	15.2	0.1	0%	Negligible
R20	17.0	15.6	15.5	0.1	0%	Negligible
R21	15.8	14.7	14.7	0.0	0%	Negligible

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R22	15.6	14.5	14.4	0.0	0%	Negligible
R23	16.2	15.1	15.1	0.1	0%	Negligible

Table E.3 Annual Mean Predicted Concentration of $PM_{2.5}$ (μgm^{-3}) at Existing Receptors

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R1	10.3	9.4	9.4	0.0	0%	Negligible
R2	10.4	9.5	9.5	0.0	0%	Negligible
R3	9.8	8.9	8.9	0.0	0%	Negligible
R4	9.8	8.9	8.9	0.0	0%	Negligible
R5	10.3	9.5	9.5	0.0	0%	Negligible
R6	10.2	9.3	9.3	0.0	0%	Negligible
R7	10.4	9.5	9.5	0.0	0%	Negligible
R8	10.6	9.7	9.8	0.0	0%	Negligible
R9	10.0	9.1	9.2	0.0	0%	Negligible
R10	11.0	10.1	10.1	0.0	0%	Negligible
R11	10.2	9.3	9.3	0.0	0%	Negligible
R12	9.9	9.0	9.0	0.0	0%	Negligible
R13	10.5	9.6	9.5	0.1	0%	Negligible
R14	10.3	9.3	9.3	0.0	0%	Negligible
R15	10.2	9.2	9.2	0.0	0%	Negligible
R16	9.6	8.7	8.7	0.0	0%	Negligible
R17	10.5	9.6	9.6	0.0	0%	Negligible
R18	10.5	9.6	9.6	0.0	0%	Negligible
R19	10.9	9.7	9.6	0.0	0%	Negligible
R20	10.3	9.2	9.2	0.0	0%	Negligible
R21	10.0	9.1	9.1	0.0	0%	Negligible
R22	9.8	8.9	8.9	0.0	0%	Negligible

Receptor ID	2019 Base	DM 2025	DS 2025	Change in Concentration (DS-DM)	% of AQO	Impact Magnitude
R23	10.3	9.4	9.3	0.0	0%	Negligible

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Table E.4 Annual Mean Predicted Concentration NO_2 (μgm^{-3}) at Future Receptors

Receptor ID	DS 2025	% of AQO
F1	10.7	27%
F2	12.5	31%
F3	11.4	29%
F4	9.2	23%
F5	8.2	20%
F6	8.4	21%
F7	9.8	24%
F8	8.1	20%
F9	7.9	20%
F10	8.0	20%

Table E.5 Annual Mean Predicted Concentration PM_{10} (μgm^{-3}) at Future Receptors

Receptor ID	DS 2025	% of AQO
F1	14.9	37%
F2	15.3	38%
F3	15.1	38%
F4	14.6	37%
F5	14.5	36%
F6	14.5	36%
F7	14.8	37%
F8	14.4	36%
F9	14.4	36%

F10	14.4	36%

Table E.6 Annual Mean Predicted Concentration $PM_{2.5}$ (μgm^{-3}) at Future Receptors

Receptor ID	DS 2025	% of AQO
F1	9.2	23%
F2	9.4	24%
F3	9.3	23%
F4	9.0	23%
F5	8.9	22%
F6	8.9	22%
F7	9.1	23%
F8	8.9	22%
F9	8.9	22%
F10	8.9	22%

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