Chase New Homes

Mount Pleasant, Saffron Walden

Air Quality Assessment

Report No. 444326/AQ/02 (00)

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RSK GENERAL NOTES

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Summary

An air quality assessment for the proposed development at Mount Pleasant Road, Saffron Walden has been undertaken with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

The assessment considered the impact of existing sources of air pollution at the proposed development site (governed by background pollutant levels and vehicle movements along the local highway network), and the impacts of the proposed development on the local area. It is understood that significant stationary combustion sources such as combined heat and power (CHP) plant or boilers are not proposed, and any modern space heating and cooking appliances to be installed at the development site are likely to be efficient, thereby having a limited impact on air quality.

Construction phase impacts of the proposed development on local air quality may have the potential to occur, due to dust and particulate matter (PM) emissions during the period of construction. The potential risk of dust impacts was predicted to be a maximum of 'medium risk' during the construction phase. Mitigation measures have been recommended to reduce the risk for general site activities and construction activity-specific activities, in accordance with the Institute of Air Quality Management (IAQM) Guidance *Assessment of Dust from Demolition and Construction* ('the IAQM 2014 guidance'). It is recommended that a Dust Management Plan (DMP) or dust management section of a Construction Environmental Management Plan (CEMP) incorporating such best practice measures is adopted, to apply for the duration of construction activities at this site. If appropriate mitigation, such as those recommended in this report and in any DMP, are implemented, the residual impact of construction phase air quality impacts should be viewed as 'not significant'.

To assess the effects of the development on local air quality, the following three scenarios were assessed using the ADMS Roads Extra dispersion modelling software:

- **S1:** 'Base case' scenario representing the 'existing' air quality situation in 2019;
- **S2:** 'Without Proposed development 2024' scenario; and,
- **S3:** 'With Proposed development 2024' scenario.

This assessment has identified that the development is expected to have a negligible effect on local air quality at existing sensitive receptor locations (regarding annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations). Moreover, no exceedances of the annual mean NO_2, PM_{10} and $PM_{2.5}$, daily mean PM_{10} or hourly mean NO_2 air quality standards (AQSs) were predicted at the modelled existing receptor locations with the development in place and therefore, overall effects of the development on local air quality are considered insignificant. Based on the results in Section 5.2, annual mean or short-term NO_2 and PM_{10} AQS exceedances are not anticipated at the proposed development site and therefore, it is considered that ambient air quality would not significantly affect future site users.

It should be noted that results from this assessment are based off traffic increases of the old 87 residential units scheme, however as all results are well below the relevant AQAL and a max of a

1% change from S2 to S3 is observed it is considered highly unlikely for an additional 9 units to cause significant impacts at any modelled sensitive receptors.

Based on the results of the assessment, it is judged that with appropriate construction phase mitigation the proposed development complies with relevant national and local planning policies and will not result in a significant adverse impact on air quality.

Abbreviations

AADT	Annual Average Daily Traffic
AQMA	Air Quality Management Area
AQS	Air Quality Standard
Defra	Department for Environment, Food and Rural Affairs
DMP	Dust Management Plan
EC	European Commission
EPUK	Environmental Protection UK
EU	European Union
FTP	Framework Travel Plan
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LAQM TG.16	Local Air Quality Management Technical Guidance (2016)
LDV	Light Duty Vehicle
NAQS	National Air Quality Strategy
NPPF	National Planning Policy Framework
NO_2	Nitrogen dioxide
NOx	Oxides of nitrogen
$PM_{2.5}$	Particulate matter of size fraction approximating to <2.5mm diameter
PM_{10}	Particulate matter of size fraction approximating to <10mm diameter
RSK	RSK Environment Limited
UK-AIR	UK Atmospheric Information Resource

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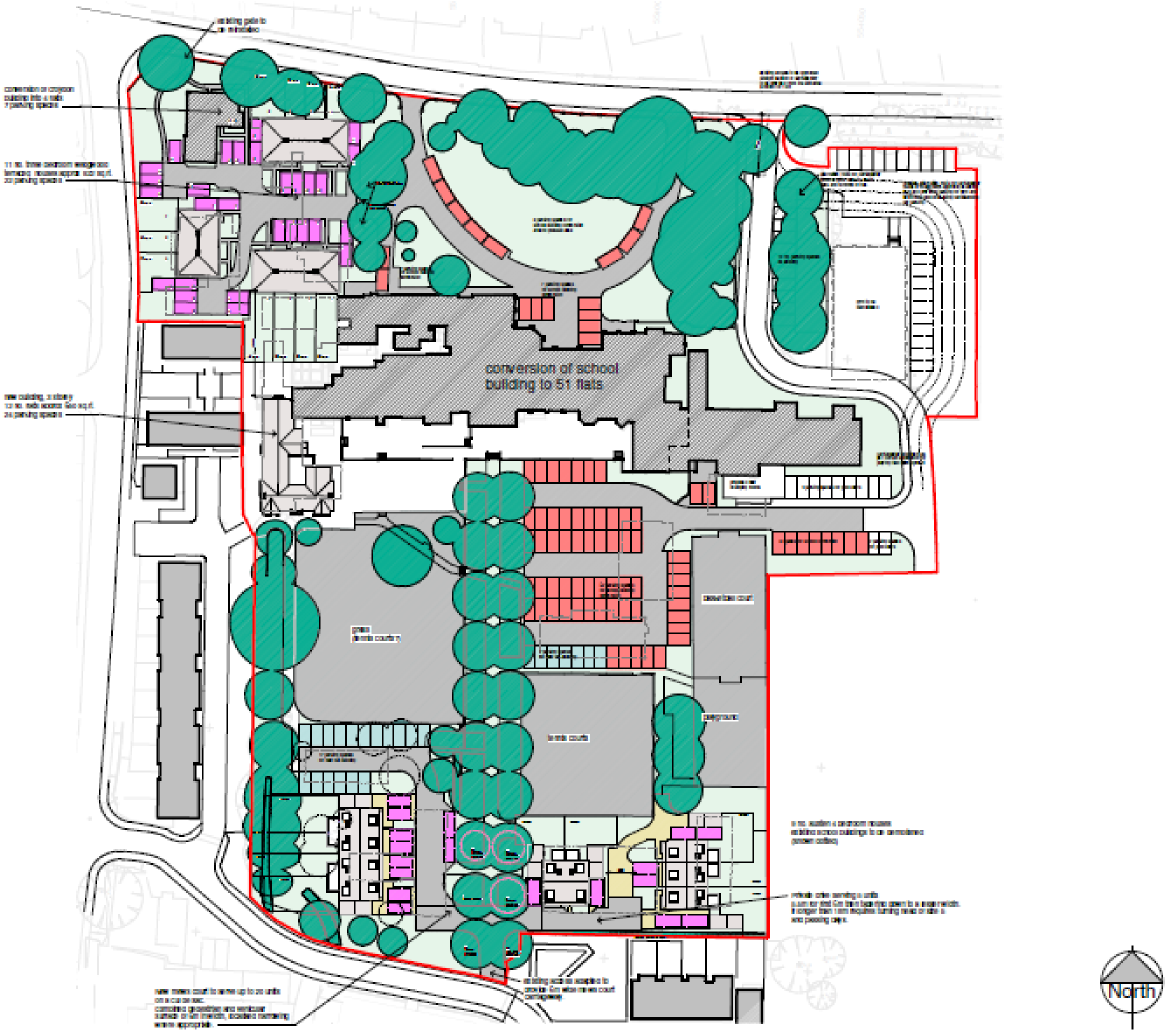
1 INTRODUCTION

RSK Environment Limited (RSK) has been commissioned to undertake an assessment of the potential air quality impacts associated with the proposed demolition of and subsequent development at Mount Pleasant Road, Saffron Walden. It is understood that planning permission is being sought for the development of an apartment-led scheme with some new build housing that totals 96 units. This report is an update of 444326-01 (00), dated April 2021, for which 87 units were assessed.

The proposed development site is within the jurisdiction of Uttlesford District Council (UDC). Figure 1.1 shows the proposed development site location and proposed layout plan.

This report presents the findings of an assessment of existing/baseline air quality conditions, potential air quality impacts during the construction phase of the proposed development and predicted air quality impacts once the development is fully operational.

Figure 1.1: Proposed Development Site Plan



2 LEGISLATION, PLANNING POLICY AND GUIDANCE

2.1 Air Quality Strategy

UK air quality policy is published under the umbrella of the Environment Act 1995, Part IV and specifically Section 80, the National Air Quality Strategy. The latest *Air Quality Strategy for England, Scotland, Wales and Northern Ireland – Working Together for Clean Air*, published in July 2007, sets air quality standards and objectives for ten key air pollutants to be achieved between 2003 and 2020.

The EU (European Union) Air Quality Framework Directive (1996) established a framework under which the EU could set limit or target values for specified pollutants. The directive identified several pollutants for which limit or target values have been or will be set in subsequent 'daughter directives'. The framework and daughter directives were consolidated by Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe, which retains the existing air quality standards and introduces new objectives for fine particulates ($PM_{2.5}$).

The Clean Air Strategy 2019 supersedes the policies outlined in the 2007 strategy. This latest strategy aims to have a more joined-up approach, outlining actions the Government plans to take to reduce emissions from transport, homes, agriculture and industry. However, the air quality objectives remain as previously detailed within the 2007 strategy.

2.1.1 Air Quality Objectives

The air quality standards (AQSs) in the United Kingdom are derived from European Commission (EC) directives and are adopted into English law via the Air Quality (England) Regulations 2000 and Air Quality (England) Amendment Regulations 2002. The Air Quality Limit Values Regulations 2003 and subsequent amendments implement the EU Air Quality Framework Directive into English Law. Directive 2008/50/EC was translated into UK law in 2010 via the Air Quality Standards Regulations 2010. The European Union (Withdrawal) Act retains existing EU environmental provisions in the UK.

The relevant[1] AQSs for England and Wales to protect human health are summarised in Table 2.1.

Table 2.1: Air Quality Objectives Relevant to the Proposed Development

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit ($\mu g/m^3$)
Nitrogen dioxide (NO_2)	1 calendar year	-	40
	1 hour	18	200

[1] Relevance, in this case, is defined by the scope of the assessment.

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m³)
Particles (PM_{10})	1 calendar year	-	40
	24 hours	35	50
Fine particles ($PM_{2.5}$)	1 calendar year	-	25

2.1.2 The Environment Act

Local authorities are required to review and assess air quality in their areas under Section 82 of the Environment Act (1995). If exceedances of the air quality objectives are measured or predicted, the local authority must declare an air quality management area (AQMA) and prepare an air quality action plan to outline how air quality is to be improved.

2.2 Planning Policy

The land use planning process is a key means of improving air quality, particularly in the long term, through the strategic location and design of new developments. Any air quality concern that relates to land use and its development can, depending on the details of the proposed development, be a material consideration in the determination of planning applications.

2.2.1 National Planning Policy Framework

In 2019 the revised National Planning Policy Framework (NPPF) was published, superseding the previous NPPF with immediate effect. The NPPF includes a presumption in favour of sustainable development.

Section 15 of the NPPF deals with Conserving and Enhancing the Natural Environment, and states that the intention is that the planning system should prevent '*development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability*' and goes on to state that '*new development* [should be] *appropriate for its location' and 'the effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account*.'

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

2.2.2 Land-Use Planning & Development Control: Planning for Air Quality

Environmental Protection UK's (EPUK) and the IAQM jointly published a revised version of the guidance note 'Land-Use Planning & Development Control: Planning for Air Quality' in 2017 (herein the 'EPUK-IAQM guidance') to facilitate consideration of air quality within local development control processes. It provides a framework for air quality considerations, promoting a consistent approach to the treatment of air quality issues within development control decisions.

The guidance includes methods for undertaken an air quality assessment and an approach for assessing the significance of effects. The guidance note is widely accepted as an appropriate reference method for this purpose.

2.2.3 Guidance on the Assessment of Dust from Demolition and Construction (Institute of Air Quality Management, 2014) ('the IAQM 2014 guidance')

Published by the Institute of Air Quality Management (IAQM), this gives guidance on the assessment of risk of dust and PM impacting on any nearby sensitive receptors during the construction phase of a development. It is used to define the appropriate level of mitigation required to minimise impacts.

3 ASSESSMENT SCOPE AND METHOD

3.1 Overall Approach

The approach taken for assessing the potential air quality impacts of the proposed development may be summarised as follows:

- Consultation with UDC;
- Baseline characterisation of local air quality;
- Qualitative assessment of the construction phase of the development using the IAQM 2014 guidance;
- Quantitative assessment of air quality impacts during the operational phase of the proposed development using detailed dispersion modelling; and
- Recommendation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

Chase New Homes have confirmed that no significant combustion sources such as combined heat and power (CHP) plant or biomass boilers are proposed as part of the scheme. This report has therefore focussed on the impacts of the development associated with road traffic on air quality.

3.2 Baseline Characterisation

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources.

A desk-based study has been undertaken including a review of monitoring data available from UDC and estimated background data from the Local Air Quality Management (LAQM) Support website maintained by the Department of Environment, Food and Rural Affairs (Defra). Consideration has also been given to potential sources of air pollution in the vicinity of the application site.

3.3 Construction Phase Impact Assessment

3.3.1 Construction Dust and Particulate Matter

Demolition and construction works for the proposed development have the potential to lead to the release of fugitive dust and particulate matter. An assessment of the impacts of construction phase dust and particulate matter at sensitive receptors has therefore been undertaken following the IAQM's construction dust guidance.

In order to assess the potential impacts construction activities are divided into four types:

- Demolition;
- Earthworks;

- Construction; and
- Trackout[2].

Appendix A details how the 'dust emission magnitude', associated with each of these activities, is combined with the sensitivity of receptors (human or ecological), to determine the overall 'dust risk'. Once the level of risk has been determined, mitigation proportionate to the level of risk can be identified.

3.3.2 Emissions to Air from Construction Traffic and Plant

Exhaust emissions from construction phase vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the application site and in the vicinity of the application site itself. Detailed information on the number of vehicles and plant associated with the construction phase is not available at this stage (and would not be until after appointment of the main demolition and construction contractors), therefore a qualitative impact assessment has been undertaken based on professional judgement and considering the following factors:

- The likely duration of the construction phase;
- The potential number and type of construction traffic and plant that could be required; and
- The number and proximity of sensitive receptors to the application site and along the likely construction vehicle routes.

3.4 Operational Phase Assessment

There are two aspects of air quality impact to be considered for the proposed development.

- The impacts of the proposed development on local air quality; and
- The impact of existing sources in the local area on the proposed development.

This assessment has therefore used dispersion modelling to ascertain these potential impacts. The following scenarios were modelled:

- Scenario 1 (S1): '2019 Baseline' representing the 'existing' air quality situation in 2019;
- Scenario 2 (S2): '2024 Without Development' (without the proposed development in place, but with committed developments); and
- Scenario 3 (S3): '2024 With Development' (with the proposed development and other committed developments in place).

[2] Trackout is defined as the transport of dust and dirt from the construction / demolition sites onto public road network, where it may be deposited and then re-suspended by vehicles using the network.

The following subsections provide further information regarding input to the dispersion model including traffic emissions sources, meteorological data and receptors included.

3.4.1 Modelling Software

ADMS-Roads is a 'new generation' advanced dispersion model developed by the UK consultancy CERC (Cambridge Environmental Research Consultants). ADMS-Roads is widely used and validated within the UK and Europe.

ADMS-Roads (Version 4.0.1) was used for assessing potential road traffic emission air quality impacts resulting from the operational phase of the proposed development.

3.4.2 Traffic Data

The transport consultants for the development scheme, Iceni, provided the annual average daily traffic flows (AADT) and percentage of heavy-duty vehicles (%HDVs) for each of the roads included in the modelling assessment.

The modelled future year scenarios accounted for the following committed and consented developments:

- The development of up to 100 dwellings off Shire Hill Saffron Walden (planning reference UTT/17/2832/OP);
- The development of up to 150 dwellings off Thaxted Road SW (UTT/18/0824/OP); and,
- Granite site off Thaxted Road (UTT/18/2366/FUL).

The traffic data used in the model are presented in Appendix C. The road network included in the dispersion model is presented in Figure 3.1. Speed limits, professional judgement and LAQM.TG (16) were used to determine speeds for use within the model, including reduced speeds at junctions.

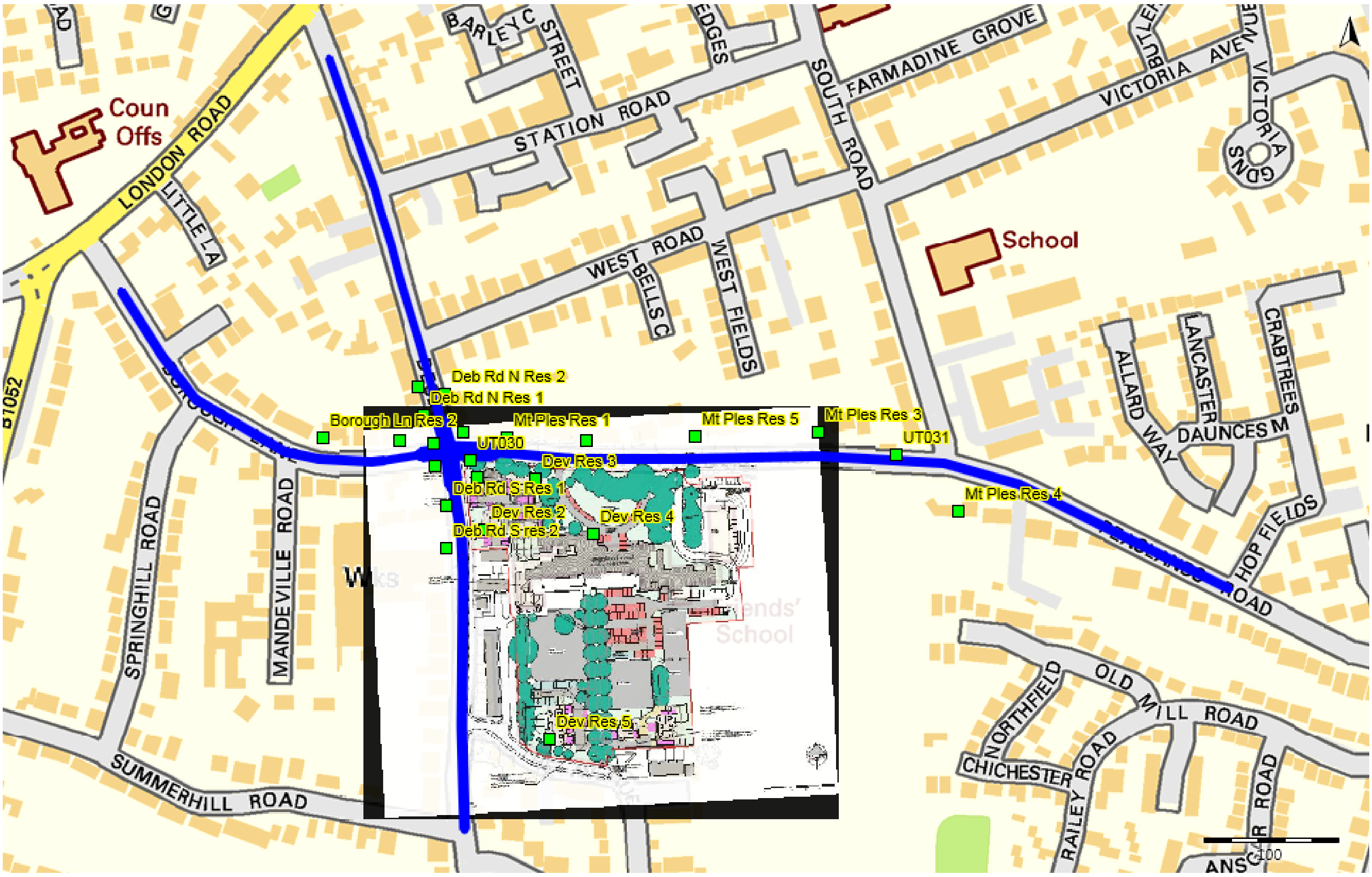
Traffic data used in this assessment was supplied by Iceni for 87 residential properties, the scheme is now for 96 properties however updated traffic data is not available at time of writing.

3.4.3 Emission Factors

Version 10.1 of the emissions factor toolkit (EFT), published by DEFRA, was used to derive vehicle emissions factors for NOx, PM_{10} and $PM_{2.5}$. The EFT serves to estimate pollutant concentrations emitted, depending on the volume and composition of traffic, its speed, the road type and its location within the country.

Within the EFT, emission factors are available for all years between 2018 and 2030 and take into account the most recent evidence relating to factors such as advances in vehicle and exhaust technology and changes in composition of the vehicle fleet. The emission factors consequently reduce over time. Hence, emissions factors for 2019 were used to estimate vehicle emissions for S1 modelling scenario and 2024 emissions factors were used for S2 and S3.

Figure 3.1: Receptors and Roads Included in the Dispersion Modelling



3.4.4 Time-Varying Profile

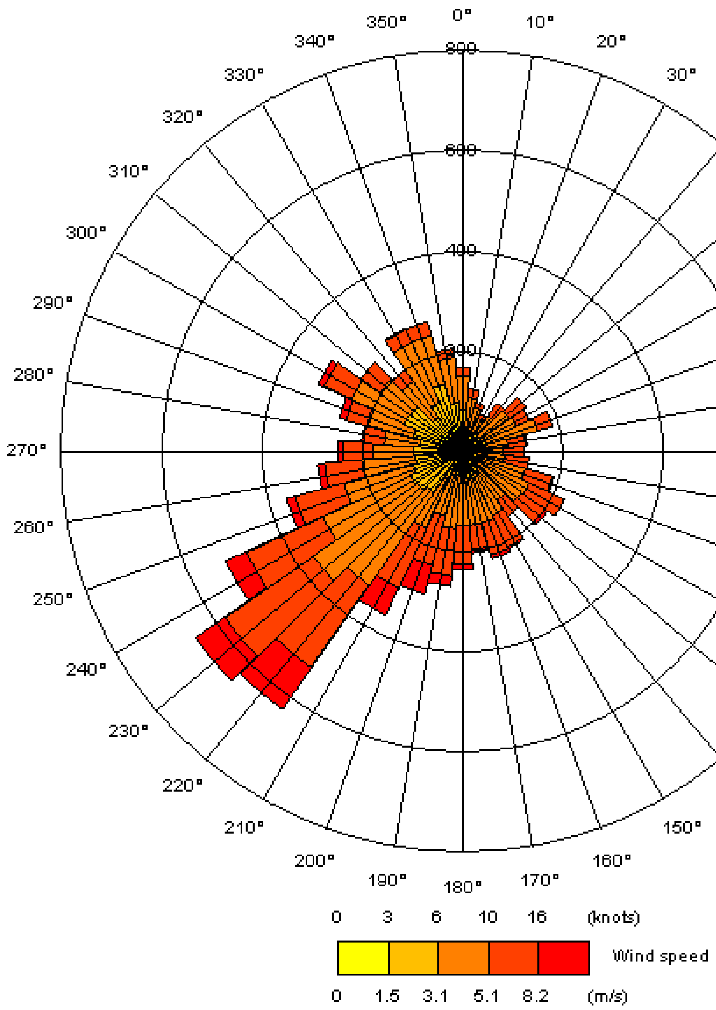
Vehicle movements vary with time. Diurnal profiles for the modelled roads were not available, therefore, the UK National Profile 2019 published by the DfT has been applied to all of the assessed roads. The profile serves to multiply the emissions factors in each hour of each day upward or downward, depending on anticipated variations in traffic volumes on the road network during the day. The applied road emissions profiles are displayed in Figure D1 in Appendix D.

3.4.5 Meteorological Data

Hourly sequential meteorological data obtained were employed in the dispersion model. The data were recorded in 2019 at the Stansted Airport meteorological monitoring station. The station is approximately 14.25km south of the proposed development site, and it is considered likely to be reasonably representative of conditions at the development site.

The windrose derived from the 2019 dataset is presented in Figure 3.3. The predominant wind direction was from the southwest.

Figure 3.3: Windrose from the Stansted Meteorological Station in 2019



3.4.6 Background Air Quality Data Used in the Modelling

2019 annual mean NO_2 data from Gibson Gardens Urban Background monitoring site, ID UT003, was used for both baseline and future year NO_2 background concentrations. Most recent Defra mapped estimated background data were used for the 2019 base year and 2024 future years for PM_{10} and $PM_{2.5}$ background concentrations.

3.4.7 Receptor Locations

Pollutant concentrations were predicted at a number of discrete receptors in the vicinity of the site. Details of all specific receptors included in the modelling study (and hence the air quality impacts assessed) are summarised in Table 3.1. The locations of all assessed receptors are shown in Figure 3.1.

Table 3.1: Receptors Included in the Dispersion Modelling Assessment

Receptor ID	Receptor Location	Grid reference		Height (m)
		X	Y	
UT030	Friends School (Diffusion tube)	553874.94	237760.8	2
UT031	Mount Pleasant Road (Diffusion tube)	554178	237765.19	2.5
Mt Ples Res 1	3 Mount Pleasant Road Saffron Walden CB11 3EA	553900.94	237777.64	1.5
Mt Ples Res 2	7 Mount Pleasant Road Saffron Walden CB11 3EA	553958	237775.5	1.5
Mt Ples Res 3	17 Mount Pleasant Road Saffron Walden CB11 3EA	554123.19	237781.69	1.5
Mt Ples Res 4	4 Peaslands Road Saffron Walden CB11 3EF	554222.75	237724.55	1.5
Jct Res 1	1 Mount Pleasant Road Saffron Walden CB11 3EA	553869.81	237781.08	1.5
Jct Res 2	68 Debden Rd Saffron Walden CB11 4AL	553849.5	237756.72	1.5
Jct Res 3	66 Debden Rd Saffron Walden CB11 4AL	553848.94	237773.41	1.5
Deb Rd S Res 1	70 Debden Rd Saffron Walden CB11 4AL	553858	237729.06	1.5
Deb Rd S res 2	72 Debden Rd Saffron Walden CB11 4AL	553858.19	237698.97	1.5
Borough Ln Res 1	19 Borough Ln Saffron Walden CB11 4AG	553824.5	237775	1.5
Borough Ln Res 2	17 Borough Ln Saffron Walden CB11 4AG	553770.25	237777.64	1.5
Deb Rd N Res 1	64 Debden Rd Saffron Walden CB11 4AL	553841.75	237793.16	1.5
Deb Rd N Res 2	43 Debden Rd Saffron Walden CB11 4AL	553856.62	237808.84	1.5
Deb Rd N Res 3	60 Debden Rd Saffron Walden CB11 4AL	553837.75	237814	1.5
Mt Ples Res 5	9 Mount Pleasant Road Saffron Walden CB11 3EA	554035.19	237778.41	1.5
Dev Res 1	Proposed Development 1	553879.81	237748.81	1.5
Dev Res 2	Proposed Development 2	553884.88	237711.45	1.5
Dev Res 3	Proposed Development 3	553921.38	237748.44	1.5

Receptor ID	Receptor Location	Grid reference		Height (m)
		X	Y	
Dev Res 4	Proposed Development 4	553963.25	237708.45	1.5
Dev Res 5	Proposed Development 5	553931.31	237562.62	1.5

3.4.8 Other Model Input Parameters

The modelling input parameters for the dispersion modelling assessment are presented in Table 3.2.

Table 3.2: Summary of Inputs to the Dispersion Model

Parameter	Brief Description	Input into model
Road elevation	Elevation of road above ground level	No roads elevated and no terrain file used.
Road width	Width of road (m)	Road widths determined based on approximate measurement of roads (based on mapping data).
Canyon heights	Height of canyons effects turbulent flow patterns; these are greater with larger canyon heights	No canyons included.
Road type	Selection of different types of road to be assessed, inputted into the EFT and CURED toolkit calculations	Urban (not London) settings used for all roads
Road speeds	Speed of the road effects the vehicle emissions to air	These were estimated based on local speed limits, with reduced speeds at junctions.
Meteorology	Representative hourly sequential meteorological data	Stansted 2019 data
Latitude	Allows the location of the model area to be determined	52.01°
Surface roughness	This defines the surface roughness of the model area	0.5 at dispersion site and 0.25 at meteorological site
Monin-Obukhov length	A boundary layer parameter required to precisely describe the atmospheric stability conditions and to predict dispersion of pollutants released from road traffic.	30m at dispersion site and 10m at meteorological site

3.4.9 Model Verification and Results Processing

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results, and was carried out following the methodology specified in LAQM.TG(16).

Full details of the verification calculations are presented within Appendix E.

An adjustment factor of 4.43 was obtained for the NO_2 verification process and applied to the modelled road-NO_x component predicted at assessment receptors. Annual mean NO_2 concentrations were estimated from modelled NO_X, using the NO_x to NO_2 calculator (version 8.1) available from the Defra website.

Local background monitoring data are available for concentrations of PM_{10} and $PM_{2.5}$ however traffic data for these roads was not and consequently, the predicted road-PM_{10} and road-$PM_{2.5}$ contributions were adjusted using the factors calculated for road-NO_x, before adding the appropriate background concentrations. This approach is consistent with guidance given in LAQM.TG(16).

The following method was used to calculate total annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations:

- Modelled annual mean road NOx, PM_{10} and $PM_{2.5}$ concentrations were verified as set out above;
- The road source NO_2 at the verification location was estimated from the verified modelled NOx concentration using version 8.1 of the NOx to NO_2 calculator, using settings appropriate to the locality of the receptor and using 2019 or 2024 as the appropriate emissions factor year; and,
- Predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations were added to the applicable background concentration and point source contribution.

LAQM.TG(16) advises that an exceedance of the 1 hour mean NO_2 objective is unlikely to occur where the annual mean concentration is below 60µg/m^3, where road transport is the main source of pollution. This concentration has been used to screen whether the hourly mean objective is likely to be achieved.

To calculate the number of days per annum where the daily mean PM_{10} AQS may be exceeded, the following formula, derived from the Local Air Quality Management Technical Guidance (2016), has been used: =-18.5+0.00145*([N] ^3)+(206/[N]), where [N] is the predicted annual mean concentration at each receptor location.

3.4.10 Interpretation of Modelled Results

To assess the magnitude of impacts of the development on the surrounding area (associated with changes in annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations), the approach suggested in the EPUK-IAQM 2017 guidance was used. This guidance recommends that an impact is described by expressing the magnitude of incremental change as a proportion of the relevant air quality assessment level (i.e. the relevant annual mean AQS) and examining this change in the context of the predicted total concentration with the development in place, relative to the AQS. The approach is further described in Appendix C, including the impact magnitude descriptors.

The overall significance of effects was assessed using professional judgement, with reference to the impact magnitudes assigned at each receptor, and to the number and extent of any modelled exceedances of any of the AQSs of both annual and short-term AQSs. The results of the dispersion modelling are presented in Section 5.2 and Appendix E.

3.5 Additional Uncertainties and Assumptions

The following uncertainties and assumptions have been made in the air quality assessment:

- No on-site background monitoring was undertaken and therefore it is assumed that the background data used are likely to reasonably represent conditions at each of the discrete receptors modelled;
- Emissions from the average vehicle fleet using the local road network cannot be known, and therefore it is assumed those generated by the EFT provided an accurate representation of emissions generated by vehicles which currently and will use the modelled roads;
- There will be uncertainties introduced because the modelling has simplified real-world processes into a series of algorithms. For example, it has been assumed that meteorological conditions measured during 2019 at the Stansted monitoring station are representative of conditions throughout the modelled domain. Furthermore, it has been assumed that the subsequent dispersion of emitted pollutants will conform to a Gaussian distribution over flat terrain in order to simplify the real-world dilution and dispersion conditions; and
- There is an element of uncertainty in all measured and modelled data. All values presented in this report are best estimates available.

4 BASELINE AIR QUALITY CHARACTERISATION

4.1 Emissions Sources and Key Air Pollutants

Existing or baseline air quality refers to the concentrations of relevant substances that are already present in ambient air. These substances are emitted by various sources, including road traffic, industrial, domestic, agricultural and natural sources. The following sources of baseline information have been investigated to characterise the air quality baseline:

- The presence of air quality management areas (AQMAs) at and around the site;
- Air quality monitoring data from UDC; and
- Estimated background concentrations in the LAQM Support website operated by Defra.

4.2 Presence of AQMAs

The proposed development site is partially located within an AQMA which was declared due to known or anticipated exceedances of the annual mean NO_2 AQS in 2012 as a result of road traffic.

4.3 Baseline Monitoring Data

The closest automatic monitoring sites to the proposed site is located approximately 0.6km and 0.9km away and the closest diffusion tube monitoring location is 0.2km away from the proposed site.

Results for monitoring locations within 3km have been replicated in table 4.1 below.

Table 4.1: UDC automatic and diffusion tube monitoring site Data

Site ID	Site Description	Site Type[1]	Approximate Distance from Site (km)	Annual Mean NO_2 Concentration ($\mu g/m^3$)				
				2015	2016	2017	2018	2019
Automatic monitoring locations								
UTT2	Junction Thaxted Rd & Radwinter Rd, Saffron Walden	Roadside	0.9	N/A	N/A	N/A	35.31	32.7
UTT3	Mobile Unit London Road, Saffron Walden	Roadside	0.6	N/A	23.95	18.34	21.17	19.57
Diffusion tube monitoring locations								
UT001	High Street	Urban Centre	0.9	36.4	40.0	34.0	19.2	30.0
UT003	Gibson Gardens	Urban Background	0.8	12.3	16.2	13.4	11.2	11.1
UT004	YHA	Kerbside	1.1	42.2	46.9	38.0	30.6	35.1
UT005	Thaxted Road	Kerbside	0.9	41.2	47.5	38.0	28.5	33.9

UT011	33 High Street	Urban Centre	0.9	32.9	38.6	31.0	29.0	26.3
UT012	Town Hall	Urban Background	0.9	18.5	20.5	16.2	11.1	15.5
UT015	57 High Street, Saffron Walden	Roadside	0.8	N/A	N/A	N/A	25.8	24.9
UT016	Radwinter Road, Saffron Walden	Roadside	0.9	N/A	N/A	N/A	32.1	30.7
UT021	41 East Street, Saffron Walden	Roadside	0.8	N/A	N/A	N/A	27.1	24.0
UT028	London Rd	Roadside	0.6	38.0	44.8	37.4	33.4	31.2
UT029	Debden Road	Roadside	0.5	21.6	26.5	21.4	20.5	20.1
UT030	Friends School	Kerbside	0.2	29.0	35.3	26.1	27.2	25.0
UT031	Mount Pleasant Road	Roadside	0.2	22.0	26.2	21.4	19.8	20.7
UT032	Borough Lane	Roadside	0.5	16.8	19.7	17.4	15.2	15.0
UT036	Church Street	Urban Centre	1.0	21.6	27.1	20.9	19.2	18.4
UT037	Castle Street	Kerbside	1.2	24.2	29.1	24.0	22.0	22.4
UT044	Thaxted Road Co-located 1	Roadside	0.9	N/A	N/A	N/A	N/A	36.6
UT045	Thaxted Road Co-located 2	Roadside	0.9	N/A	N/A	N/A	N/A	37.0
UT046	Thaxted Road Co-located 3	Roadside	0.9	N/A	N/A	N/A	N/A	37.3

4.4 Defra UK-AIR Background Data

Estimated background air quality data are available from the LAQM Support website operated by the Defra. The website provides estimated annual average background concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ on a 1 km^2 grid basis.

Table 4.2 identifies estimated annual average background NO_x, NO_2, PM_{10} and $PM_{2.5}$ concentrations at the proposed development site for the years 2021, 2022, 2023 and 2024. None of the NO_2, PM_{10} or $PM_{2.5}$ estimated background concentrations exceed their respective annual mean AQSs. As Defra has predicted that concentrations will fall with time, exceedances would not be identified beyond 2024.

Table 4.2: Estimated Background Annual Average NOx, NO_2, PM_{10} and $PM_{2.5}$ Concentrations at Proposed Development Site (2021 to 2024)

Assessment Year	Estimated Annual Average Pollutant Concentrations Derived from the LAQM Support Website ($\mu g/m^3$)			
	Annual Average NO_X	Annual Average NO_2	Annual Average PM_{10}	Annual Average $PM_{2.5}$
2021	12.10	9.27	14.83	9.26
2022	11.64	8.94	14.65	9.13
2023	11.30	8.70	14.48	8.99
2024	10.81	8.35	14.31	8.85

Assessment Year	Estimated Annual Average Pollutant Concentrations Derived from the LAQM Support Website (µg/m³)			
	Annual Average NO_X	Annual Average NO_2	Annual Average PM_{10}	Annual Average $PM_{2.5}$
Air Quality Objective	**30^**	**40**	**40**	**25***

Notes: Presented concentrations for 1km2 grid centred on 553500, 237500; approximate centre of development site is 553961 237692; * target objective only, ^air quality objective designated for the protection of vegetation and ecosystems only.

5 IMPACT ASSESSMENT

5.1 Construction Phase

Atmospheric emissions from construction activities will depend on a combination of the potential for emissions (the type of activity and prevailing conditions) and the effectiveness of control measures. In general terms, there are two sources of emissions that will need to be controlled to minimise the potential for adverse environmental effects:

- exhaust emissions from site plant, equipment and vehicles; and,
- fugitive dust / particulates emissions from site activities.

5.1.1 Exhaust Emissions from Plant and Vehicles

The operation of vehicles and equipment powered by internal combustion engines results in the emission of exhaust gases containing pollutants including NO_x, PM_{10}, $PM_{2.5}$, volatile organic compounds and carbon monoxide. The quantities emitted depend on factors such as engine type, service history, pattern of usage and fuel composition.

Construction traffic will comprise haulage/construction vehicles and vehicles used for workers' trips to and from the site. Regarding haulage and construction vehicles, it is estimated that between 10-50 HDV outward movements per day, which is considered unlikely to bring about a significant change in local air quality. Due to the transient nature of the works, traffic generated by employee vehicle movements are also unlikely to have significant effects on air quality.

The operation of plant and machinery will also result in emissions to atmosphere of exhaust gases, but with suitable controls and site management such emissions are unlikely to be significant (as per guidance within LAQM TG(16)).

5.1.2 Fugitive Dust Emissions

Fugitive dust and PM emissions arising from construction activities are likely to be variable in nature and will depend upon the type and extent of the activity, soil type and moisture, road surface conditions and weather conditions. Periods of dry weather combined with higher than average wind speeds have the potential to generate more dust.

Construction activities that are considered to be the most significant potential sources of fugitive dust emissions are:

- Demolition activities
- earth moving, due to the handling, storage and disposal of soil and subsoil materials;
- construction aggregate usage, due to the transport, unloading, storage and use of dry and dusty materials (such as cement and sand);
- movement of heavy site vehicles on dry or untreated haul routes; and,

- movement of vehicles over surfaces where muddy materials have been transferred off-site (for example, on to public highways).

Fugitive emissions arising from construction activities are mainly dust of a particle size greater than the PM_{10} fraction (the fraction which can potentially impact upon human health); however it is noted that construction activities may contribute to local PM_{10} concentrations. Appropriate dust control measures can be highly effective for controlling emissions from potentially dust generating activities identified above, and adverse effects can be greatly reduced or eliminated.

See Appendix A for further explanation of the tendency of dust to remain airborne.

An explanation of how cumulative effects associated with construction related activities has been identified in Section 5.1.5 below.

5.1.3 Potential Dust Emission Magnitude

With reference to the IAQM guidance criteria outlined in Appendix A, the dust emissions magnitude for earthworks, construction and trackout activities are summarised in table 5.1 to 5.3. Table 5.4 summarises the emissions magnitude categories assigned to each of the four types of construction related activity prior to the implementation of mitigation. Any assumptions made have been identified.

Table 5.1: Summary of Dust Emissions Magnitude of Demolition Activities (Before Mitigation)

Earthworks Criteria	Dust Emissions Class	Evaluation of the Effects
Total building volume	Medium	It is assumed that 20,000-50,000 m^3 of building is to be demolished
Potentially dusty construction material (e.g. Concrete)	Medium to Large	It is assumed that there will be potentially dusty construction materials on site
On-site crushing and screening	Large	Some on-site crushing and screening will take place
Demolition activities above ground level	Small	Demolition activities will take place <10m above ground level
Overall Rating	**Medium**	Conservative estimate

Table 5.2: Summary of Dust Emissions Magnitude of Earthworks Activities (Before Mitigation)

Earthworks Criteria	Dust Emissions Class	Evaluation of the Effects
Total site area	Large	>10,000m^2
Soil type	Large	According to the British Geological Survey (BGS) website, the site has a Chalky to Silty loamy texture.

Earthworks Criteria	Dust Emissions Class	Evaluation of the Effects
Earth moving vehicles at any one time	Medium	5 to 10 HDVs may be used at any one time.
Height of bunds/ stockpiles	Small	Formation of bunds will be <4m in height
Total material moved	Medium	It is assumed that 20,000 – 100,000 tonnes is the maximum amount of material which may be moved.
Work times	Medium	It is assumed that work could occur throughout the year.
Overall Rating	**Medium**	Conservative estimate

Table 5.3: Summary of Dust Emissions Magnitude of Construction Activities (Before mitigation)

Construction Criteria	Dust Emissions Class	Evaluation of the Effects
Total building volume	Medium	It is assumed that the total building volume could be 25,000m^3 - 100,000m^3
On-site concrete batching proposed	Small	None proposed.
On-site sandblasting proposed	Small	None proposed.
Dust potential of construction materials	Medium to large	Some potentially dusty materials will be used at site.
Overall Rating	**Medium**	Conservative estimate

Table 5.4: Summary of Dust Emissions Magnitude of Trackout Activities (Before mitigation)

Trackout Criteria	Dust Emissions Class	Evaluation of the Effects
Number of HDV (heavy duty vehicles) >3.5t per day	Medium	It is assumed that 10-50 outward HDV movements per day (maximum) can be anticipated.
Surface type of the site	Small	It is expected that roads will be constructed before further construction is undertaken on site enabling a hard surface to run on.
Length of unpaved road	Small	Unpaved roads will be <50m.
Overall Rating	**Small**	Conservative estimate

Table 5.5: Summary of Dust Emission Magnitude of the Site (Before mitigation)

Construction Activities	Dust Emissions Class
Demolition	Medium
Earthworks	Medium
Construction	Medium
Trackout	Small

5.1.4 Sensitivity of the Area

As per the IAQM guidance, the sensitivity of the area takes into account a number of factors, including:

- The sensitivity of individual receptors in the area;
- The proximity and number of those individual receptors;
- In the case of PM_{10}, the local background concentration; and,
- Site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

The area sensitivity has been determined by reviewing the number of individual human and ecological receptors classified as 'high', 'medium' and 'low' sensitivity (using the classifications outlined in the IAQM guidance), and identifying the distance of these receptors from either (i) the area of the site to be developed (for demolition, construction and earthworks activities as it is assumed that construction-related activities will be confined to the developable area); or (ii) the assumed routes along which trackout may occur. The area sensitivity has been considered for three types of potential impact: a loss of amenity arising from dust deposition; the impact of additional PM_{10} on human health; and impacts on ecological receptors caused by dust deposition.

The MAGIC Maps website was used to determine the presence of sites designated for their ecological sensitivity, such as Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Sites of Special Scientific Interest (SSSI), Ancient Woodlands, and National & Local Nature Reserves.

Construction activities are considered relevant up to 350m from the proposed development site boundary, and it is assumed that HDVs may cause trackout anywhere in the area of the site being developed, and up to 50m from local roads within 500m of the site entrance, as per the IAQM guidance.

Table 5.5: Sensitivity of the area

Potential Impact		Sensitivity of the surrounding area			
		Demolition	Earthworks	Construction	Trackout
Dust deposition and loss of amenity	Receptor sensitivity	High	High	High	High
	Number of receptors	10-100	10-100	10-100	1-10
	Distance from the source	20m	20m	20m	20m
	Sensitivity of the area	**High**	**High**	**High**	**Medium**
Human health	Receptor sensitivity	High	High	High	High

	Background annual mean PM_{10} concentration	<24µg/m³	<24µg/m³	<24µg/m³	<24µg/m³
	Number of receptors	10-100	10-100	10-100	1-10
	Distance from the source	20m	20m	20m	20m
	Sensitivity of the area	**Low**	**Low**	**Low**	**Low**
Ecological	Screened out as no relevant ecologically designated sites identified within 50m of site or routes along which trackout may occur.				

5.1.5 Risk of Impacts

Using the risk categories from the IAQM guidance (replicated in Appendix A), the dust emission magnitudes summarised in Table 5.4 has been compared to the area sensitivities in Table 5.5 to determine the scale of risk that construction-related activities may generate dust and air quality impacts on human and ecological receptors.

The risk of dust impacts from construction activities is identified in Table 5.6. Mitigation measures to reduce construction phase impacts are identified, based on this assessment, in Section 7.

Table 5.6: Summary of the Dust Risk from Construction Activities

Potential Impact	Dust Risk Impact			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium risk	Medium risk	Medium risk	Negligible risk
Human health	Low Risk	Low risk	Low Risk	Negligible risk
Ecological	Screened out			

5.2 Operational Phase

The main potential impact of the proposed development is considered to be emissions from increased road traffic associated with the proposed development. Figure 3.1 shows the roads and sensitive receptors included in the dispersion modelling assessment.

Full details of the results are presented within Table E5 of Appendix E and are summarised below.

5.2.1 Nitrogen Dioxide – NO_2

Table 5.4 shows a comparison of predicted annual mean NO_2 concentrations for S2 and S3 at the assessed receptor locations.

The results as percentages of the Air Quality Assessment Level (AQAL) (i.e. the annual mean AQS) are also presented and are used in the determination of magnitudes of impacts (based on the EPUK-IAQM guidance). The results predict that the development would have a 'negligible' impact on air quality at all of the assessed existing receptor locations. None of the receptors modelled (both at the proposed site and at existing receptors) were predicted to exceed the annual mean NO_2 AQS.

The development is not predicted to expose any of the modelled discrete receptors to concentrations of the annual mean NO_2 AQS exceeding 60µg/m^3 in future year scenarios. As road traffic is the main source of NO_2 at these locations, the potential for the hourly mean NO_2 AQS being exceeded on more than the permissible number of occasions each year at these locations can be screened out.

The result show the modelled traffic increase of the old 87 residential units scheme, however as the results show a maximum of 51% of the NO_2 AQAL and a max of a 1% change from S2 to S3 it is considered highly unlikely for an additional 9 units to cause a significant impact.

Table 5.4: Comparison of Predicted Annual Mean NO_2 Concentrations between the S2 '2024 without proposed Development' and S3 '2024 with proposed Development' Scenarios

Receptor ID	S2		S3		% Change NO_2 concentration relative to AQAL	Predicted Impact
	µg/m^3	% of AQAL	µg/m^3	% of AQAL		
UT030	21.1	52.8	21.4	53.6	1	Negligible
UT031	16.7	41.7	16.9	42.1	0	Negligible
Mt Ples Res 1	18.2	45.4	18.4	46.1	1	Negligible
Mt Ples Res 2	15.6	39.1	15.8	39.5	0	Negligible
Mt Ples Res 3	14.3	35.6	14.4	35.9	0	Negligible
Mt Ples Res 4	12.7	31.8	12.8	31.9	0	Negligible
Jct Res 1	19.8	49.6	20.1	50.3	1	Negligible
Jct Res 2	18.0	45.0	18.2	45.4	0	Negligible
Jct Res 3	20.2	50.4	20.4	51.0	1	Negligible
Deb Rd S Res 1	15.9	39.8	16.1	40.2	0	Negligible
Deb Rd S res 2	14.0	34.9	14.0	35.1	0	Negligible
Borough Ln Res 1	15.7	39.2	15.8	39.5	0	Negligible
Borough Ln Res 2	14.0	35.0	14.1	35.2	0	Negligible
Deb Rd N Res 1	15.7	39.3	15.9	39.7	0	Negligible
Deb Rd N Res 2	18.7	46.6	18.9	47.3	1	Negligible
Deb Rd N Res 3	14.9	37.1	15.0	37.4	0	Negligible
Mt Ples Res 5	14.6	36.6	14.8	36.9	0	Negligible
Dev Res 1	17.5	43.7	17.7	44.2	1	Negligible
Dev Res 2	15.0	37.5	15.1	37.8	0	Negligible

Dev Res 3	15.4	38.6	15.6	39.0	0	Negligible
Dev Res 4	12.6	31.4	12.6	31.6	0	Negligible
Dev Res 5	12.0	29.9	12.0	30.0	0	Negligible

Particulate matter – PM_{10}

As shown in Table 5.5 below, the change in annual mean PM_{10} concentrations associated with the development was assessed as 'negligible' at all receptors (as per the EPUK-IAQM guidance) and no receptors were predicted to exceed the annual mean PM_{10} AQS with the development in place.

The result show the modelled traffic increase of the old 87 residential units scheme, however as the results show a maximum of 42% of the PM_{10} AQAL and a max of a 0% change from S2 to S3 it is considered highly unlikely for an additional 9 units to cause a significant impact.

Table 5.5: Comparison of Predicted Annual Mean PM_{10} Concentrations between the S2 '2024 without proposed Development' and S3 '2024 with proposed Development' Scenarios

Receptor ID	Without Development with committed		With Development		% Change NO_2 concentration relative to AQAL	Predicted Impact
	µg/m³	% of AQAL	µg/m³	% of AQAL		
UT030	16.80	42	16.89	42	0	Negligible
UT031	16.33	41	16.39	41	0	Negligible
Mt Ples Res 1	16.04	40	16.10	40	0	Negligible
Mt Ples Res 2	15.66	39	15.71	39	0	Negligible
Mt Ples Res 3	15.53	39	15.56	39	0	Negligible
Mt Ples Res 4	15.03	38	15.05	38	0	Negligible
Jct Res 1	16.49	41	16.56	41	0	Negligible
Jct Res 2	16.02	40	16.07	40	0	Negligible
Jct Res 3	16.56	41	16.63	42	0	Negligible
Deb Rd S Res 1	15.53	39	15.56	39	0	Negligible
Deb Rd S res 2	15.14	38	15.17	38	0	Negligible
Borough Ln Res 1	15.50	39	15.53	39	0	Negligible
Borough Ln Res 2	15.21	38	15.23	38	0	Negligible
Deb Rd N Res 1	15.48	39	15.51	39	0	Negligible
Deb Rd N Res 2	16.22	41	16.28	41	0	Negligible
Deb Rd N Res 3	15.33	38	15.37	38	0	Negligible
Mt Ples Res 5	15.64	39	15.68	39	0	Negligible

Dev Res 1	15.89	40	15.95	40	0	Negligible
Dev Res 2	15.41	39	15.44	39	0	Negligible
Dev Res 3	15.42	39	15.46	39	0	Negligible
Dev Res 4	14.73	37	14.74	37	0	Negligible
Dev Res 5	14.57	36	14.58	36	0	Negligible

The number of exceedances of the daily mean PM_{10} AQS was far fewer than the permissible 35 at all of the receptor locations for S1, S2 and S3. No receptors were predicted to be exposed to concentrations of PM_{10} or $PM_{2.5}$ exceeding the annual mean AQSs with the development in place as seen in appendix E table E4.

Particulate matter – $PM_{2.5}$

As shown in Table 5.6 below, the change in annual mean $PM_{2.5}$ concentrations associated with the development was assessed as 'negligible' at the modelled discrete receptor locations (as per the EPUK-IAQM guidance) and no receptors were predicted to exceed the annual mean $PM_{2.5}$ AQS.

The result show the modelled traffic increase of the old 87 residential units scheme, however as the results show a maximum of 25% of the $PM_{2.5}$ AQAL and a max of a 0% change from S2 to S3 it is considered highly unlikely for an additional 9 units to cause a significant impact.

Table 5.6: Comparison of Predicted Annual Mean $PM_{2.5}$ Concentrations between the S2 '2024 without proposed Development' and S3 '2024 with proposed Development' Scenarios

Receptor ID	Without Development with committed		With Development		% Change NO_2 concentration relative to AQAL	Predicted Impact
	µg/m³	% of AQAL	µg/m³	% of AQAL		
UT030	10.27	26	10.31	26	0	Negligible
UT031	9.99	25	10.02	25	0	Negligible
Mt Ples Res 1	9.83	25	9.87	25	0	Negligible
Mt Ples Res 2	9.61	24	9.64	24	0	Negligible
Mt Ples Res 3	9.54	24	9.56	24	0	Negligible
Mt Ples Res 4	9.27	23	9.28	23	0	Negligible
Jct Res 1	10.09	25	10.12	25	0	Negligible
Jct Res 2	9.82	25	9.85	25	0	Negligible
Jct Res 3	10.13	25	10.16	25	0	Negligible
Deb Rd S Res 1	9.54	24	9.56	24	0	Negligible
Deb Rd S res 2	9.32	23	9.34	23	0	Negligible

Borough Ln Res 1	9.52	24	9.54	24	0	Negligible
Borough Ln Res 2	9.36	23	9.37	23	0	Negligible
Deb Rd N Res 1	9.51	24	9.53	24	0	Negligible
Deb Rd N Res 2	9.93	25	9.97	25	0	Negligible
Deb Rd N Res 3	9.43	24	9.45	24	0	Negligible
Mt Ples Res 5	9.60	24	9.63	24	0	Negligible
Dev Res 1	9.75	24	9.78	24	0	Negligible
Dev Res 2	9.47	24	9.49	24	0	Negligible
Dev Res 3	9.48	24	9.50	24	0	Negligible
Dev Res 4	9.09	23	9.10	23	0	Negligible
Dev Res 5	9.00	23	9.01	23	0	Negligible

5.3 Significance of Air Quality Effects

Based on the results in Section 5.2, annual mean or short-term NO_2 and PM_{10} AQS exceedances are not anticipated at the proposed development site. Therefore, it is considered that ambient air quality would not significantly affect future site users.

Section 5.2 also confirms that the development is expected to have a generally negligible effect on local air quality at existing sensitive receptor locations (with regard to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations). Moreover, no exceedances of the mean NO_2, PM_{10} and $PM_{2.5}$, daily mean PM_{10} or hourly mean NO_2 AQSs were predicted at the modelled existing receptor locations with the development in place. Therefore, the development is not expected to significantly affect local air quality.

6 MITIGATION MEASURES

6.1 Construction Phase Mitigation

The dust emitting activities outlined in Section 5 can be effectively controlled by appropriate dust control measures and any adverse effects can be greatly reduced or eliminated.

Prior to commencement of construction activities, it is anticipated that an agreement on the scope of a dust management plan (DMP) or a dust and air quality-related contribution to a construction environmental management plan (CEMP) is prepared and that it incorporates the mitigation measures recommended in Appendix C of this document as appropriate, to ensure that the potential for adverse environmental effects on local receptors is minimised. The DMP or CEMP contribution should include *inter alia*, measures for controlling dust and general pollution from site construction operations, and include details of any monitoring scheme, if appropriate. Controls should be applied throughout the construction period to ensure that emissions are mitigated.

The traffic effects of the proposed development during the construction phase will be limited to a relatively short period and will be along traffic routes employed by haulage/construction vehicles and workers. Any effects on air quality will be temporary i.e. during the construction period only and can be suitably controlled by the employment of mitigation measures appropriate to the development project. Therefore, no further mitigation measures have been recommended.

6.2 Operational Mitigation

As identified in Section 5, the development is not predicted to significantly impact air quality or introduce receptors to an area likely to exceed any of the relevant AQSs. As such, mitigation is not considered to be required.

6.3 Residual Impacts: Significance

With appropriate mitigation measures (such as those proposed for the construction phase) in place, the residual impacts of the development on local air quality during the construction phase of the development are likely to be negligible. The residual impacts of the development on local air quality, and of ambient air at proposed receptors, when the development is complete and operational, are also likely to be insignificant (negligible), without the need for mitigation.

7 CONCLUSIONS

An air quality assessment for the proposed development at Mount Pleasant Road, Saffron Walden has been undertaken with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

The assessment considered the impact of existing sources of air pollution at the proposed development site (governed by background pollutant levels and vehicle movements along the local highway network), and the impacts of the proposed development on the local area. It is understood that significant stationary combustion sources such as CHP plant or boilers are not proposed, and any modern space heating and cooking appliances to be installed at the development site are likely to be efficient, thereby having a limited impact on air quality.

Construction phase impacts of the proposed development on local air quality may have the potential to occur, due to dust and PM emissions during the period of construction. The potential risk of dust impacts was predicted to be a maximum of 'medium risk' during the construction phase. Mitigation measures have been recommended to reduce the risk for general site activities and construction activity-specific activities, in accordance with the IAQM 2014 guidance. It is recommended that a DMP or dust management section of a CEMP incorporating such best practice measures is adopted, to apply for the duration of construction activities at this site. If appropriate mitigation, such as those recommended in this report and in any DMP, are implemented, the residual impact of construction phase air quality impacts should be viewed as 'not significant'.

To assess the effects of the development on local air quality, the following three scenarios were assessed using the ADMS Roads Extra dispersion modelling software:

- **S1:** 'Base case' scenario representing the 'existing' air quality situation in 2019;
- **S2:** 'Without Proposed development 2024' scenario; and
- **S3:** 'With Proposed development 2024' scenario.

This assessment has identified that the development is expected to have a negligible effect on local air quality at existing sensitive receptor locations (regarding annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations). Moreover, no exceedances of the mean NO_2, PM_{10} and $PM_{2.5}$, daily mean PM_{10} or hourly mean NO_2 AQSs were predicted at the modelled existing receptor locations with the development in place and therefore, overall effects of the development on local air quality are considered insignificant. Based on the results in Section 5.2, annual mean or short-term NO_2 and PM_{10} AQS exceedances are not anticipated at the proposed development site and therefore, it is considered that ambient air quality would not significantly affect future site users.

It should be noted that results from this assessment are based off traffic increases of the old 87 residential units scheme, however as all results are well below the relevant AQAL and a max of a 1% change from S2 to S3 is observed it is considered highly unlikely for an additional 9 units to cause significant impacts at any modelled sensitive receptors.

Based on the results of the assessment, it is judged that with appropriate construction phase mitigation the proposed development complies with relevant national and local planning policies and will not result in a significant adverse impact on air quality.

APPENDIX A – CONSTRUCTION DUST ASSESSMENT METHODOLOGY

This appendix contains the construction dust assessment methodology used in the assessment.

To assess the potential impacts, construction activities are divided into demolition, earthworks, construction and trackout. The descriptors included in this section are based upon the IAQM 2014 guidance. The assessment follows the steps recommended in the guidance.

<u>Step 1</u>: Screen the requirement for assessment

The first step is to screen out the requirement for a construction dust assessment, this is usually a somewhat conservative level of screening. An assessment is usually required where there is:

- a 'human receptor' within:
  - 350m of the boundary of the site; or
  - 50m of the route used by construction vehicles on the public highway, up to 500m from the site entrance(s).
- an 'ecological receptor':
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

<u>Step 2A</u>: Defining the Potential Dust Emission Magnitude

Demolition

The dust emission magnitude category for demolition is varied for each site in terms of timing, building type, duration and scale. Examples of the potential dust emission classes are provided in the guidance as follows:

- **Large**: Total building volume >50,000m^3, potentially dusty construction material, on-site crushing and screening, demolition activities >20m above ground level;
- **Medium**: Total building volume 20,000m^3 – 50,000m^3, potentially dusty construction material, demolition activities 10m – 20m above ground level; and,
- **Small**: Total building volume <20,000m^3, construction material with low potential for dust release, demolition activities <10m above ground, demolition during wetter months.

Earthworks

The dust emission magnitude category for earthworks is varied for each site in terms of timing, geology, topography and duration. Examples of the potential dust emission classes are provided in the guidance as follows:

- **Large**: Total site area >10,000m^2, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100,000 tonnes;
- **Medium**: Total site area 2,500 – 10,000m^2, moderately dusty soil type (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 8m in height, total material moved 20,000 – 100,000 tonnes; and,

- **Small**: Total site area < 2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <10,000 tonnes, earthworks during wetter months.

Construction

The dust emission magnitude category for construction is varied for each site in terms of timing, building type, duration, and scale. Examples of the potential dust emissions classes are provided in the guidance as follows:

- **Large**: Total building volume >100,000m^3, piling, on site concrete batching;
- **Medium**: Total building volume 25,000 – 100,000m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and,
- **Small**: Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

Factors which determine the dust emission magnitude class of trackout activities are vehicle size, vehicle speed, vehicle number, geology and duration. Examples of the potential dust emissions classes are provided in the guidance as follows:

- **Large**: >50 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- **Medium**: 10 – 50 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 – 100m; and,
- **Small**: <10 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

<u>Step 2B</u>: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health and ecosystems. The sensitivity of the area takes into account the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and,
- Site-specific factors, such as whether here are natural shelters such as trees, to reduce the risk of wind-blown dust.

Table A1 was used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Table A1: Sensitivity of the Area Surrounding the Site

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
High	• Users can reasonably expect an enjoyment of a high level of amenity. • The appearance, aesthetics or value of their property would be diminished by soiling. • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • Examples include dwellings, museums and other culturally important collections, medium and long-term car parks and car showrooms.	• Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day) • Examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• Locations with an international or national designation *and* the designated features may be affected by dust soiling. • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain. • Examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home. • The appearance, aesthetics or value of their property could be diminished by soiling. • The 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. • Examples include parks and places of work.	• Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. • Locations with a national designation where the features may be affected by dust deposition. • Example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
Low	• The enjoyment of amenity would not reasonably be expected. • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• Locations where human exposure is transient. • Indicative examples include public footpaths, playing fields, parks and shopping streets.	• Locations with a local designation where the features may be affected by dust deposition. • Example is a local Nature Reserve with dust sensitive features.

Based on the sensitivities assigned of the different types of receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification for the area can be defined for each. Tables A2 to A4 indicate the method used to determine the sensitivity of the area for dust soiling, human health and ecological impacts, respectively.

For trackout, as per the guidance, it is only considered necessary to consider trackout impacts up to 50m from the edge of the road.

Table A2: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distances from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A3: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Conc.	Number of Receptors	Distances from the Source (m)				
			<20	<50	<100	<200	<350
High	>32μg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
		>100	High	High	Medium	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Conc.	Number of Receptors	Distances from the Source (m)				
			<20	<50	<100	<200	<350
	28-32 µg/m³	10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32µg/m³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32µg/m³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

Table A4: Sensitivity of the area to Ecological Impacts

Receptor Sensitivity	Distances from the Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

<u>Step 2C</u>: Defining the Risk of Impacts

The final step is to use both the dust emission magnitude classification with the sensitivity of the area, to determine a potential risk of impacts for each construction activity, before the application of mitigation. Tables A5 to A7 indicate the method used to assign the level of risk for each construction activity.

Table A5: Risk of Dust Impacts from Demolition

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

Table A6: Risk of Dust Impacts from Earthworks/Construction

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

Table A7: Risk of Dust Impacts from Trackout

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

APPENDIX B - CONSTRUCTION PHASE RECOMMENDED MITIGATION MEASURES

The IAQM 2014 guidance divides site-specific mitigation measures are divided into general measures applicable to all sites, and measures specific to earthworks, construction and trackout. Depending on the level of risk assigned in relation to each type of construction activity, different mitigation is assigned. The method for assigning mitigation measures as detailed in the IAQM guidance has been used. For those 'general' mitigation measures, the greatest risk category assigned to the assessed construction activities should be applied. Therefore, in this case, the 'medium risk' 'general' site mitigation measures have been recommended.

There are two categories of mitigation measure – 'highly recommended' and 'desirable', which are indicated according to the dust risk level identified in Table 5.3. Desirable measures are presented in *italics*.

Communications

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- Display the name and contact details of people 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

- Develop and implement a 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. The desirable measures should be included as appropriate for the site.

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 off-site or the action taken to resolve the situation in the log book.

Monitoring

- *Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority if asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.*

- Carry out regular site inspections to monitor compliance with any dust management plan, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicles/Machinery

- 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 un-surfaced haul roads and work areas.*
- 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 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 as soon as reasonably practicable after the event using wet clean methods.

Waste Management

Avoid bonfires or 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. Hand held 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 particulates 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

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 tore-vegetate or re-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 ab dither 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 powder materials ensure bags are sealed after use and stored appropriately to prevent dust*

Measures Specific to Trackout

- *Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use*
- *Avoid dry sweeping of large areas.*
- *Ensure vehicles entering and leaving sites are covered to prevent the escape of materials during transport.*

- *Record any inspections of haul routes and subsequent action in site log book.*
- *Implement wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).*

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APPENDIX C
OPERATION IMPACT ASSESSMENT METHODOLOGY

This appendix contains the methodology used in the assessment for the operational impact assessment to include reference to EP-UK & IAQM guidance.

The EPUK & IAQM guidance makes reference to the Town and Country Planning (Development Management Procedure) Order (England) 2010 [(Wales) 2012] definition of a 'major' development when scoping assessments required for the planning process. A 'major' development includes developments where:

- The number of dwellings is 10 or above;
- The residential development is carried out of a site of more than 0.5ha where the number of dwellings is unknown;
- The provision of more than 1,000m^2 commercial floorspace; or,
- Development carried out on land of 1ha or more.

Consideration of air quality impacts and approaches to reduce impacts from any 'major' developments is therefore recommended.

There are two types of air quality impact to be considered:

- The impact of existing sources in the local area on the proposed development (governed by background pollutant levels and proximity to sources of air pollution); and,
- The impacts of the proposed development on the local area.

With regard to the changes in air quality or exposure to air pollution, the guidance indicates that each local authority will be likely to have their own view on the significance of this; these are to be described in relation to whether an air quality objective is predicted to be met, or at risk of not being met. Exceedances of these objectives are considered as **significant** if not mitigated.

As part of the impact of the proposed development on the local area, a two-staged assessment is recommended as per guidance.

Stage 1: Determines whether an air quality assessment is required. Requires any of the criteria under (A) coupled with any of the criteria under (B) in Table B1 to apply to be required to proceed to Stage 2.

Stage 2: Where an assessment is deemed to be required, this may take the form of a Simple Assessment or a Detailed Assessment, taking reference to the criteria in Table B2.

Table B1: Stage 1 Criteria to proceed to Stage 2

Criteria to Proceed to Stage 2
A. If any of the following apply: • 10 or more residential units of a site area of more than 0.5ha • More than 1,000m^2 of floor space for all other uses or a site area greater than 1ha
B. Coupled with any of the following: • The development has more than 10 parking spaces • The development will have a centralised energy facility or other centralised combustion process

Table B2: Indicative Criteria for Requiring an Air Quality Assessment

The Development will	Indicative Criteria to Proceed to an Air Quality Assessment
1. Cause a significant change in Light Duty Vehicle (LDV) traffic slows on local roads with relevant receptors.	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors.	A Change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100AADT elsewhere.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA
4. Introduce 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.
5. Introduce or change a bus station.	Where bus flows will change by: - more than 25 AADT within or adjacent to an AQMA - more than 100AADT elsewhere.
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors.	Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

The impacts of a development are usually assessed at selected 'receptors'. The magnitude of impacts is derived by the percentage of change in pollutant concentration relative to an Air Quality Assessment Level (AQAL) and long term average pollutant concentration at receptor, as presented in Table B3.

Table B3: Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% of less of AQAL	Negligible	Negligible	Slight	Moderate
79 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

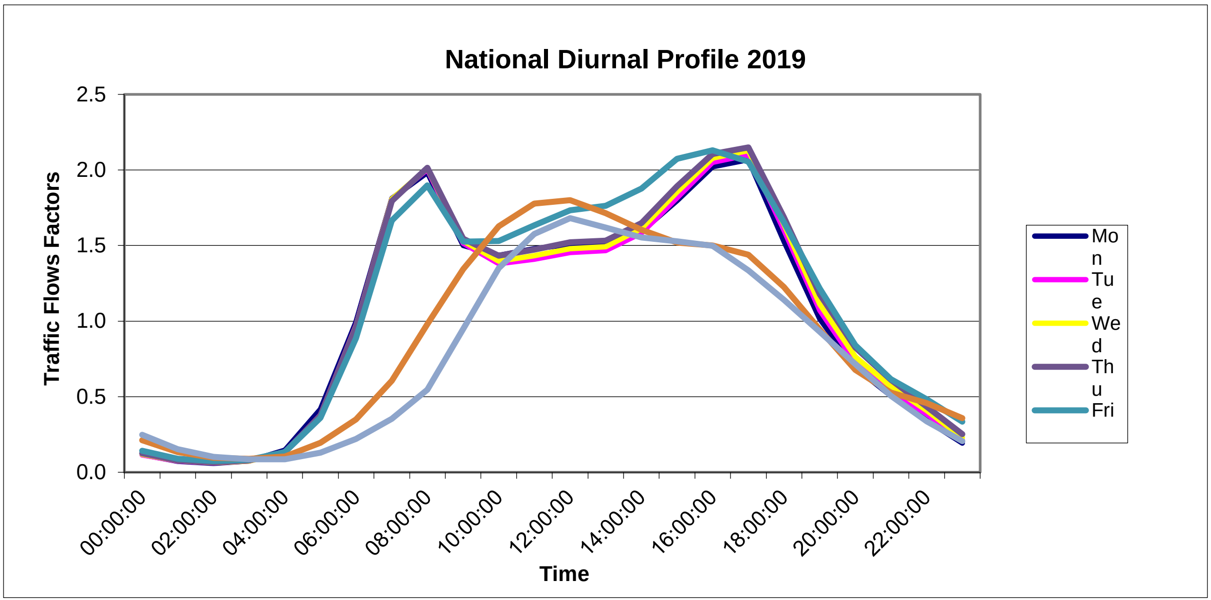
APPENDIX D
TRAFFIC DATA

This appendix contains the traffic data used in the dispersion modelling assessment. Included are traffic flow data in AADT, percentage Heavy Duty Vehicle (HDV) and vehicle speeds (km/h) used on free-flowing links.

Table D1: AADT Traffic Flows for Model Scenarios used in the dispersion modelling assessment

Road	Baseline Flows 2019		2024 Baseline with committed developments		2024 Baseline + Development		Speed (km/h)
	24-Hr AADT	%HDV	24-Hr AADT	%HDV	24-Hr AADT	%HDV	
Debden Road (N)	4624	6.46%	5251	5.88%	5413	6.04%	48
Debden Road (S)	4662	6.46%	5292	5.88%	5440	6.05%	48
Borough Lane (W)	4157	6.46%	5366	5.17%	5450	5.37%	48
Mount Pleasant Site access east	5740	6.45%	7546	5.07%	7746	5.25%	48
Mount Pleasant Site access west	5740	6.45%	7546	5.07%	7822	5.18%	48

Figure D1: National Diurnal Profile used in modelling



APPENDIX E
MODELLING OF OPERATIONAL PHASE – VERIFICATION METHODOLOGY AND MODEL RESULTS

The dispersion model results were verified following the relevant guidance in LAQM.TG(16). Predicted results from a dispersion model may differ from measured concentrations for a variety of reasons, these are identified in TG(16) to include:

- Estimates of background concentrations;
- Meteorological data uncertainties;
- Uncertainties in source data for example, traffic flow data, stack emissions and emission factors;
- Model input parameters such as roughness length, minimum Monin-Obukhov and overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

A comparison of modelled versus monitored NO_2 concentrations at the sites is presented in Table E1. As the model underpredicted by an average of 39.6%; therefore, model verification was undertaken.

Table E1 Modelled versus Monitored NO_x Concentrations

Site	Background NO_2	Monitored total NO_2	Modelled total NO_2	% Difference [(modelled – monitored)/ monitored]x100
UT030	11.10	25.0	14.6	-41.6
UT031	11.10	20.7	12.87	-37.7

Modelled versus measured road NO_2 at the diffusion tube monitoring sites are shown in Table E2. This indicated that the model under-predicted road NO_x concentrations by a factor of 2.26. No PM_{10} or $PM_{2.5}$ monitors were available to verify results therefore the NO_X factor of 4.43 was also used for PM_{10} and $PM_{2.5.}$

Table E2: Modelled versus Monitored NO_x/NO_2

Site	Monitored total NO_2	Background NO_2	Monitored Road Contribution NO_2	Monitored Road Contribution NOx	Modelled road contribution NOx	Ratio of Modelled and Measured Road NOx
UT030	25.0	11.10	13.88	26.48	6.40	4.14
UT031	20.7	11.10	9.55	17.89	3.22	5.56

Verified model results are shown in Table E4 for all scenarios.

Table E4: Predicted Annual Mean NO_2 and PM_{10} Concentrations, at modelled discrete receptor location in all modelled scenarios

Receptor ID	NO_2 Annual Average Concentrations (µg/m³)				No. days PM_{10} 24-Hour Average Concentrations (µg/m³)			PM_{10} Annual Average Concentrations (µg/m³)				$PM_{2.5}$ Annual Average Concentrations (µg/m³)			
	Background	S1	S2	S3	S1	S2	S3	Background	S1	S2	S3	Background	S1	S2	S3
UT030	11.10	25.88	21.10	21.44	1	1	1	15.28	17.50	16.80	16.89	9.62	10.95	10.27	10.31
UT031	11.10	18.77	16.68	16.85	1	0	0	15.50	17.00	16.33	16.39	9.75	10.62	9.99	10.02
Mt Ples Res 1	11.10	21.40	18.16	18.42	1	0	0	15.28	16.78	16.04	16.10	9.62	10.52	9.83	9.87
Mt Ples Res 2	11.10	17.49	15.63	15.79	0	0	0	15.28	16.42	15.66	15.71	9.62	10.29	9.61	9.64
Mt Ples Res 3	11.10	15.47	14.25	14.35	0	0	0	15.50	16.34	15.53	15.56	9.75	10.24	9.54	9.56
Mt Ples Res 4	11.10	13.34	12.71	12.76	0	0	0	15.50	15.93	15.03	15.05	9.75	10.00	9.27	9.28
Jct Res 1	11.10	24.23	19.84	20.13	1	0	1	15.28	17.24	16.49	16.56	9.62	10.80	10.09	10.12
Jct Res 2	11.10	21.40	17.98	18.17	1	0	0	15.28	16.81	16.02	16.07	9.62	10.54	9.82	9.85
Jct Res 3	11.10	24.55	20.15	20.39	1	1	1	15.28	17.29	16.56	16.63	9.62	10.82	10.13	10.16
Deb Rd S Res 1	11.10	18.61	15.92	16.07	0	0	0	15.28	16.41	15.53	15.56	9.62	10.29	9.54	9.56
Deb Rd S res 2	11.10	15.50	13.95	14.03	0	0	0	15.28	16.05	15.14	15.17	9.62	10.07	9.32	9.34
Borough Ln Res 1	11.10	17.83	15.67	15.79	0	0	0	15.28	16.32	15.50	15.53	9.62	10.24	9.52	9.54
Borough Ln Res 2	11.10	15.25	14.01	14.07	0	0	0	15.28	16.05	15.21	15.23	9.62	10.07	9.36	9.37
Deb Rd N Res 1	11.10	18.17	15.71	15.86	0	0	0	15.28	16.34	15.48	15.51	9.62	10.26	9.51	9.53
Deb Rd N Res 2	11.10	22.87	18.65	18.90	1	0	0	15.28	17.06	16.22	16.28	9.62	10.69	9.93	9.97
Deb Rd N Res 3	11.10	16.90	14.85	14.97	0	0	0	15.28	16.22	15.33	15.37	9.62	10.18	9.43	9.45
Mt Ples Res 5	11.10	16.03	14.63	14.75	0	0	0	15.50	16.44	15.64	15.68	9.75	10.30	9.60	9.63
Dev Res 1	11.10	20.79	17.48	17.69	1	0	0	15.28	16.72	15.89	15.95	9.62	10.48	9.75	9.78
Dev Res 2	11.10	17.10	14.98	15.10	0	0	0	15.28	16.29	15.41	15.44	9.62	10.22	9.47	9.49
Dev Res 3	11.10	17.43	15.43	15.59	0	0	0	15.28	16.24	15.42	15.46	9.62	10.20	9.48	9.50

Receptor ID	NO_2 Annual Average Concentrations (µg/m³)				No. days PM_{10} 24-Hour Average Concentrations (µg/m³)			PM_{10} Annual Average Concentrations (µg/m³)				$PM_{2.5}$ Annual Average Concentrations (µg/m³)			
	Background	S1	S2	S3	S1	S2	S3	Background	S1	S2	S3	Background	S1	S2	S3
Dev Res 4	11.10	13.28	12.57	12.63	0	0	0	15.28	15.65	14.73	14.74	9.62	9.84	9.09	9.10
Dev Res 5	11.10	12.44	11.97	11.99	0	0	0	15.28	15.52	14.57	14.58	9.62	9.77	9.00	9.01