



St Edward

Green Park Village Phase 6A, Reading

Detailed Air Quality Assessment

Project No. 442611-01(02)

MAY 2017



RSK GENERAL NOTES

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Summary

RSK Environment Ltd (RSK) was commissioned to undertake a detailed air quality assessment for a proposed residential development at Green Park Village Phase 6A in Reading. The site lies within the jurisdiction of Reading Borough Council (RBC). RSK consulted with RBC on the scope and methodology of the air quality assessment. The assessment has been undertaken with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

Construction phase impacts of the proposed development may potentially arise due to fugitive dust emissions. The risk of dust impacts was assessed according to a widely used method published by the Institute of Air Quality Management (IAQM). Mitigation measures appropriate to the construction phase will be specified by a dust management plan (DMP) agreed with RBC; therefore, significant residual effects are not anticipated.

A dispersion modelling assessment of the operational phase air quality impacts associated with emissions from the increase in traffic on local roads associated with the proposed development has been carried out by RSK. The assessment methodology and outcomes of the study are presented in this report.

The key air pollutants of concern for operational phase impacts are considered to be nitrogen dioxide (NO₂) and fine particulate matter (PM₁₀ and PM_{2.5}). In order to quantify potential air quality impacts at receptor locations during the operational phase of the development, three scenarios were assessed using an advanced dispersion model, ADMS-Roads, and hourly sequential meteorological data. The scenarios assessed were as follows:

- 'Base Case' scenario representing the 'existing' air quality situation;
- 'Without Development' (2022, the expected year of opening without the proposed development in place but including other committed/consented developments); and
- 'With Development' scenario (2022, the expected year of opening with proposed development in place and including other committed/consented developments).

Impact of the Development on Local Air Quality

The predicted long-term NO₂, PM₁₀ and PM_{2.5} and short-term NO₂ and PM₁₀ concentrations at all the assessed existing and proposed receptors, and for all modelled scenarios, would not exceed the relevant air quality objectives.

As a result of the development (S3 2022 With Development), there is a 'negligible' air quality impact predicted with respect to annual mean NO₂, PM₁₀ and PM_{2.5} at all modelled existing sensitive receptors. Therefore, it may be considered that the air quality impact of the development on local air quality is not significant.

It is likely that a communal boiler will be included. However, at this stage, the boiler specification is not confirmed. Following confirmation, it is recommended that an assessment of the air quality impact of the boiler is undertaken.

Impact of Future Air Quality on the Proposed Development Sensitive Receptors

None of the modelled proposed residential receptors are predicted to experience pollutant concentrations above the annual mean NO₂, PM₁₀ or PM_{2.5} objectives. It is considered that increased exposure to poor air quality at the proposed development is unlikely and therefore the air quality impact of the development may be considered 'not significant'.

Abbreviations

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System – Roads (a dispersion modelling software application)
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CHP	Combined Heat and Power
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMP	Dust Management Plan
EC	European Commission
EP-UK	Environmental Protection UK
EU	European Union
GLA	Greater London Authority
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
NAQS	National Air Quality Strategy
NPPF	National Planning Policy Framework
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
O ₃	Ozone
PM _{2.5}	Particulate matter of size fraction approximating to <2.5mm diameter
PM ₁₀	Particulate matter of size fraction approximating to <10mm diameter
RBC	Reading Borough Council
UK-AIR	UK Air Information Resource
VOC	Volatile Organic Compounds

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1 INTRODUCTION

1.1 Background

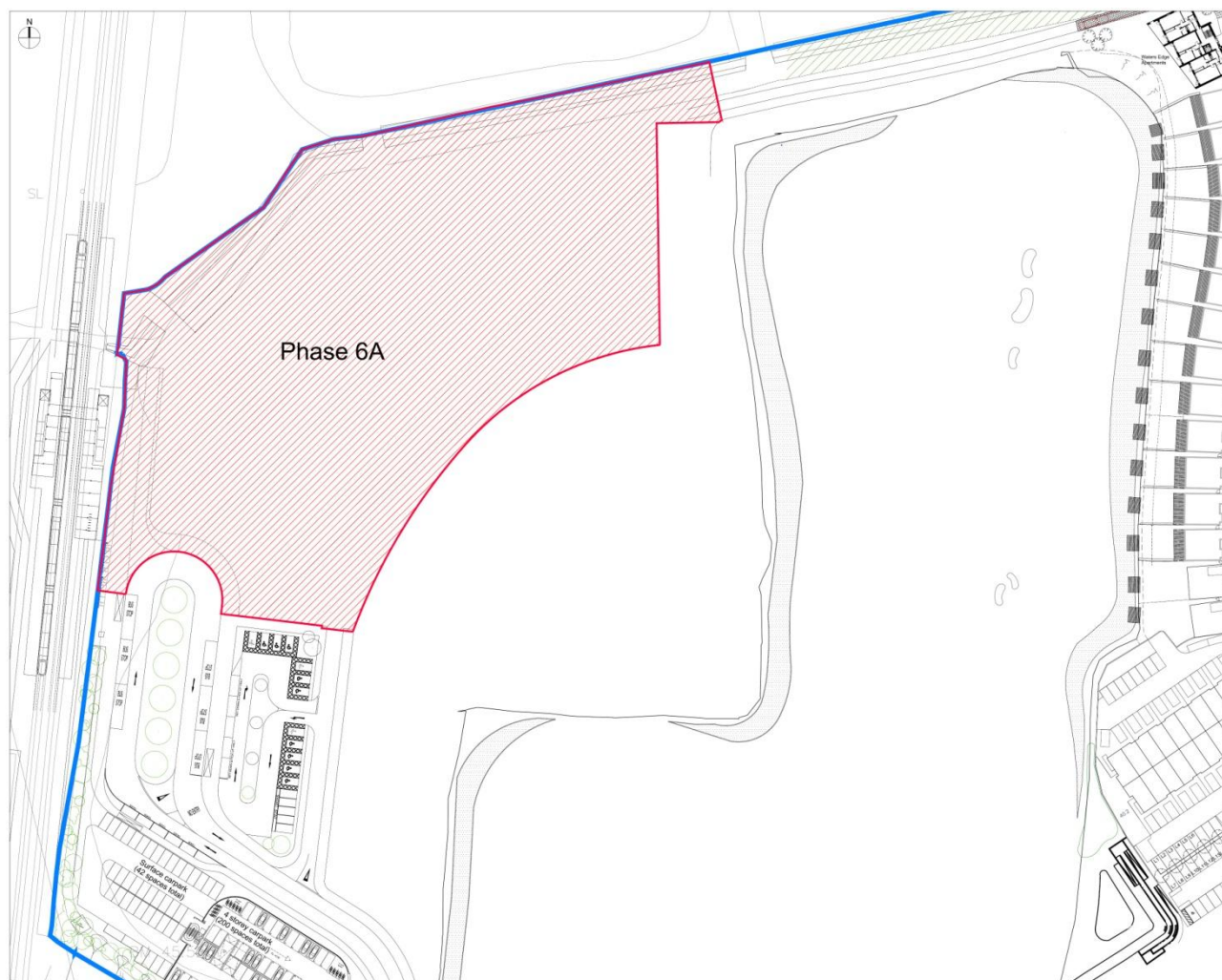
RSK Environment Ltd (RSK) has been commissioned to undertake an assessment of the potential air quality impacts associated with a proposed residential development at Green Park Village Phase 6A, Reading. The site lies within the jurisdiction of Reading Borough Council (RBC). The approximate grid reference for the centre of the site is 469597, 170318. Figure 1.1 shows the location including the boundary of the site, indicated by the red line.

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 impacts on local air quality resulting from emissions generated by the development once it is operational.

1.2 Proposed Development

The proposed development consists of 281 apartments in 3 blocks. The planning reference for the original outline application is 10/01461 and 10/2172. The proposal for the whole of phase 6 (i.e. phase 6A and phase 6B) consists of approximately 459 apartments in 7 blocks.

Figure 1.1: Proposed Development Site Location



2 LEGISLATION AND POLICY CONTEXT

2.1 Key Legislation

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 (NAQS). 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 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 air quality standards 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 relevant¹ objectives for England and Wales are summarised below in Table 2.1.

These objectives are to be used in the review and assessment of air quality by local authorities under Section 82 of the Environment Act (1995). If exceedances are measured or predicted through the review and assessment process, the local authority must declare an air quality management area (AQMA) under Section 83 of the act, and prepare an air quality action plan (AQAP) to outline how air quality is to be improved.

Table 2.1: Air Quality Objectives Relevant to the Proposed Development

Substance	Averaging period	Exceedances allowed per year	Ground level concentration limit (µg/m ³)
Nitrogen dioxide (NO ₂)	1 calendar year	-	40
	1 hour	18	200
Particles (PM ₁₀)	1 calendar year	-	40
	24 hours	35	50
Fine particles (PM _{2.5})*	1 year	N/A	25

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

*Note: The PM_{2.5} objective is not in Regulations and there is no requirement for local authorities to meet it.

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 March 2012 The National Planning Policy Framework (NPPF) was published, superseding the bulk of previous Planning Policy Statements with immediate effect. The National Planning Policy Framework was intended to simplify the planning system and includes a presumption in favour of sustainable development.

Section 11 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 should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan”.

2.2.2 Local Planning Policy

Reading Borough Local Development Framework Sites and Detailed Policies Document was adopted in January 2015. Policy DM19 states the need to improve air quality and to reduce the effects of poor air quality:

“Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

- Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly reduce air quality;
- Whether the development is within, or accessed via, an Air Quality Management Area; and

- Whether it can be demonstrated that a local reduction in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.
- Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application.”

2.2.3 Guidance on the Assessment of Dust from Demolition and Construction

The Institute of Air Quality Management (IAQM) published a guidance document in 2014 (Holman et al., 2014) on the assessment of construction phase impacts.

The assessment is used to define the appropriate level of mitigation required and the measures to reduce the identified potential impact and determine the significance of the predicted level of impact to air quality.

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

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) jointly published a guidance note ‘Land-Use Planning & Development Control: Planning for Air Quality’ v1.2 in January 2017 to ensure that air quality is adequately considered in the land-use planning and developmental control process.

It provides guidance on assessment methodology and a framework for air quality considerations within local development control processes, promoting a consistent approach to the treatment of air quality issues within development control decisions.

3 ASSESSMENT SCOPE

3.1 Overall Approach

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

- correspondence with the local authority on the proposed development in terms of air quality;
- baseline characterisation of local air quality;
- qualitative impact assessment of the construction phase of the development;
- advanced dispersion modelling assessment of air quality impacts of the proposed development under the following three scenarios:
 - (i) 'Base case' scenario representing the 'existing' air quality situation;
 - (ii) 'Without Development' scenario (2022, the expected year of opening but without the proposed development in place); and
 - (iii) 'With Development' scenario (2022, the expected year of opening with the proposed development in place).
- recommendation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised; and
- identification of residual impacts resulting from the proposed development.

The scope of the air quality assessment was determined in consultation with the local authority.

3.2 Construction Phase Assessment

The Institute of Air Quality Management (IAQM) has published a guidance document on the assessment of construction phase impacts.

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

- demolition (Note that no demolition is proposed under the current development proposals. Included here for reference and completeness);
- earthworks;
- construction; and
- trackout.

A qualitative construction impact assessment has been conducted in accordance with the IAQM Guidance. The method is further described in Appendix A.

3.3 Dispersion Modelling Assessment

The study area for the road traffic emissions dispersion modelling was based on roads predicted to be impacted by the proposed development and other cumulative development traffic generation, and those predicted to have an impact on local air quality at the proposed development site with reference to the EPUK-IAQM guidance, described in Appendix B.

There are two aspects to be considered in relation to air quality impacts of the proposed development:

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

The site is not within an Air Quality Management Area (AQMA). However, dispersion modelling was considered an appropriate option due to the scale of the development.

4 BASELINE AIR QUALITY 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. Baseline air quality data employed in this study were obtained from automatic and diffusion tube monitoring stations maintained by RBC and from the LAQM Support website operated by the Department for Environment, Food and Rural Affairs (Defra).

4.1 Emissions Sources and Key Air Pollutants

Transport-related emissions are one of the main sources of air pollution in urban areas. The principal pollutants relevant to this assessment are considered to be NO₂ and PM₁₀, generally regarded as the two most significant air pollutants released by vehicular combustion processes, or subsequently generated by vehicle emissions in the atmosphere through chemical reactions. These pollutants are generally considered to have the greatest potential to result in human health impacts, and are the substances of most concern in terms of existing levels in the area, as discussed below.

4.2 Local Authority Review and Assessment of Air Quality

As directed by the Environment Act 1995, local authorities are required to review and assess air quality with respect to the standards and objectives for the pollutants specified in the Government's National Air Quality Strategy (NAQS, 2007). Where objectives are not predicted to be met, local authorities must declare an AQMA. In addition, local authorities are required to produce an Air Quality Action Plan (AQAP), which outlines measures aimed at improving air quality within the designated AQMA.

4.2.1 Reading Borough Council (RBC)

RBC has declared an Air Quality Management Area (AQMA) covering Reading Town Centre, areas along the major radial road routes into Reading (including J11 of the M4) and along the railway lines where they pass through built-up areas, for exceedances of the annual mean air quality objective for NO₂. The proposed development is not located within an AQMA but is approximately 1km west of the Reading AQMA covering the A33 and 0.8km north of the Wokingham District Council (WDC) AQMA covering properties along the M4. The WDC AQMA was also declared for exceedances of the air quality objective for NO₂.

4.3 Baseline Monitoring Data

According to RBC's 2016 Air Quality Status Report there are four automatic monitoring stations in the borough. NO₂ was monitored at 60 diffusion tube locations by RBC, at a mixture of roadside and background sites. There are a number of diffusion tubes within 3.3km of the proposed development.

The 2016 annual average NO₂ concentrations for the nearby diffusion tube sites and all automatic sites are reproduced in Table 4.1. These data show that there were exceedances of the annual mean standard for NO₂ at roadside monitoring sites over 3km from the proposed development site.

Table 4.1 Annual Average Measured Pollutant Concentrations at Automatic Stations and Diffusion Tubes Sites Nearest to the Proposed Development Site

Site Name	Site Type	Approx distance from proposed development (km)	Annual Average NO ₂ (µg/m ³)	Annual Average PM ₁₀ (µg/m ³)
			2016	2016
Automatic sites				
Oxford Road	Roadside	3.9	33	22
Caversham Rd	Roadside	4.4	38	20
London Road	Rural	4.5	33	19
AURN	Urban background	4.8	34	13
Diffusion tube sites				
495 Basingstoke Road	Roadside	2.1	33	-
144 Bath Road	Roadside	2.3	29	-
Tilehurst Rd / Water Road	Roadside	2.8	32	-
4 Tilehurst Road	Roadside	2.9	30	-
162a Castle Hill	Roadside	2.9	37	-
102 Whitley Street	Roadside	3.0	29	-
128 Castle Hill	Roadside	3.0	45	-
Blenheim Terrace	Roadside	3.1	39	-
281 Oxford Road	Roadside	3.2	44	-
327 Oxford Road	Roadside	3.2	40	-
165 Oxford Road	Roadside	3.3	44	-
Red Cow, Southampton Street	Roadside	3.3	38	-
44 Crown Street	Roadside	3.3	37	-
10-20 Hieatt Close	Roadside	3.3	32	-
10 Trinity Place	Roadside	3.3	31	-
Air Quality Objective			40	

Notes: Data presented in **bold** exceeds the objective.

4.4 LAQM Support Background Data

In addition to the local monitoring data, estimated background air quality data available from the LAQM website, operated by DEFRA, may also be used to establish likely

background air quality conditions at the proposed development site. The LAQM website provides estimated annual average background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5} on a 1km² grid basis. Table 4.2 identifies estimated annual average background NO_x, NO₂, PM₁₀ and PM_{2.5} concentrations at the proposed development site for the years 2015 to 2017 (2013 base year maps). No exceedance of annual average air quality objectives for human health, for NO₂ or PM₁₀ is predicted at background locations.

Table 4.2 2015 to 2017 Estimated Background Annual Average NO_x, NO₂, PM₁₀ and PM_{2.5} Concentrations at Proposed Development Site

Assessment Year	Estimated Annual Average Pollutant Concentrations Derived from the UK-AIR Website			
	Annual Average NO _x (µg/m ³)	Annual Average NO ₂ (µg/m ³)	Annual Average PM ₁₀ (µg/m ³)	Annual Average PM _{2.5} (µg/m ³)
2015	26.6	18.1	15.9	11.3
2016	25.4	17.4	15.7	11.2
2017	24.1	16.7	15.6	11.1
Air Quality Objective	30[^]	40	40	25

Notes: Presented concentrations for 1km² grid centered 469500, 170500; approximate centre of development site is 469597, 170318. [^]air quality objective designated for the protection of vegetation and ecosystems only.

5 METHODOLOGY

5.1 Construction Dust Assessment

The potential for construction phase impacts was assessed according to the Institute of Air Quality Management (IAQM) guidance document (Holman et al., 2014) on the assessment of construction phase impacts.

For each construction activity, the risk of dust arising to cause annoyance and/or health or ecological impacts is assessed using three risk categories: low, medium and high risk. The risk category may be different for each of the four activities and depends on the sensitivity of the area. Three separate dust impacts are considered:

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

The assessment is used to define the appropriate level of mitigation required and determine the significance of the predicted level of impact to air quality. Appendix A sets out the construction dust assessment methodology.

The Magic Map application, available online from Defra, was used to identify statutory ecological receptors near the proposed development site area.

5.2 Operational Impact Assessment

Operational phase impacts were assessed according to the EPUK-IAQM Guidance Document '*Land-Use Planning & Development Control: Planning For Air Quality*' (v1.2 January 2017). Two aspects to air quality impacts are considered:

- 'Exposure' - 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.

The approach is further described in Appendix B, to include the descriptors of magnitude of change and impact significance.

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

5.2.1 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. The model allows for the skewed nature of turbulence within the atmospheric boundary layer. An equivalent model, ADMS-Urban, is often used by local councils for air quality review and assessment work.

ADMS-Roads is capable of processing hourly sequential meteorological data, whilst taking the turbulence caused by vehicles into account in calculating the dispersion profiles of emitted pollutants. ADMS-Roads enables the user to model line (e.g. road), point (e.g. industrial stack), area (e.g. car park) and volume emission sources simultaneously and facilitates the prediction of ground level concentrations of pollutants of concern at multiple receptor locations.

ADMS-Roads (Version 4.1) was used for assessing potential road traffic emission air quality impacts resulting from the operational phase of the proposed development.

5.2.2 Vehicular Emissions

The transport consultants for the development scheme, Glanville Consultants Limited, provided the traffic data for use in the air quality assessment. The traffic data used in the modelling are presented in Appendix C. The road network included in the dispersion model is presented in Figure 5.1.

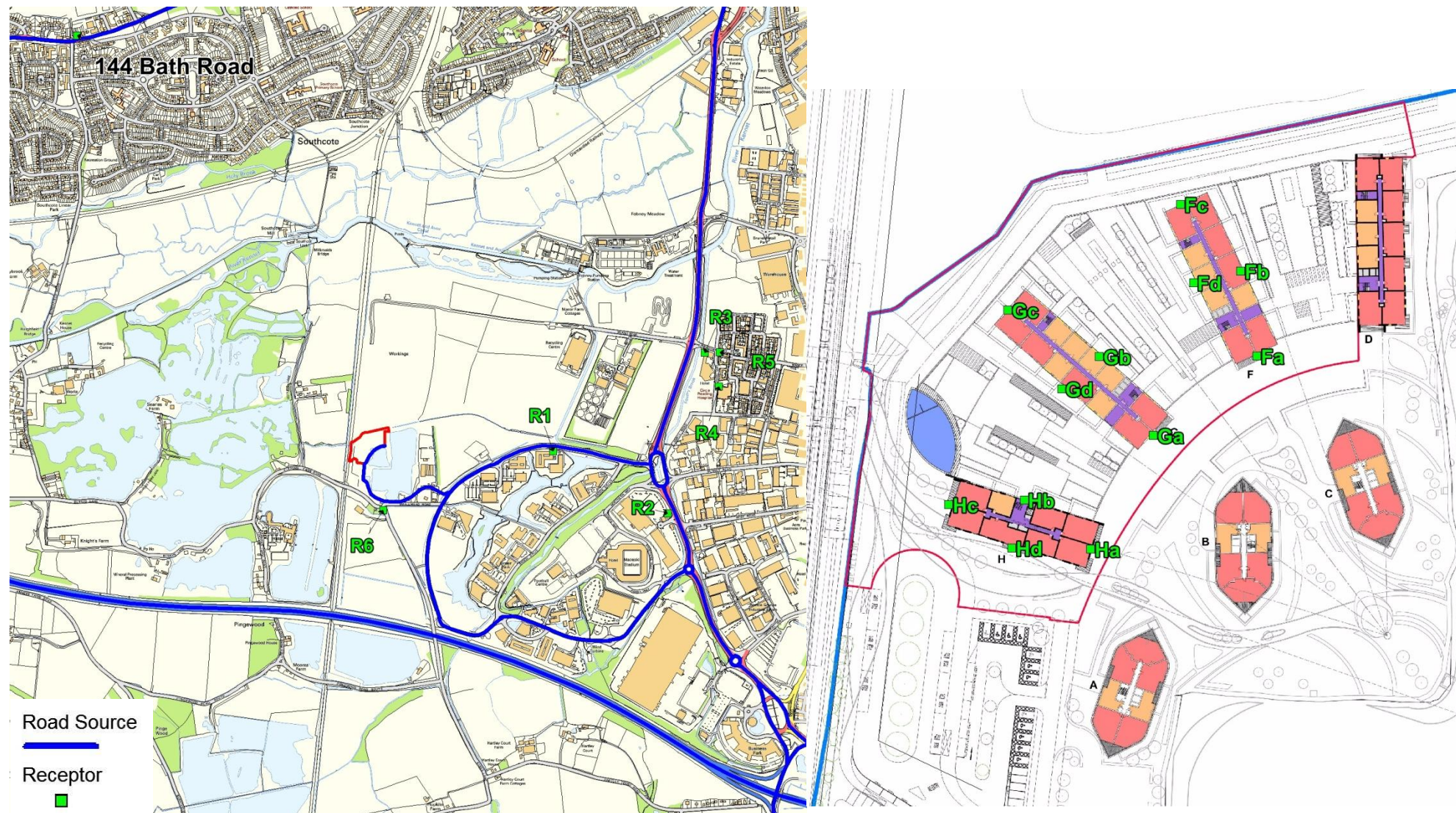
Speed data from were made available and used within the model for all road links. Reduced speeds at junctions were employed in the model; all road link speeds used in the model are presented in Appendix C.

Department for Transport (DfT) traffic count data have been used and TEMPro grow factors were provided by the transport consultants. Information regarding the dispersion of development traffic on these links was not available. Therefore, for a conservative assessment, all the development traffic for the S3 scenario has been added to all DfT count links.

5.2.3 Emission Factors

Vehicular emissions were calculated using the Emission Factors Toolkit (Version 7.0), which is available from the Defra UK-AIR website. Emission scenario year 2016 was used for the '2016 base case', '2022 Without Development' and '2022 With Development' scenarios for a conservative assessment.

Figure 5.1: The roads and receptors included in the dispersion modelling assessment



Road Source

Receptor

St Edward

Detailed Air Quality Assessment for Green Park Village Phase 6A, Reading

RSK 442611-01(02)

5.2.4 Time-Varying Profile

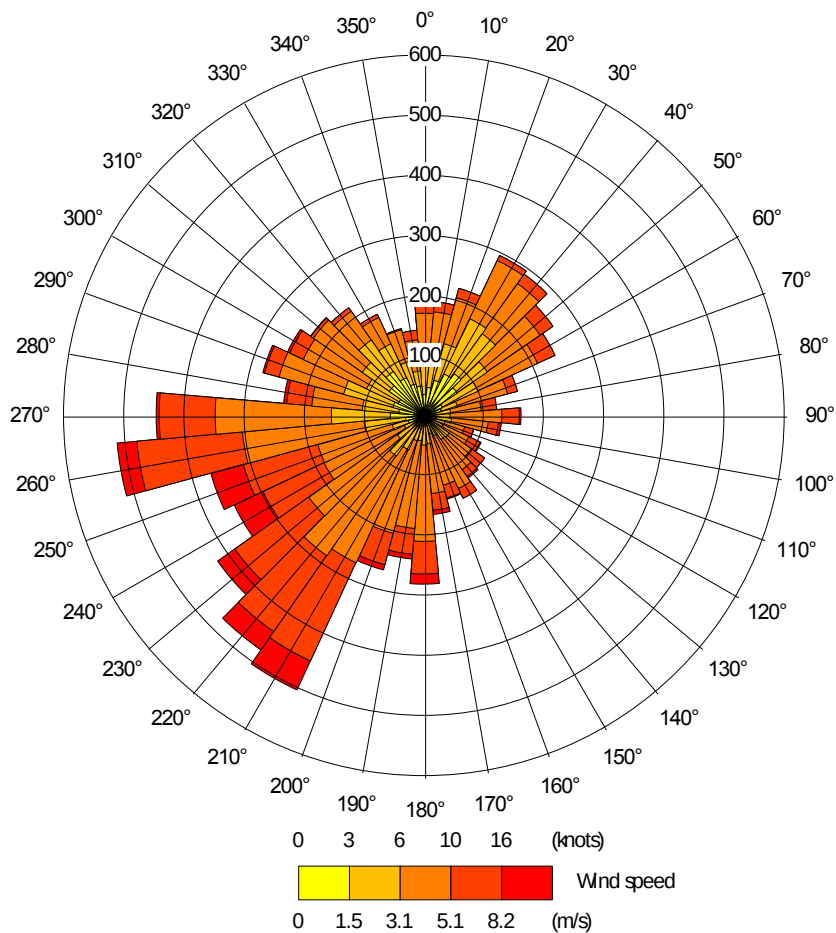
Vehicle movements vary with time. The national diurnal profile was applied to all roads, which can be seen in Appendix C.

5.2.5 Meteorological Data

Hourly sequential meteorological data were employed in the dispersion model. The data were recorded in 2016 at the Heathrow meteorological monitoring which is located around 35km from the proposed development site.

The windrose derived from the 2016 dataset is presented in Figure 5.3. The predominant wind direction was south-westerly.

Figure 5.2: Windrose from the Heathrow meteorological station in 2016



5.2.6 Background Air Quality Data Used in the Modelling

Estimated background annual average concentrations in 2016 of NO₂, NO_x, PM₁₀ and PM_{2.5} obtained from the LAQM Support website operated by Defra were used for all scenarios in the modelling; these are detailed in Table 5.1. This is considered representative of local air quality conditions at the development site. The AURN background site was not used because the 2016 NO₂ concentration recorded was higher than that recorded at 144 Bath Road (the verification site).

Table 5.1 Background Annual Average NO_x, NO₂, PM₁₀ and PM_{2.5} Concentrations used in the Assessment

Assessment Year	Annual Average Pollutant Concentrations			
	Annual Average NO _x (µg/m ³)	Annual Average NO ₂ (µg/m ³)	Annual Average PM ₁₀ (µg/m ³)	Annual Average PM _{2.5}
2016	25	17	16	11
Air Quality Objective	30^	40	40	25

5.2.7 Receptor Locations

Pollutant concentrations were predicted at a number of receptors in and around the development site. Details of all specific receptors included in the modelling study (and hence the air quality impacts assessed) are summarised in Table 5.2. The locations of all assessed receptors are shown in Figure 5.1.

The receptors were selected to represent existing receptors and locations on the proposed development site, considered to represent 'worst-case' exposure locations.

Table 5.2: Receptors Included in the Dispersion Modelling Assessment

Receptor ID	Receptor Location	Grid reference		Height (m)
		X	Y	
Monitoring data, used for model verification purposes				
-	144 Bath Road	468288	172168	2.5
Existing receptors				
R1	Longwater Avenue	470471	170263	1.5
R2	A33 and Northern Way	470997	169978	1.5
R3	A33 hotel	471167	170716	1.5
R4	Reading Circle Hospital	471233	170560	1.5
R5	Lindisfarne Way	471237	170718	1.5
R6	Kirton Farms Road property	469692	169993	1.5
Proposed receptors				
Fa	Block F – south side	469667	170293	5.65
Fb	Block F – east side	469662	170321	5.65

Receptor ID	Receptor Location	Grid reference		Height (m)
		X	Y	
Fc	Block F – north side	469643	170343	5.65
Fd	Block F – west side	469647	170317	5.65
Ga	Block G – east side	469634	170266	5.65
Gb	Block G – north side	469617	170292	5.65
Gc	Block G – west side	469588	170307	5.65
Gd	Block G – south side	469605	170281	5.65
Ha	Block H – east side	469614	170228	5.65
Hb	Block H – north side	469593	170244	5.65
Hc	Block H – west side	469569	170242	5.65
Hd	Block H – south side	469589	170228	5.65

5.2.8 Other Model Input Parameters

In order to represent the suburban nature of the proposed development site and surrounding area, a surface roughness length of 0.5m was included in the model. The Monin-Obukhov length (related to atmospheric stability) was assumed to be 30m.

5.2.9 NO_x/NO₂ Chemistry

The latest NO_x/NO₂ conversion spreadsheet/tool downloaded from the Defra LAQM website was used to estimate the predicted roadside NO₂ concentrations from modelled NO_x concentrations. The calculator is only applicable to the calculation of annual average concentrations of NO₂.

For short-term NO₂ predictions, the ‘chemical-reaction scheme’ function of the ADMS-Roads dispersion model was employed and a measured background ozone (O₃) concentration of 37µg/m³ was used. The ozone concentration was obtained from the Defra LAQM-Tools website from the nearest O₃ urban background monitoring site, Reading New Town AURN, for the year 2016. The Reading New Town AURN monitoring site is located around 5km from the proposed development site.

5.2.10 Model Verification

The data from 2016 at diffusion tube NO₂ monitoring site 144 Bath Road was used for model verification (no other monitoring sites were suitable for verification due to location). The diffusion tube is located approximately 2.3km from the proposed development site. Model verification is described in Appendix D.

5.2.11 Predicted Pollution Concentrations

Long and short-term concentrations of NO₂, PM₁₀ and PM_{2.5} were, taking into account background air quality, predicted at each receptor location for each modelled scenario. The dispersion model results have been verified and details are presented in Appendix D.

Isopleths, or pollution concentration contour plots, for long-term NO₂, PM₁₀ and PM_{2.5} predicted concentrations for the 'S3 With Development' scenario have been created and presented in Appendix E.

5.2.12 Model Inputs Summary

The modelling input parameters for the dispersion modelling assessment are presented in Table 5.3.

Table 5.3: Summary of Inputs to the Dispersion Model

Parameter	Brief Description	Input into model
Chemistry	NO _x chemistry using a simple reaction scheme for NO _x , NO ₂ and ozone (O ₃)	Chemistry parameters included, for short term predictions.
Emission year	Predicted emission rates depend on the year of emission being used	2016, for all scenarios
Road source emissions	Road source emission rates calculated from traffic flow data using an emission factor toolkit from UK-AIR	EFTv7.0
Time varied emissions	Diurnal variations of emissions applied to road sources	2015 national diurnal profiles used
Road elevation	Elevation of road above ground level	No terrain file used
Road width	Width of road (m)	Road widths determined based on approximate measurement of roads (internet mapping)
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 emission factor toolkit calculations	Urban (not London) settings used
Road speeds	Speed of the road effects the vehicle emissions to air	Standard speed limits used and those provided by the traffic consultants
Meteorology	Representative hourly sequential meteorological data	Heathrow 2016 data used
Latitude	Allows the location of the model area to be determined	51.43°
Surface roughness	This defines the surface roughness of the model area	0.5m to represent an suburban location
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	Assumed to be 30m
Background	Concentrations of pollutants in background locations	Reference Table 5.1 for levels included
Receptors	Sensitive receptors at risk of increased exposure, either existing or	Reference Table 5.2 for receptors included

Parameter	Brief Description	Input into model
	proposed	

5.3 Uncertainties and Assumptions

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

- In the absence of measured air quality data at the proposed development location, estimated background data from the Defra LAQM website were used in the assessment. In reality, baseline air quality levels vary with time and location but in the absence of on-site baseline monitoring data, the assumption that the baseline concentrations obtained from the above-mentioned data source is applicable to the proposed scheme location, is considered appropriate;
- Vehicle emission factors were obtained from the Emission Factor Toolkit (version 7.0), published on the DEFRA website, for the scenario year 2016;
- 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 wind conditions measured at Heathrow meteorological monitoring station in 2016 were representative of wind conditions at the site, as this meteorological station is closest to the proposed development site. 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;
- An important step in the assessment is verifying the dispersion model against measured data. The model verification was based on the comparison of model results based on 2017 traffic data with 2016 measured roadside NO₂ diffusion tube data. As no PM₁₀ or PM_{2.5} monitoring data were available near the site area, the adjustment factor used for the predicted roadside NO_x concentrations has been applied to the predicted PM₁₀ and PM_{2.5} concentrations, as per guidance provided in the Local Air Quality Management Technical Guidance Note LAQM.TG (16) published by Defra;
- The national diurnal profile obtained from DfT has been assumed to be applicable for the roads assessed where specific diurnal profiles were not available; and
- There is an element of uncertainty in all measured and modelled data. All values presented in this chapter are best possible estimates.

6 ASSESSMENT OF IMPACTS

6.1 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 emissions from site activities.

6.1.1 Exhaust Emissions from Plant and Vehicles

Construction traffic will comprise haulage/construction vehicles and vehicles used for workers' trips to and from the site. The operation of vehicles and equipment powered by internal combustion engines results in the emission of exhaust gases containing the pollutants NO_x, PM₁₀, volatile organic compounds (VOCs), and carbon monoxide (CO). The quantities emitted depend on factors such as engine type, service history, pattern of usage and fuel composition. The operation of site equipment, vehicles and machinery will result in emissions to atmosphere of exhaust gases, but such emissions are unlikely to be significant, particularly in comparison to levels of similar emission components from vehicle movements on the local road network surrounding the development site.

6.1.2 Fugitive Dust Emissions

Fugitive dust 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:

- 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 dust arising from construction activities is mainly of a particle size greater than the PM₁₀ fraction (that which can potentially impact upon human health); however, it is noted that construction activities may contribute to local PM₁₀ 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.

6.1.3 Potential Dust Emission Magnitude

With reference to the IAQM guidance criteria outlined in Appendix A, the dust emissions magnitudes for earthworks, construction and trackout activities are presented in Table 6.1 to Table 6.3. No demolition is proposed. The dust emissions magnitudes for the three construction activities are summarised in

Table 6.4.

Table 6.1: Summary of Dust Emissions Magnitude of Earthworks Activities (Before mitigation)

Earthworks Criteria	Dust Emissions Class	Basis of classification
Total site area	Large	>10,000m ² (20,812m ²)
Soil type	Medium	Clay Rill
Earth moving vehicles at any one time	Small	<5
Height of bunds	Medium	Maximum 4m
Total material moved	Large	Unknown
Work times	Medium	Wet/dry
Overall Rating	Large	Conservative rating

Table 6.2: Summary of Dust Emissions Magnitude of Construction Activities (Before mitigation)

Construction Criteria	Dust Emissions Class	Basis of classification
Total building volume	Medium	25,000-100,000m ³
On-site concrete batching or sandblasting proposed	Small	Neither proposed
Dust potential of construction materials	Medium	Potentially dusty construction materials
Overall Rating	Medium	Conservative rating

Table 6.3: Summary of Dust Emissions Magnitude of Trackout Activities (Before mitigation)

Trackout Criteria	Dust Emissions Class	Basis of classification
Number of HDV>3.5t per day	Medium	20 heavy vehicles per day
Surface type of the site	Medium	Top soil, sandy/fill
Length of unpaved road	Small	None
Overall Rating	Medium	Conservative rating

Table 6.4: Summary of Dust Emission Magnitudes (Before mitigation)

Construction Activities	Dust Emissions Class
Demolition	Not Applicable (NA)
Earthworks	Large
Construction	Medium
Trackout	Medium

6.1.4 Sensitivity of the Area

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

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM₁₀, 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.

Consideration is given to human and ecological receptors from the impact of the construction site boundary and the trackout route proposed. Where necessary, for example, the trackout route is not yet known, a conservative view on the likely route has been taken.

As the proposed phasing of building is not yet known, and for a conservative assessment, it has been assumed that Phase 6B will be completed and occupied during the construction of phase 6A.

Table 6.5 presents the determined sensitivity of the area with the factors itemised which have helped to define this.

The dust emission magnitude for trackout is classed as medium (Table 6.3); therefore, trackout may occur along the public highway up to 200m, as measured from site exit. Construction activities are relevant up to 350m from the proposed development site boundary whereas trackout activities are only considered relevant up to 50m from the edge of the road, as per the guidance. Only 20m and 50m buffers have been included for trackout for this reason.

For a conservative assessment, it has been assumed that Phase 6B will be occupied during the construction of Phase 6A.

There are no designated statutory ecological receptor within 1km of the site boundary. There is a Local Nature Reserve over 3.7km from the site, Pearman's Copse.

Table 6.5: Sensitivity of the area

Potential Impact		Sensitivity of the surrounding area		
		Earthworks	Construction	Trackout
Dust soiling	Receptor sensitivity	High	High	High
	Number of receptors	>100	>100	>100
	Distance from the source	<50m	<50m	<50m
	Sensitivity of the area	High	High	High
Human health	Receptor sensitivity	High	High	High
	Annual mean PM ₁₀ concentration	<24µg/m ³	<24µg/m ³	<24µg/m ³
	Number of receptors	10-100	10-100	10-100
	Distance from the source	<50m	<50m	<50m
	Sensitivity of the area	Medium	Medium	Medium
Ecological	Receptor sensitivity	There are no designated ecologically sensitive sites within 50m of the site or proposed trackout routes.		
	Distance from the source			
	Sensitivity of the area	Negligible		

6.1.5 Risk of Impacts

The dust emission magnitudes summarised in

Table 6.4 were combined with the sensitivity of the area in Table 6.5 to determine the risk of impacts of construction activities before mitigation; these are evaluated based on risk categories of each activity in Appendix A.

The risk of dust impacts from construction activities is identified in Table 6.6. Site specific mitigation measures to reduce construction phase impacts are defined based on this assessment, in Section 7.

Table 6.6: Summary of the Dust Risk from Construction Activities

Potential Impact	Dust Risk Impact		
	Earthworks	Construction	Trackout
Dust soiling	High risk	Medium risk	Medium risk
Human health	Medium risk	Medium risk	Low risk
Ecological	Negligible risk	Negligible risk	Negligible risk

6.2 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 5.1 shows the roads and sensitive receptors included in the dispersion modelling assessment.

It is noted that a railway track lies to the west of the site and a station is planned adjacent to the development which is due to be completed in late 2018. The nearest proposed development facade is over 30m from the railway track and the background annual mean NO₂ concentration is less than 25µg/m³ (using the DEFRA LAQM website estimated annual average background concentration). Therefore, with reference to LAQM.TG(16) 7.18, further assessment of locomotives is not considered necessary.

6.2.1 Dispersion Modelling Results

Detailed dispersion modelling was undertaken with the use of the ADMS-Roads dispersion model software, following guidance in accordance with Local Air Quality Management Technical Guidance (LAQM TG(16)).

The modelled concentrations were verified using monitoring data; for reference, the methodology for this has been described in Appendix D. Model results for NO₂, PM₁₀ and PM_{2.5} concentrations at receptors are presented in Table D4 (NO₂) and Table D5 (PM₁₀, PM_{2.5}) of Appendix D. As described in Appendix D, following verification model performance improved.

The contour plots for long-term NO₂, PM₁₀ and PM_{2.5} predicted concentrations for the 'S3 With Development' scenario are presented in Appendix E.

6.2.2 Impact of the Development on Local Air Quality

Nitrogen Dioxide

Table D4 in Appendix D presents the predicted annual mean NO₂ concentrations for the assessed scenarios at the assessed receptor locations. The short-term (hourly mean) objective for NO₂ is not predicted to be exceeded at any locations.

Table 6.7 shows the comparison of annual mean NO₂ concentrations under the 'S2 Without development 2022' and 'S3 With Development 2022' scenarios at the assessed receptor locations. The percentage changes in annual mean NO₂ concentrations relative to the air quality objective and the classification of impact magnitudes with reference to the EPUK-IAQM guidance are also presented.

The maximum annual mean NO₂ increase and air quality impact as a result of the development is predicted to be 0.29µg/m³ at R6 (Kirton Farms Road property) (0.7% change relative to the air quality assessment level (AQAL)). This 0.7% change

corresponds to a 'negligible' air quality impact, as the existing concentration is <75% of the AQAL. .

LAQM TG.16 indicates that the hourly mean NO₂ AQS would be unlikely to be exceeded if annual mean NO₂ concentrations do not exceed 60µg/m³. Therefore, it is not anticipated that the hourly mean NO₂ objective would be exceeded at the site prior to or when the proposed development becomes operational.

Table 6.7: Comparison of Predicted Long-Term NO₂ Concentrations Under the 'S2 Without Development 2022' and 'S3 With Development 2022' Scenarios

ID	Annual mean NO ₂ concentration, without Development 2022 (µg/m ³)		Annual mean NO ₂ concentration with Development 2022 (µg/m ³)		Change between S2 and S3 (µg/m ³)	% Change in NO ₂ concentration relative to AQAL	Impact Descriptor (IAQM-EPUK)
	(µg/m ³)	% of AQAL	(µg/m ³)	% of AQAL			
Fa	19.9	49.8	20.1	50.3	0.2	0.5	Negligible
Fb	19.7	49.1	19.8	49.4	0.1	0.3	Negligible
Fc	19.5	48.8	19.6	49.0	0.1	0.2	Negligible
Fd	19.6	49.1	19.8	49.4	0.1	0.3	Negligible
Ga	20.0	50.1	20.3	50.7	0.2	0.6	Negligible
Gb	19.7	49.3	19.8	49.6	0.1	0.3	Negligible
Gc	19.6	48.9	19.6	49.1	0.1	0.2	Negligible
Gd	19.7	49.3	19.8	49.6	0.1	0.3	Negligible
Ha	20.3	50.6	20.5	51.3	0.3	0.7	Negligible
Hb	19.9	49.8	20.1	50.2	0.2	0.4	Negligible
Hc	19.8	49.5	19.9	49.8	0.1	0.3	Negligible
Hd	20.0	50.0	20.2	50.4	0.2	0.5	Negligible
R1	22.1	55.1	22.3	55.7	0.2	0.5	Negligible
R2	38.9	97.3	39.1	97.8	0.2	0.4	Negligible
R3	25.1	62.8	25.2	63.0	0.1	0.2	Negligible
R4	21.9	54.7	21.9	54.8	0.1	0.1	Negligible
R5	22.2	55.4	22.2	55.5	0.1	0.1	Negligible
R6	21.2	53.0	21.5	53.7	0.3	0.7	Negligible

Particulate Matter (PM₁₀ and PM_{2.5})

Table D5 in Appendix D presents annual mean PM₁₀ and PM_{2.5} concentrations for the assessed scenarios at the assessed receptor locations. The predicted PM₁₀ and PM_{2.5} concentrations at all the assessed receptors and under all scenarios would not exceed the relevant air quality objectives.

Table 6.8 shows the comparison of annual mean PM₁₀ and PM_{2.5} concentrations under the 'S2 Without Development 2022' and 'S3 With Development 2022' scenarios at the assessed receptor locations. With reference to the EPUK-IAQM guidance, the proposed development would have a 'negligible' predicted impact upon annual mean PM₁₀ and

PM_{2.5} concentrations, as all concentration changes are less than 0.6% of the standard and existing concentrations are likely to be 'well below' (<75%) the relevant AQALs.

Table 6.8: Comparison of Predicted Long-Term PM₁₀ and PM_{2.5} Concentrations Under the 'S2 Without Development 2022' and 'S3 With Development 2022' Scenarios

Receptor ID	Long-term PM ₁₀		Long-term PM _{2.5}	
	Without Development 2022 (µg/m ³)	With Development 2022 (µg/m ³)	Without Development 2022 (µg/m ³)	With Development 2022 (µg/m ³)
Fa	16.5	16.5	11.3	11.3
Fb	16.5	16.5	11.3	11.3
Fc	16.5	16.5	11.3	11.3
Fd	16.5	16.5	11.3	11.3
Ga	16.5	16.6	11.3	11.3
Gb	16.5	16.5	11.3	11.3
Gc	16.5	16.5	11.3	11.3
Gd	16.5	16.5	11.3	11.3
Ha	16.6	16.6	11.3	11.4
Hb	16.5	16.5	11.3	11.3
Hc	16.5	16.5	11.3	11.3
Hd	16.5	16.6	11.3	11.3
R1	16.9	17.0	11.6	11.6
R2	19.3	19.4	13.0	13.0
R3	17.8	17.8	12.0	12.0
R4	16.9	16.9	11.5	11.6
R5	17.1	17.1	11.6	11.6
R6	16.7	16.8	11.4	11.5

LAQM TG.16 indicates that the number of annual exceedances of the 24-hour mean PM₁₀ AQS can be estimated using the following formula: $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$. On this basis, it is estimated that annual mean PM₁₀ concentrations would need to exceed 31.89µg/m³ before the daily mean objective is exceeded more than the 35 permissible times per annum. It is not expected that the 50µg/m³ 24-hour mean objective for PM₁₀ would be exceeded.

The predicted PM₁₀ and PM_{2.5} concentrations at all the assessed receptors and under all scenarios would not exceed the relevant air quality objectives. Therefore, air quality impact is predicted to be 'negligible' with reference to the EPUK-IAQM guidance.

6.2.3 Impact of Future Air Quality on the Proposed Sensitive Receptors

The effect of existing air quality upon the proposed sensitive receptors is an important planning consideration and, with reference to the EPUK-IAQM guidance, has been included in the assessment. Table 6.7 and Table 6.8 present the predicted pollutant concentrations at proposed receptors (F, G, H) for annual mean NO₂, PM₁₀ and PM_{2.5} for 'S3 With Development' scenario. NO₂, PM₁₀ and PM_{2.5} concentrations are not

predicted to exceed the annual mean objectives at any of the proposed receptors assessed, in all cases.

6.2.4 Overall Significance of Operational Phase Impacts

Significance of the Impact of the Development on Local Air Quality

As per Section 6.2.2, the proposed development (S3 2022 With Development) is predicted to experience annual mean NO₂, PM₁₀ and PM_{2.5} concentrations below the air quality objectives with a 'negligible' impact to air quality predicted, with reference to the EPUK-IAQM guidance. Therefore, the air quality impact of the development on local air quality is considered not significant.

Significance of Impact of Future Air Quality on the Proposed Sensitive Receptors

Under the 'S3 With Development', the NO₂, PM₁₀ and PM_{2.5} concentrations are not predicted to exceed the annual mean objectives at any of the proposed receptors. The predicted air quality impact on future proposed receptors is 'negligible', with reference to the EPUK-IAQM guidance. Therefore, the impact may be considered not significant.

7 MITIGATION MEASURES

7.1 Construction Phase Mitigation

The dust emitting activities outlined in section 6.1 (earthworks, construction and trackout activities) can be effectively controlled by appropriate dust control measures and any adverse affects 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) for the construction phase will be reached with the local authority to ensure that the potential for adverse environmental effects on local receptors (including ecological) is minimised. The DMP 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 dust risk categories identified have been used to define appropriate, site-specific mitigation methods. More detailed, site-specific mitigation measures are contained in Appendix F.

The air quality impact of increased traffic 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 (see Appendix F).

7.2 Operational Mitigation

It is likely that a communal boiler will be included. However, at this stage, the boiler specification is not confirmed. Following confirmation, it is recommended that an assessment of the air quality impact of the boiler is undertaken.

As identified in Section 6.2, the proposed development is predicted to have a 'negligible' air quality impact on surrounding sensitive receptors and proposed development receptors.

As best practice, it is recommended that transport related mitigation measures should be included to minimise the impact of the development on the surrounding road network and hence air quality. These measures could include:

- travel plans;
- car clubs;
- incentives for increased public transport use; and

- provision for alternative fuels, such as electric vehicle charge points.

7.3 Residual Impacts: Significance

With the proposed construction activities mitigation measures as described in Section 6.1 and Appendix F in place, the significance of the residual impacts at locations including the ecologically sensitive site location, is considered to be 'not significant' for the construction phase.

As discussed in Section 6.2, the assessment demonstrates that the proposed development is not predicted to have a significant adverse effect on local air quality when complete and occupied.

None of the modelled proposed residential receptors are predicted to experience pollutant concentrations above the annual mean NO₂, PM₁₀ or PM_{2.5} objectives; hence, it is not considered that there would be a risk of increased exposure at the proposed development site.

8 CONCLUSIONS

RSK Environment Ltd (RSK) was commissioned to undertake a detailed air quality assessment for a Green Park Village Phase 6A. The site lies within the jurisdiction of Reading Borough Council (RBC). RSK consulted with RBC on the scope and methodology of the air quality assessment. The assessment has been undertaken with reference to existing air quality in the area and relevant air quality legislation, policy and guidance.

Construction phase impacts on local air quality may potentially arise due to fugitive dust emissions. The risk of dust impacts was assessed according to a widely used method published by the Institute of Air Quality Management (IAQM). Mitigation measures appropriate to the construction phase will be specified by a dust management plan (DMP) agreed with RBC; therefore, significant residual effects are not anticipated.

The principal air quality impact once the proposed development is complete and occupied is likely to be emissions from the increased traffic on local roads surrounding the site. An assessment of operational impacts has been undertaken using the latest version of the ADMS-Roads atmospheric dispersion model.

Concentrations of the key pollutants (NO_2 , PM_{10} and $\text{PM}_{2.5}$) were predicted at the most relevant receptor locations for the base year, for the year 2022 without the proposed development and for 2022 with the proposed development in place. The air quality impacts of the proposed development on existing receptors and the impact of future local air quality upon the proposed development receptors have been assessed.

Impact of the Development on Local Air Quality

The predicted long-term NO_2 , PM_{10} and $\text{PM}_{2.5}$ and short-term NO_2 concentrations, at all the assessed proposed development receptors and for all modelled scenarios, would not exceed the relevant air quality objectives. As a result of the development (S3 2022 With Development), there is a 'negligible' air quality impact predicted with respect to annual mean NO_2 , PM_{10} and $\text{PM}_{2.5}$ at all existing sensitive receptors. Therefore, the overall air quality impact of the development may be considered 'not significant'.

Impact of Future Air Quality on the Proposed Sensitive Receptors

None of the modelled proposed residential receptors are predicted to experience pollutant concentrations above the annual mean NO_2 , PM_{10} or $\text{PM}_{2.5}$ standards. It is considered that increased exposure at the proposed development site is unlikely and therefore, the overall impact of air quality on the development may be considered 'not significant'.

It is likely that a communal boiler will be included. However, at this stage, the boiler specification is not confirmed. Following confirmation, it is recommended that an assessment of the air quality impact of the boiler is undertaken.

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APPENDIX A

CONSTRUCTION DUST ASSESSMENT

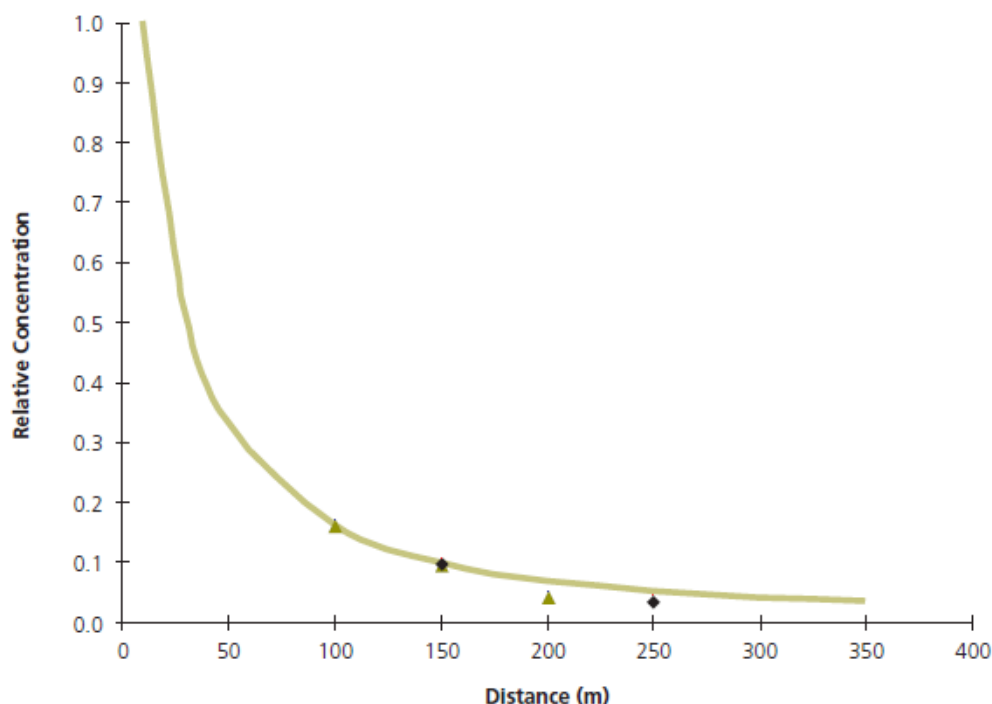
METHODOLOGY

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 (note that no demolition activities are involved in the current development proposals). The descriptors included in this section are based upon the IAQM guidance. The assessment follows the steps recommended in the guidance.

Step 1 and Step 2 methods from the IAQM guidance are described in this Appendix to assign dust risk categories for each of the construction activities.

The tendency of dust to remain airborne is determined by the particle size and weather conditions. Eventually, particles will drop from suspension as a deposit. The previous Local Air Quality Management Technical Guidance document (LAQM.TG(03))² identifies that PM₁₀ concentrations fall-off rapidly with distance from source. Figure A1 shows the fall-off in PM₁₀ concentration from source for a typical wind speed of 6m/s. At 100m from source, the PM₁₀ concentration is predicted to be less than 20% of that at the point of generation.

Figure A1: Typical Fall-off in PM₁₀ Concentration with Distance from Source



² LAQM TG (03). The Local Air Quality Management Technical Guidance Note published by the Department for Food and Rural Affairs in 2003. This guidance note is revised in 2016 and is available as LAQM TG(16).

Step 1: 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).

Step 2A: Defining the Potential Dust Emission Magnitude

Demolition (Note that no demolition activities are involved in the current development proposals)

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 $>50,000\text{m}^3$, potentially dusty construction material, on-site crushing and screening, demolition activities $>20\text{m}$ above ground level;
- **Medium:** Total building volume $20,000\text{m}^3 - 50,000\text{m}^3$, potentially dusty construction material, demolition activities $10\text{m} - 20\text{m}$ above ground level; and
- **Small:** Total building volume $<20,000\text{m}^3$, construction material with low potential for dust release, demolition activities $<10\text{m}$ 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 $>10,000\text{m}^2$, potentially dusty soil type (e.g. clay), >10 heavy earth moving vehicles active at any one time, formation of bunds $>8\text{m}$ in height, total material moved $>100,000$ tonnes;
- **Medium:** Total site area $2,500 - 10,000\text{m}^2$, moderately dusty soil type (e.g. silt), $5 - 10$ heavy earth moving vehicles active at any one time, formation of bunds $4 - 8\text{m}$ in height, total material moved $20,000 - 100,000$ tonnes; and
- **Small:** Total site area $< 2,500\text{m}^2$, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds $<4\text{m}$ 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 $>100,000\text{m}^3$, piling, on site concrete batching;
- **Medium:** Total building volume $25,000 - 100,000\text{m}^3$, potentially dusty construction material (e.g. concrete), piling, on site concrete batching; and

- **Small:** Total building volume <25,000m³, 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.

Step 2B: 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 PM₁₀, 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.

Table A1 has been 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 a 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 PM₁₀ (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 <i>and</i> 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.

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
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 PM₁₀ (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 PM₁₀, 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.
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.

Note: No demolition is proposed for the proposed development.

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/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32µg/m ³	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 µg/m ³	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28 µg/m ³	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m ³	>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

Receptor Sensitivity	Distances from the Source (m)	
Low	Low	Low

Step 2C: 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

Note: No demolition is proposed for the proposed development.

Table A6: Risk of Dust Impacts from Earthworks/Construction

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

APPENDIX B

OPERATION IMPACT ASSESSMENT

METHODOLOGY

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

The IAQM and EP-UK 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 1,000m² 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 1,000m² 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 flows 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 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 100 AADT 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 NO_x 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% or 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 C

TRAFFIC DATA

This appendix contains the traffic data used in the dispersion modelling assessment, survey data were provided by Glanville Consultants Limited. Included are traffic flow data in AADT, percentage Heavy Duty Vehicle (HDV) and the speed included for each road link. A reduced speed was employed at junctions. S2 and S3 data include other committed/consented developments.

Table C1 AADT Traffic Flows, Heavy Duty Vehicle Composition and Speed data for Model Scenarios used in the dispersion modelling assessment

Table C2 Heavy Duty Vehicle Composition for Model Scenarios used in the dispersion modelling assessment

Figure C1 Diurnal Profile Included in the dispersion modelling assessment

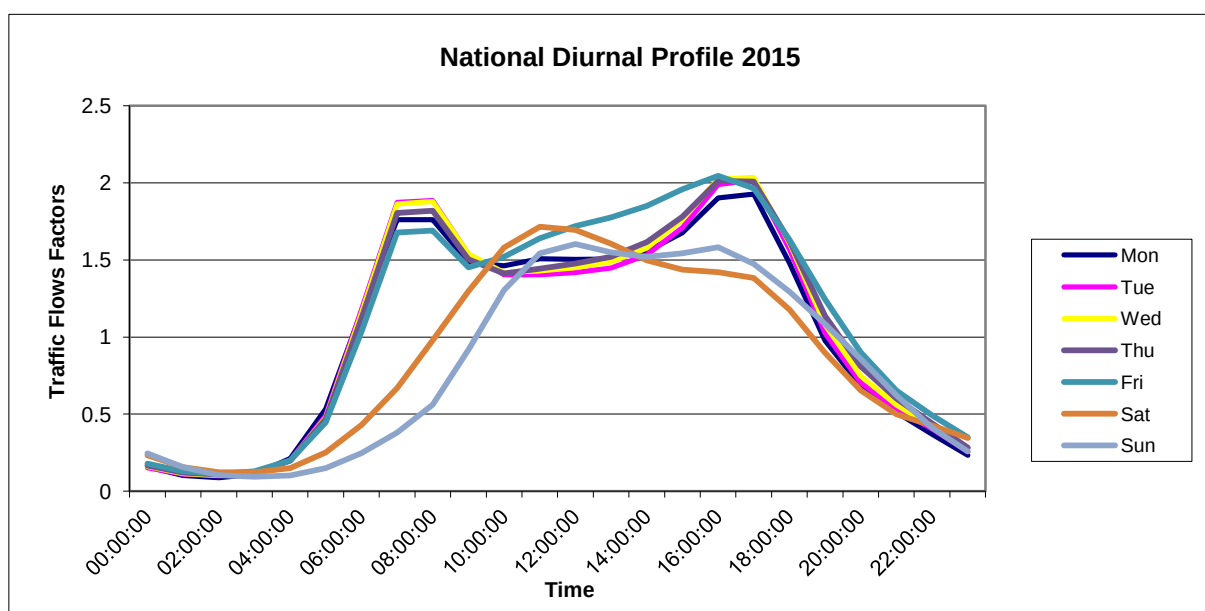
Table C1: AADT Traffic Flows, Heavy Duty Vehicle Composition and Speed data for Model Scenarios used in the dispersion modelling assessment

Road Link	S1 2016 Base Case	S2 2022 Without Development	S3 2022 With Development	Speed (kph)
ATC 1	3705	6562	7184	38.9
ATC 2	2039	4652	5274	47.1
ATC 3a	908	3125	3747	43.8
ATC 3b	908	6498	7120	43.8
ATC 4	4827	10861	11483	39.6
ATC 5	9342	15375	15997	43.2
ATC 6	11123	17156	17778	38.5
99742	46206	50222	50884	64.4
74218	17851	19403	20065	48.3
74035	123297	133285	133947	112.7
73899	37237	40474	41136	48.3
73893	123739	134944	135606	64.4
46127	20971	22794	23456	48.3
26121	16408	17834	18496	32.2
26014	122916	132068	132730	112.7
16116	18248	19834	20496	48.3
Flagstaff Road	0	1890	3134	16

Table C2: Heavy Duty Vehicle % for Model Scenarios used in the dispersion modelling assessment

Road Link	S1 2016 Base Case	S2 2022 Without Development	S3 2022 With Development
ATC 1	9.98	5.63	5.14
ATC 2	17.99	7.89	6.96
ATC 3a	12.52	3.64	3.03
ATC 3b	12.52	1.75	1.60
ATC 4	6.81	3.03	2.86
ATC 5	5.08	3.09	2.97
ATC 6	6.40	4.15	4.00
99742	4.34	4.50	4.44
74218	1.03	1.06	1.03
74035	7.38	7.63	7.59
73899	3.28	3.40	3.35
73893	7.38	7.65	7.62
46127	4.52	4.68	4.55
26121	4.42	4.58	4.42
26014	7.38	7.60	7.56
16116	2.32	2.40	2.32
Flagstaff Road	0	4.92	2.97

Figure C1: Diurnal Profile Included in the Dispersion Modelling Assessment



APPENDIX D

MODELLING OF OPERATIONAL PHASE – VERIFICATION METHODOLOGY AND MODEL RESULTS

The dispersion model results were verified following the relevant guidance in LAQM.TG(09). 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 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.

The NO₂ diffusion tube on 144 Bath Road, as detailed in Section 4, was used for the dispersion model verification against traffic data.

A comparison of modelled versus monitored NO₂ concentrations at this site is presented in Table D1, showing that the percentage difference between the modelled and monitored results is more 18.8%. Guidance suggests that if the model result is not within 25% of the monitoring result at the verification point, verification is considered required. Verification was carried out to improve the model performance.

Table D1 Modelled versus Monitored NO₂ Concentrations, unverified

Site	Background NO ₂	Monitored total NO ₂	Modelled total NO ₂	% Difference [(modelled – monitored)/monitored]x100
144 Bath Road	17	29.00	23.55	-18.8

Modelled versus measured road NO_x at the sites is shown in Table D2. The model predicts a lower emission than that measured. The under representation of emissions may be because data on queuing traffic were not available.

Table D2 Modelled versus Monitored NO_x/NO₂

Site	Monitored total NO ₂	Background NO ₂	Background NO _x	Monitored Road Contribution NO ₂	Monitored Road Contribution NO _x	Modelled road contribution NO _x	Ratio of Modelled and Measured Road NO _x
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Site	Monitored total NO ₂	Background NO ₂	Background NO _x	Monitored Road Contribution NO ₂	Monitored Road Contribution NO _x	Modelled road contribution NO _x	Ratio of Modelled and Measured Road NO _x
144 Bath Road	29.00	17	25	12.00	24.24	8.94	2.71

The verified annual average modelled road contribution NO_x concentration was used to estimate annual average road NO₂ by using the Defra NO_x to NO₂ spreadsheet. A comparison of monitored and model adjusted total NO₂ is presented in Table D3 for the diffusion tube result used for verification. This indicates that following verification model performance improved.

Table D3 Modelled versus Monitored NO₂ Concentrations, following verification

Site	Background NO ₂	Monitored total NO ₂	Modelled total NO ₂ after adjustment	% Difference [(modelled – monitored)/monitored]x100
144 Bath Road	17	29.00	28.95	-0.17

Monitored annual PM₁₀ and PM_{2.5} concentrations were not available. Therefore, model results were adjusted using the same factor as for NO_x, as per the recommendations in TG(16). Model results for NO₂, PM₁₀ and PM_{2.5} concentrations at receptors are presented in Table D4 (NO₂) and Table D5 (PM₁₀, PM_{2.5}).

Table D4: Predicted Annual Mean and Hourly NO₂ Pollutant Concentrations at Proposed Receptor Locations (2016 meteorological data, background concentrations included)

Receptor	Long-term			Short-term		
	NO ₂ Annual Average Concentrations (µg/m ³)			NO ₂ 99.8 th Percentile of Hourly Average Concentrations (µg/m ³)		
	S1 2016	S2 2022	S3 2022	S1 2016	S2 2022	S3 2022
Fa	19.4	19.9	20.1	48.2	39.8	40.13
Fb	19.3	19.7	19.8	50.3	39.4	39.63
Fc	19.3	19.5	19.6	38.3	39.1	39.38
Fd	19.3	19.6	19.8	38.1	39.5	39.86
Ga	19.4	20.0	20.3	38.0	40.0	40.32
Gb	19.4	19.7	19.8	38.2	40.0	40.37
Gc	19.4	19.6	19.6	38.6	39.9	40.23
Gd	19.4	19.7	19.8	38.5	40.1	40.52
Ha	19.5	20.3	20.5	38.4	40.5	40.82
Hb	19.5	19.9	20.1	38.6	40.6	41.04
Hc	19.5	19.8	19.9	39.1	40.8	41.24
Hd	19.5	20.0	20.2	38.9	40.9	41.30
R1	21.1	22.1	22.3	39.0	42.9	43.03
R2	37.1	38.9	39.1	39.2	66.9	67.13
R3	24.5	25.1	25.2	41.8	48.0	48.18
R4	21.5	21.9	21.9	64.3	44.7	44.85

Receptor	Long-term			Short-term		
	NO ₂ Annual Average Concentrations (µg/m ³)			NO ₂ 99.8 th Percentile of Hourly Average Concentrations (µg/m ³)		
	S1 2016	S2 2022	S3 2022	S1 2016	S2 2022	S3 2022
R5	21.8	22.2	22.2	46.8	44.8	45.00
R6	20.4	21.2	21.5	43.4	43.4	43.58
Air Quality Objective	40			200		

Table D5: Predicted Annual Mean PM₁₀ and PM_{2.5} Pollutant Concentrations at Proposed Receptor Locations (2016 meteorological data, background concentrations included)

Receptor	Long-term			Long-term		
	PM ₁₀ Annual Average Concentrations (µg/m ³)			PM _{2.5} Annual Average Concentrations (µg/m ³)		
	S1 2016	S2 2022	S3 2022	S1 2016	S2 2022	S3 2022
Fa	16.1	16.5	16.5	11.2	11.3	11.3
Fb	16.1	16.5	16.5	11.2	11.3	11.3
Fc	16.1	16.5	16.5	11.2	11.3	11.3
Fd	16.1	16.5	16.5	11.2	11.3	11.3
Ga	16.1	16.5	16.6	11.2	11.3	11.3
Gb	16.1	16.5	16.5	11.2	11.3	11.3
Gc	16.1	16.5	16.5	11.2	11.3	11.3
Gd	16.1	16.5	16.5	11.2	11.3	11.3
Ha	16.1	16.6	16.6	11.2	11.3	11.4
Hb	16.1	16.5	16.5	11.2	11.3	11.3
Hc	16.1	16.5	16.5	11.2	11.3	11.3
Hd	16.1	16.5	16.6	11.2	11.3	11.3
R1	16.2	16.9	17.0	11.4	11.6	11.6
R2	17.1	19.3	19.4	13.1	13.0	13.0
R3	16.6	17.8	17.8	12.1	12.0	12.0
R4	16.3	16.9	16.9	11.6	11.5	11.6
R5	16.3	17.1	17.1	11.6	11.6	11.6
R6	16.1	16.7	16.8	11.3	11.4	11.5
Air Quality Objective	40			200		

APPENDIX E

CONTOUR PLOTS SHOWING PREDICTED POLLUTANT CONCENTRATIONS

This Appendix contains contour plots (isopleths) illustrating the dispersion profiles of road traffic emissions to air resulting from the operation of the development ('S3 2022 With Development' scenario with 2016 meteorological data). The contour plots are arranged in the following order:

- Figure E1** Predicted Annual Average NO₂ Concentrations (µg/m³) including Background Concentration for 'S3 2022 With Development' Scenario
- Figure E2** Predicted Annual Average PM₁₀ Concentrations (µg/m³) including Background Concentration for 'S3 2022 With Development' Scenario
- Figure E3** Predicted Annual Average PM_{2.5} Concentrations (µg/m³) including Background Concentration for 'S3 2022 With Development' Scenario

Figure E1: Predicted Annual Average NO₂ Concentrations (µg/m³) including Background Concentration for 'S3 2022 With Development' Scenario

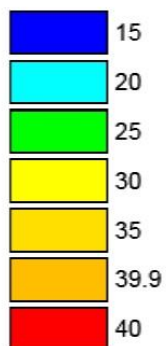
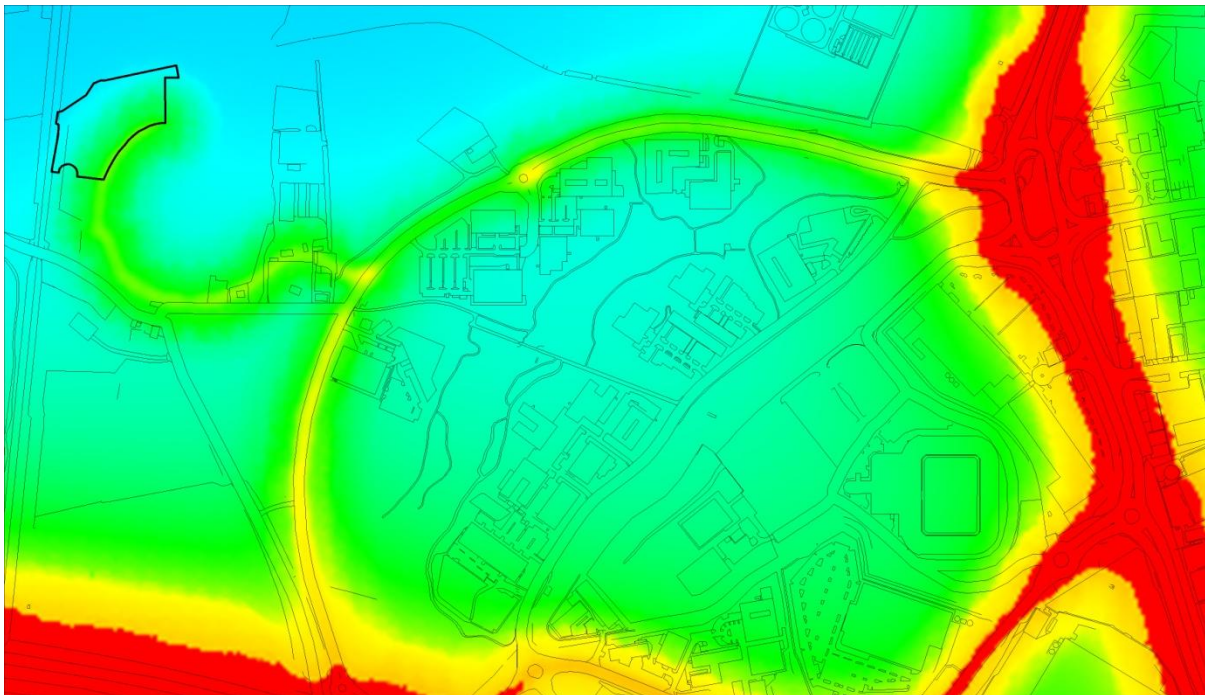


Figure E2: Predicted Annual Average PM₁₀ Concentrations (µg/m³) including Background Concentration 'S3 2022 With Development' Scenario

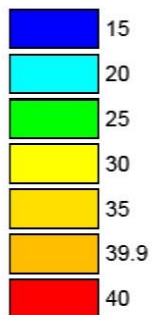
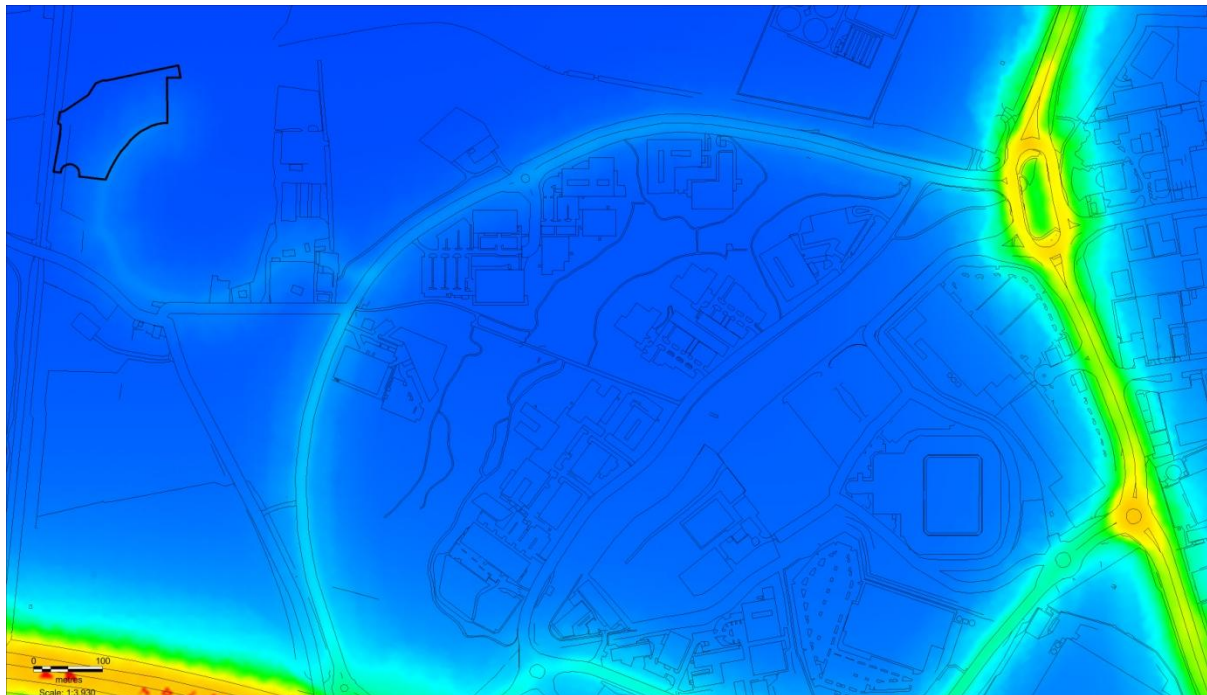
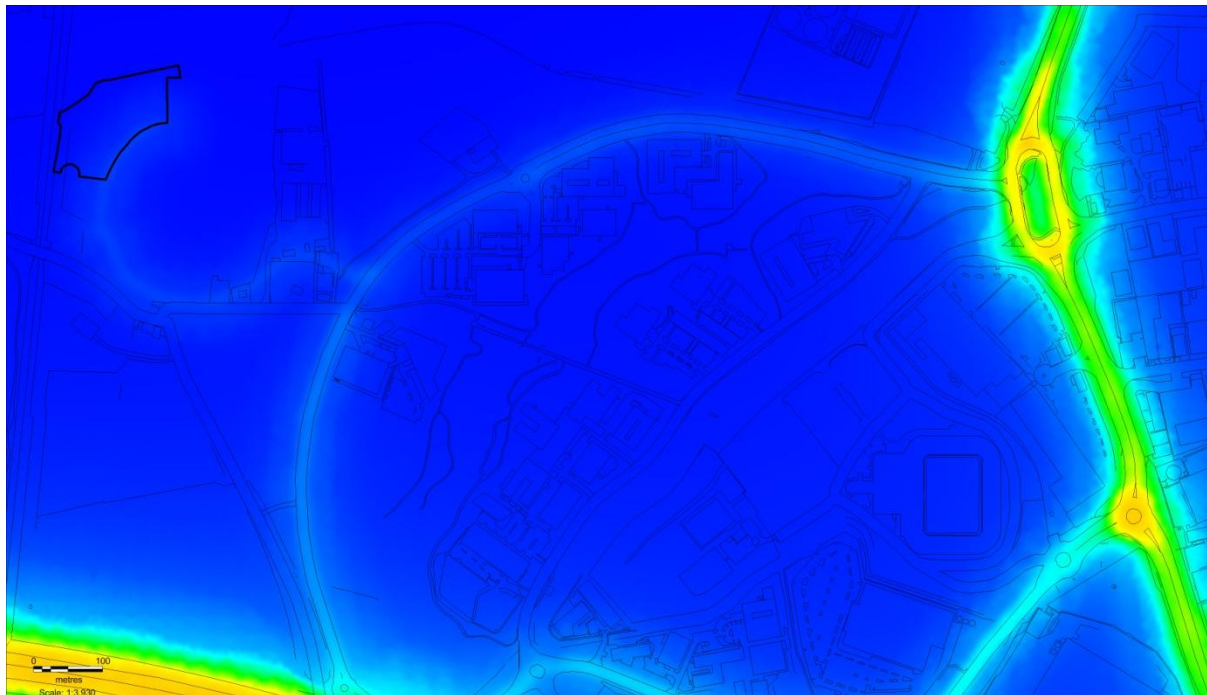


Figure E3: Predicted Annual Average PM_{2.5} Concentrations (µg/m³) including Background Concentration 'S3 2022 With Development' Scenario



APPENDIX F

SITE-SPECIFIC MITIGATION MEASURES

Site-specific mitigation measures are divided into general measures, applicable to all sites and measures specific to demolition, earthworks, construction and trackout (Note that no demolition is proposed under the current development proposals). Depending on the level of risk assigned to each site, different mitigation is assigned. The method of assigning mitigation measures as detailed in the IAQM guidance has been used.

For those mitigation measures that are general, the highest risk level assessed has been applied. In this case, the 'high risk' site mitigation measures have been applied, as determined by the dust risk assessment in Section 6. There are two categories of mitigation measure – 'highly recommended' and 'desirable', which are indicated according to the dust risk level identified in Table 6.6. 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. The DMP may include monitoring of dust deposition, dust flux, real-time PM₁₀ 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 off-site and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk construction sites within 500m 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 off-site transport/deliveries which might be using the same strategic road network routes.

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 when 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 the 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 PM₁₀ continuous monitoring locations with the local authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences.

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 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 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 15mph on surfaced and 10mph on unsurfaced 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 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

- No bonfires or burning of waste material.

Specific to Demolition

No demolition is proposed.

Specific to Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate to cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

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.*

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 any 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 log book.
- Install hard surfaced haul route, 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 10m from receptors where possible.