

# LOCKWOOD ROAD, GOLDTHORPE

## Proposed Residential Development Air Quality Assessment

Prepared for: Gleeson Developments Ltd

SLR Ref: 10.03044.00189  
Version No: v1.0  
November 2021



## BASIS OF REPORT

This document has been prepared by SLR Consulting Limited with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with Gleeson Developments Ltd (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

## CONTENTS

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 Scope of Assessment.....	1
<b>2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE .....</b>	<b>2</b>
2.1 Legislative Context .....	2
2.2 Clean Air Strategy.....	3
2.3 General Nuisance Legislation .....	3
2.4 Planning Policy .....	3
2.5 Assessment Guidance .....	5
<b>3.0 ASSESSMENT METHODOLOGY .....</b>	<b>6</b>
3.1 Construction Phase .....	6
3.2 Operational Phase.....	7
<b>4.0 BASELINE ENVIRONMENT .....</b>	<b>13</b>
4.1 Baseline Air Quality .....	13
4.2 Defra’s Pollution Climate Mapping Model .....	17
<b>5.0 CONSTRUCTION PHASE ASSESSMENT.....</b>	<b>19</b>
5.1 Construction Dust Assessment .....	19
<b>6.0 OPERATIONAL PHASE ASSESSMENT .....</b>	<b>23</b>
6.1 NO <sub>2</sub> Modelling Results .....	23
6.2 PM <sub>10</sub> Modelling Results.....	24
6.3 PM <sub>2.5</sub> Modelling Results .....	25
<b>7.0 MITIGATION MEASURES .....</b>	<b>27</b>
7.1 Construction Phase .....	27
7.2 Operational Phase.....	29
<b>8.0 CONCLUSIONS.....</b>	<b>30</b>
8.1 Construction Phase .....	30
8.2 Operational Phase.....	30
<b>APPENDIX A – MODEL INPUTS AND VERIFICATION .....</b>	<b>31</b>
Traffic Data .....	31
Model Verification .....	31

**APPENDIX B – SENSITIVITY ANALYSIS ..... 34**

## DOCUMENT REFERENCES

### TABLES

Table 2-1 Relevant Ambient AQALs.....	2
Table 2-2 Human Health Relevant Exposure.....	3
Table 3-1 Receptor Locations Considered.....	9
Table 3-2 Impact Descriptor Matrix for Receptors.....	10
Table 4-1 Local LAQM NO <sub>2</sub> Passive Diffusion Tube Monitoring Sites: Details .....	14
Table 4-2 Local LAQM NO <sub>2</sub> Passive Diffusion Tube Monitoring Sites: Results .....	14
Table 4-3 Defra Background Pollutant Concentrations.....	17
Table 5-1 Potential Dust Emission Magnitude .....	19
Table 5-2 Sensitivity of the Area .....	20
Table 5-3 Risk of Dust Impacts (Unmitigated).....	20
Table 6-1 Predicted Annual Mean NO <sub>2</sub> Concentrations – 2022 Development Opening Year .....	23
Table 6-2 Predicted Annual Mean PM <sub>10</sub> Concentrations – 2022 Development Opening Year .....	24
Table 6-3 Predicted Annual Mean PM <sub>2.5</sub> Concentrations – 2022 Development Opening Year .....	25
Table 7-1 Construction Dust Mitigation Measures .....	27
Table A-1 Traffic Data Used Within the Assessment.....	31
Table A-2 Local Monitoring Data Used for Model Verification .....	32
Table A-3 NO <sub>x</sub> / NO <sub>2</sub> Model Verification (3.660) .....	32
Table B-1 Predicted Annual Mean NO <sub>2</sub> Concentrations: Sensitivity Test.....	34

### FIGURES

Figure 3-1 Windrose for Doncaster Meteorological Station (2019).....	8
Figure 3-2 Dispersion Model Study Area.....	12
Figure 4-1 Local Monitoring Locations and AQMAs in Relation to the Site .....	16
Figure 4-2 PCM Links Relative to the Site.....	18
Figure 5-1 Construction Dust Assessment Buffers .....	22
Figure A-1 Comparison of Modelled vs. Monitored Road NO <sub>x</sub> Contribution (3.660) .....	33

## 1.0 INTRODUCTION

SLR Consulting Ltd (SLR) has been commissioned by Gleeson Developments Ltd to undertake an air quality assessment in support of a planning application for a proposed residential development ('Proposed Development'), on land at Lockwood Road, Goldthorpe (the 'Site'). The planning application seeks approval for a residential development comprising of 137 residential units.

The Site is located within Goldthorpe, largely comprising residential and commercial land uses, at the approximate National Grid Reference (NGR): x446500, y404700. The Site is bounded by:

- the A635 Doncaster Road to the north and Phoenix Park beyond this;
- agricultural land and residential properties to the east;
- Dearne Goldthorpe Primary School and residential properties to the south; and
- Saint John and St Mary Magdalene Goldthorpe church, Lockwood Road and Sacred Heart Catholic Primary School to the west.

The Site is located within the administrative area of Barnsley Metropolitan Borough Council (BMBC) and is located approximately 200m north west of the administrative area of Doncaster Metropolitan Borough Council (DMBC).

Vehicular access to the Site will be via East Street (to the south of the Site).

### 1.1 Scope of Assessment

It is understood that an air quality assessment is required to assess potential air quality effects and design constraints associated with the construction and operation of the Proposed Development.

The following scope of works has been undertaken:

- Baseline Evaluation;
- Construction Phase Assessment;
- Operational Phase Assessment; and
- Mitigation Measures.

## 2.0 RELEVANT AIR QUALITY LEGISLATION AND GUIDANCE

### 2.1 Legislative Context

#### 2.1.1 Air Quality Standards

The Air Quality Standards Regulations 2010<sup>1</sup> (AQSR) transpose both the EU Ambient Air Quality Directive (2008/50/EC)<sup>2</sup>, and the Fourth Daughter Directive (2004/107/EC)<sup>3</sup> within UK legislation, in order to align and bring together in one statutory instrument the Government's obligations. The AQSR includes Limit Values, Target Values, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment. Limit values are legally binding and are considered to apply everywhere with the exception of the carriageway and central reservation of roads and any location where the public do not have access (e.g. industrial sites). Compliance is regulated at a national level (based upon a series of zones and agglomerations).

In the interim period the UK has formally left the EU, however despite this, EU rules and regulations referred above have subsequently been written into UK law and are still relevant.

#### 2.1.2 Air Quality Strategy

Irrespective of the above, the UK Government and the devolved administrations are required under the Environment Act 1995 to produce a national air quality strategy to improve air quality. The latest Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland was published in 2007<sup>4</sup>. The AQS provides the over-arching strategic framework for air quality management in the UK and contains national air quality standards and objectives established by the UK Government and Devolved Administrations for the protection of public health and the environment. There is no legal requirement to meet these objectives except where they mirror an equivalent legally binding Limit Value as prescribed within EU legislation, however compliance is regulated by local planning authorities.

The AQS objectives apply at locations outside buildings or other natural or man-made structures above or below ground, where members of the public are regularly present and might reasonably be expected to be exposed to pollutant concentrations over the relevant averaging period – herein referred to as relevant exposure. Table 2-2 provides an indication of those locations.

The ambient air quality standards of relevance to human receptors in this assessment (collectively termed Air Quality Assessment Levels (AQALs) throughout this report) are provided in Table 2-1.

**Table 2-1**  
**Relevant Ambient AQALs**

Pollutant	AQAL ( $\mu\text{g}/\text{m}^3$ )	Averaging Period
Nitrogen Dioxide ( $\text{NO}_2$ )	40	Annual mean
	200	1-hour mean (not to be exceeded on more than 18 occasions per annum)
Particles ( $\text{PM}_{10}$ )	18	Annual mean
	50	24-hour mean (not to be exceeded on more than 35 occasions per annum)
Particles ( $\text{PM}_{2.5}$ )	25	Annual mean

<sup>1</sup> The Air Quality Standards Regulations (England) 2010, Statutory Instrument No 1001, The Stationary Office Limited.

<sup>2</sup> Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe.

<sup>3</sup> Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004.

<sup>4</sup> The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Defra. July 2007.

**Table 2-2**  
**Human Health Relevant Exposure**

AQAL Averaging Period	AQALs should apply at	AQALs should not apply at
Annual Mean	Building facades of residential properties, schools, hospitals etc.	Facades of offices Hotels Gardens of residences Kerbside sites
24-hour mean	As above together with hotels and gardens of residential properties	Kerbside sites where public exposure is expected to be short term
1-hour mean	As above together with kerbside sites of regular access, car parks, bus stations etc.	Kerbside sites where public would not be expected to have regular access

### 2.1.3 Local Air Quality Management

As reinforced within the AQS, Part IV of the Environment Act 1995 induces a statutory duty for local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to Review and Assess air quality within their boundaries to determine the likeliness of compliance, regularly and systematically.

Where any of the prescribed AQS objectives are not likely to be achieved, the authority must designate an Air Quality Management Area (AQMA). For each AQMA, the local authority is required to prepare an Air Quality Action Plan (AQAP), which details measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the objective. AQMAs can give rise to potential constraints to development, or at least a higher degree of scrutiny to air quality assessment work. Local authorities therefore have formal powers to control air quality through a combination of LAQM and through application of wider planning policies.

## 2.2 Clean Air Strategy

The Clean Air Strategy (CAS)<sup>5</sup>, published in 2019, sets out the Government’s proposals aimed at delivering cleaner air in England, and indicates how devolved administrations intend to make emissions reductions. It sets out the comprehensive action that is required from across all parts of government and society to deliver clean air.

## 2.3 General Nuisance Legislation

Part III of the Environmental Protection Act (EPA) 1990 (as amended) contains the main legislation on Statutory Nuisance and allows local authorities and individuals to take action to prevent a statutory nuisance. Section 79 of the EPA defines, amongst other things, smoke, fumes, dust and smells emitted from industrial, trade or business premises so as to be prejudicial to health or a nuisance, as a potential Statutory Nuisance.

Fractions of dust greater than 10µm (i.e. greater than PM<sub>10</sub>) in diameter typically relate to nuisance effects as opposed to potential health effects and therefore are not covered within the UK AQS. In legislation there are currently no numerical limits in terms of what level of dust deposition constitutes a nuisance.

## 2.4 Planning Policy

The following policies have been considered within this assessment.

<sup>5</sup> The Clean Air Strategy, Defra. January 2019.

### 2.4.1 National Policy

The 2021 update to the National Planning Policy Framework<sup>6</sup> (NPPF) sets out planning policy for England. The NPPF states that the planning system should contribute to and enhance the natural and local environment, by preventing new development from contributing to or being adversely affected by unacceptable concentrations of air pollution and development should, wherever possible, help to improve local environmental conditions such as air quality.

In specific relation to air quality policy, the document states:

#### Chapter 15 - Conserving and Enhancing the Natural Environment

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

The NPPF is accompanied by web based supporting Planning Practice Guidance (PPG) which includes guiding principles on how planning can take account of the impacts of new development on air quality. In regard to air quality, the PPG states:

*“Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values [...] It is important that the potential impact of new development on air quality is taken into account [...] where the national assessment indicates that relevant limits have been exceeded or are near the limit.”*

*“Whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impact in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).”*

The PPG sets out the information that may be required within the context of a supporting air quality assessment, stating that *“assessments should be proportional to the nature and scale of development proposed and the level of concern about air quality [...] Mitigation options where necessary, will depend on the proposed development and should be proportionate to the likely impact”*.

### 2.4.2 Local Policy

The BMBC Local Plan<sup>7</sup> sets out the strategic objectives and policies for development within the borough. Within the Adopted Local Plan, the following policies relate to air quality:

#### **“Policy T5 Reducing the Impact of Road Travel:**

*We will reduce the impact of road travel by:*

- *Developing and implementing robust, evidence based air quality action plans to improve air quality;*
- *Working with our sub regional partners, fleet and freight operators to improve the efficiency of vehicles and goods delivery, and reduce exhaust emissions; and*

<sup>6</sup> National Planning Policy Framework (2021). Available at: <https://www.gov.uk/government/publications/national-planning-policy-framework--2>

<sup>7</sup> Barnsley metropolitan Borough Council, Local Plan, Adopted January 2019.

- *Implementing measures to ensure the current road system is used efficiently.”*

### **“Policy AQ1 Development in Air Quality Management Areas**

*Development which impacts on areas sensitive to air pollution in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), taking into account any suitable and proportionate mitigation required for the development.*

*We will only allow residential development which impacts on areas sensitive to air pollution, where the developer provides an assessment that shows living conditions will be acceptable for future residents, subject to any required mitigation.*

*We will only allow development which impacts on areas sensitive to air pollution which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality, subject to any required mitigation.*

*Furthermore, development which impacts on areas sensitive to air pollution due to traffic emissions will be expected to demonstrate suitable and proportionate mitigation relative to the increased traffic emissions generated by the development.”*

## 2.5 Assessment Guidance

This assessment has been carried out in accordance with the following principles contained within the guidance documents below.

- Department of Environment Food and Rural Affairs (Defra): Local Air Quality Management Technical Guidance (LAQM.TG(16))<sup>8</sup>;
- Defra: COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021<sup>9</sup>;
- BMBC: Air Quality and Emissions Good Practice Planning Guidance<sup>10</sup>;
- Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM): Land-Use Planning and Development Control: Planning for Air Quality<sup>11</sup>; and
- IAQM: Guidance on the Assessment Dust from Demolition and Construction<sup>12</sup>.

<sup>8</sup> Local Air Quality Management Technical Guidance 16, Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland. April 2021.

<sup>9</sup> Defra and the Greater London Authority, COVID-19: Supplementary Guidance. Local Air Quality Management Reporting in 2021. April 2021.

<sup>10</sup> Barnsley Metropolitan Borough Council, Air Quality and Emissions Good Practice Planning Guidance, March 2020.

<sup>11</sup> EPUK and IAQM, Land-Use Planning and Development Control: Planning for Air Quality, v1.2 2017.

<sup>12</sup> IAQM, Guidance on the Assessment Dust from Demolition and Construction, v1.1 2016.

## 3.0 ASSESSMENT METHODOLOGY

In accordance with BMBC's air quality guidance, the air quality assessment requirements are dependent on the development's classification (minor, medium or major). With reference to the criteria contained within the guidance document, the Proposed Development is initially believed to be 'medium' given the following:

- 137 residential (C3 land use) units are proposed;
- no additional trigger criteria for major developments is met.

As such, this assessment has been undertaken with reference to these requirements.

It is acknowledged that 'medium' developments are required to undertake a qualitative exposure assessment. However, for conservatism, dispersion modelling will be utilised for the purposes of determining the suitability of the Site for its proposed residential use – in consideration of the A635 Doncaster Road directly to the north of the Site. This approach is recommended to be employed for 'major' developments.

### 3.1 Construction Phase

The assessment has been undertaken in accordance with IAQM guidance. The assessment of risk is determined by considering the risk of dust effects arising from four activities in the absence of mitigation. The assessment will consider the potential dust impacts associated with the following activities:

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

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

- annoyance due to dust soiling;
- the risk of health effects due to an increase in exposure to PM<sub>10</sub>; and
- harm to ecological receptors.

The first stage of the assessment involves a screening to determine if there are sensitive receptors within threshold distances of the site activities associated with the construction phase of the scheme. A detailed assessment is required where a:

- human receptor is located within 350m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the Site entrance(s); and/or
- ecological receptor is located within 50m of the Site, and/or within 50m of routes used by construction vehicles, up to 500m from the Site entrance(s).

The dust emission class (or magnitude) for each activity is determined based on the guidance, indicative thresholds and expert judgement. The risk of dust effects arising is based upon the relationship between the dust emission magnitude and the sensitivity of the area. The risk of impact is then used to determine the appropriate mitigation requirements, whereby through effective application, residual effects are considered to be 'not significant'.

Significance is only assigned to the effect after considering the construction activity with mitigation. This is because for construction activities, the aim is to prevent significant effects on receptors through the use of effective mitigation.

The IAQM guidance therefore does not provide a framework to determine the significance of unmitigated effects, as is not considered appropriate nor relevant in this context. For these reasons, the significance of unmitigated effect of construction dust cannot be defined.

Given the short-term nature of the construction phase and the comparatively low volume of vehicle movements that will likely arise (when compared to the operational phase, for which a full assessment has been undertaken), there is not considered to be any potential for significant air quality effects from development related road traffic emissions during the construction phase.

## 3.2 Operational Phase

In order to appropriately assess road traffic impacts associated with the operation of the Proposed Development as well as the suitability of the Site for residential purposes, detailed dispersion modelling has been undertaken using the Cambridge Environmental Research Consultants (CERC) ADMS-Roads v5.0.0.1 dispersion model, focussing on concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> for the following scenarios:

- 2022 Do Minimum (2022 DM) – Without development flows for the assumed year of opening (2022), inclusive of any relevant committed development flows; and
- 2022 Do Something (2022 DS) – ‘Do Minimum’ flows, plus all trips associated with the Proposed Development flows for the proposed year of opening (2022).

For the above future year scenarios (2022), concurrent emission factors and background pollutant concentrations have been used.

Details of model inputs are discussed in turn, below. Advanced inputs are discussed in Appendix A.

### 3.2.1 Traffic Inputs

Traffic data was provided by TPS Consultants Ltd – the appointed transport consultant, and supplemented from the Department for Transport (DfT) counts website for the purposes of model verification.

Traffic speeds were modelled at the relevant speed limit for each road. However, where appropriate, the speeds have been reduced to simulate queues at junctions, traffic lights and other locations where queues or slower traffic are known to be an issue, in accordance with LAQM.TG(16). Traffic speeds have been assumed to be consistent across all the modelled scenarios.

The Emissions Factors Toolkit (EFT) version 10.1 developed by Defra<sup>13</sup> has been used to determine vehicle emission factors for input into the ADMS-Roads dispersion model.

To initially inform the spatial extent of the model, changes in traffic volumes on the local road network were compared to screening thresholds provided within EPUK/IAQM guidance, with consideration given to nearby AQMAs – including AQMA No.7 located within Hickleton along the A635 – Doncaster Road. Road traffic flows along this stretch of the A635 – Doncaster Road are below the relevant EPUK & IAQM screening thresholds (within an AQMA). No further assessment with regards to AQMAs and road traffic emissions was therefore required.

Details of the traffic flows used in this assessment are provided in Appendix A, whilst the modelled roads in relation to the Site are presented in Figure 3-2.

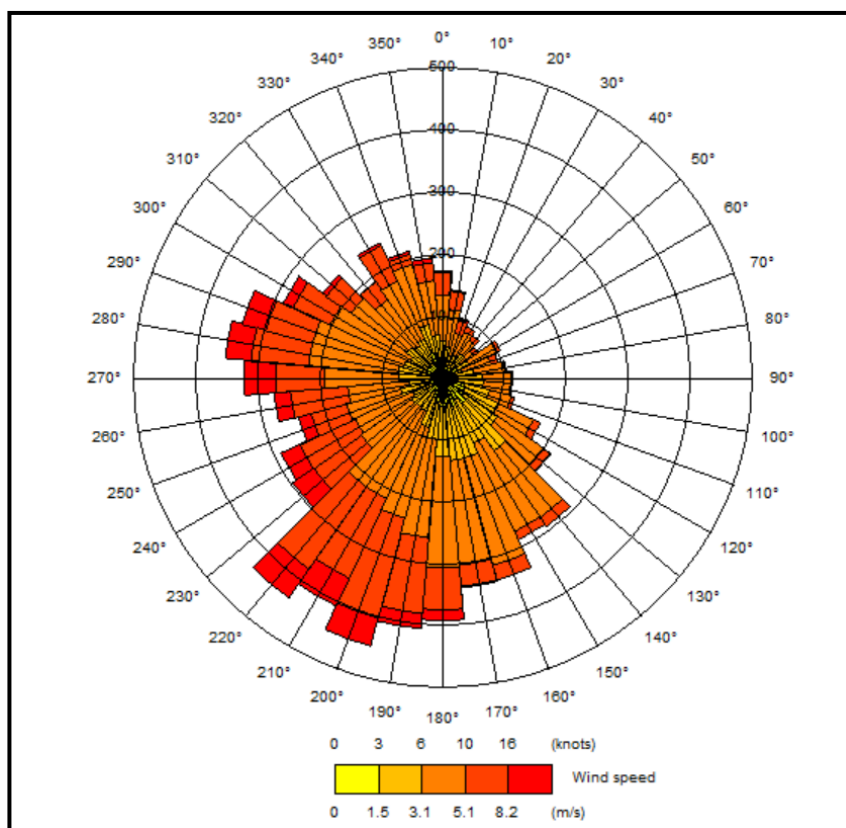
### 3.2.2 Meteorological Data

The dispersion modelling has been undertaken using 2019 data from the Doncaster meteorological station, located approximately 21km to the east of the Site – the closest representative meteorological station relative to the Site with adequate data capture for dispersion modelling.

<sup>13</sup> Defra, EFT v10.1 (2020). <https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>.

LAQM.TG(16) recommends that meteorological data should have a percentage of usable hours greater than 85%. 2019 meteorological data from Doncaster meteorological station includes 8,760 lines of usable hourly data for the year, i.e. 100% usable data. This is therefore suitable for the dispersion modelling exercise.

A windrose is presented in Figure 3-1.



**Figure 3-1**  
**Windrose for Doncaster Meteorological Station (2019)**

A surface roughness length of 0.5m was used to represent the surface roughness of the principal study area – i.e. ‘parkland, open suburbia’. Whereas a roughness length of 0.02m was used to represent the surface roughness of the meteorological site – i.e. ‘open grassland’. A minimum Monin-Obukov length of 30m was used for both the principal study area and the meteorological site – i.e. ‘mixed urban/industrial’.

### 3.2.3 Background Concentrations

In the absence of locally representative background monitoring sites, annual mean background concentrations used for the purposes of the assessment have been obtained from the Defra supplied background maps (2018 reference year)<sup>14</sup>, based on the 1km grid squares which cover the modelled area.

Further detail on these datasets can be found in Section 4.1.3.

To avoid the double counting of potential source contributions already contained within the ADMS-Roads dispersion model, ‘Primary A Road in’ was removed from the grid square containing the model domain (where modelled in full), as recommended in the Defra Background Maps User Guide<sup>15</sup>.

As the relationship between NO<sub>2</sub> and oxides of nitrogen (NO<sub>x</sub>) is not linear, the NO<sub>2</sub> Adjustment for NO<sub>x</sub> Sector Removal Tool<sup>16</sup> has been used – in accordance with LAQM.TG(16).

<sup>14</sup> Defra Background Maps (2018-Reference) <http://uk-air.defra.gov.uk/data/laqm-background-home>.

<sup>15</sup> Defra Background Concentration Maps User Guide. August 2020.

<sup>16</sup> Defra NO<sub>2</sub> Adjustment for NO<sub>x</sub> Sector Removal Tool (v8.0)

### 3.2.4 Sensitive Receptors

Human receptors considered in the assessment of emissions from road traffic are shown Table 3-1, whilst their locations are illustrated in Figure 3-2.

Receptors ER1 – ER7 are representative of worst-case exposure locations at existing receptors within the development locale, relative to the affected road network. New receptors introduced as a result of the Proposed Development, NR1 – NR6, are selected as the locations of worst-case exposure on the Site relative to the surrounding modelled road network.

All receptors were considered in relation to exposure at breathing height relative to the adjacent modelled road, at ground level, i.e. 1.5m height. Receptor locations represent relevant exposure – in accordance with LAQM.TG(16) presented in Table 2-2.

**Table 3-1**  
**Receptor Locations Considered**

Receptor	X	Y	Height (m)
<b>Existing Receptors</b>			
ER1	446547	404565	1.5
ER2	446552	404550	1.5
ER3	446527	404501	1.5
ER4	446571	404491	1.5
ER5	446582	404472	1.5
ER6	446634	404511	1.5
ER7	446749	404538	1.5
<b>New Receptors</b>			
NR1	446589	404760	1.5
NR2	446545	404761	1.5
NR3	446527	404758	1.5
NR4	446426	404736	1.5
NR5	446517	404587	1.5
NR6	446541	404594	1.5

### 3.2.5 Model Outputs

The background pollutant values discussed in Section 4.1.3 have been used in conjunction with the concentrations predicted by the ADMS-Roads model to calculate predicted total annual mean concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> for each respective scenario.

For the prediction of annual mean NO<sub>2</sub> concentrations for all modelled scenarios at receptor locations, the road NO<sub>x</sub> contributions (adjusted as per Appendix A) have been converted to total NO<sub>2</sub> following the methodology in LAQM.TG(16) using the latest version of Defra’s NO<sub>x</sub> to NO<sub>2</sub> conversion tool (v8.1)<sup>17</sup>. The modelled NO<sub>2</sub> road contribution was then added to the appropriate NO<sub>2</sub> background concentration value to obtain an overall total annual mean NO<sub>2</sub> concentration.

<sup>17</sup> Defra NO<sub>x</sub> to NO<sub>2</sub> Calculator v8.1 (2020), available at <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc>.

For the prediction of short-term NO<sub>2</sub> impacts, LAQM.TG(16) advises that it is valid to assume that exceedences of the 1-hour mean AQAL for NO<sub>2</sub> are unlikely to occur where the annual mean NO<sub>2</sub> concentration is <60µg/m<sup>3</sup>. This approach has thus been adopted for the purposes of this assessment, at relevant receptor locations with an applicable exposure period.

For the prediction of short-term PM<sub>10</sub>, LAQM.TG(16) provides an empirical relationship between the annual mean and the number of exceedences of the 24-hour mean AQAL for PM<sub>10</sub> that can be calculated as follows:

$$\text{No. 24-hour mean exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

This relationship has thus been adopted to determine whether exceedences of the short-term PM<sub>10</sub> AQAL are likely in this assessment.

Verification of the ADMS-Roads assessment has been undertaken as per Appendix A. All results presented in the assessment are those calculated following the process of model verification, using an adjustment factor of 3.660 for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>.

### 3.2.6 Assessing Significance

Guidance for determining the significance of a development's impact on local air quality is provided by EPUK/IAQM.

When describing the developmental impact at a specific receptor, the resultant total concentration as well as the magnitude of change in relation to respective AQALs are both considered – using the approach detailed in Table 3-2.

**Table 3-2**  
**Impact Descriptor Matrix for Receptors**

Long Term Average Concentration at Receptor in Assessment Year	Change in Concentration relative to AQAL			
	1% <sup>(A)</sup>	2-5%	6-10%	>10%
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% 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

<sup>(A)</sup> Changes < 0.5% will be described as Negligible.

Following derivation of impacts at all receptor locations assessed, the overall significance of the developmental 'effect' is determined based upon consideration, as necessary, of the following factors:

- the existing and future air quality in the absence of the Proposed Development;
- the extent of current and future population exposure to the impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the Proposed Development has adopted best practice to eliminate and minimise emissions.

To determine the overall significance with respect to the suitability of the Site for future occupants and likely exposure to pollutant concentrations, the EPUK/IAQM guidance states:

*"Where the air quality is such that an air quality objective at the building façade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means."*

As such, comparison of modelled pollutant concentrations at new exposure locations on-Site have been compared with the relevant AQALs to determine suitability and significance.

### 3.2.7 Uncertainty

Dispersion modelling is inherently uncertain and is principally reliant on the accuracy and representativity of its inputs. In acknowledgement of this, the ADMS-Roads dispersion model has been verified with the latest representative publicly available local monitoring data.

In addition, there is a widely acknowledged disparity between emission factors and ambient monitoring data<sup>18</sup>. To help minimise any associated uncertainty when forming conclusions from the results, this assessment has utilised the latest EFT version 10.1 utilising COPERT 5.3 emission factors, and associated tools/datasets published by Defra.

Notwithstanding the above, in consideration of the potential uncertainty in predictions of future year pollutants, as well as the current national and local sensitivities seen in response to elevated roadside NO<sub>2</sub> concentrations, an additional sensitivity assessment has been provided in Appendix B, utilising 2019 as the proposed year of opening for the Proposed Development. This theoretically assumes that there is no improvement in NO<sub>x</sub> emission factors or NO<sub>x</sub> and NO<sub>2</sub> background concentrations, within Goldthorpe for future years.

These modelled scenarios are likely to represent an overly conservative approach as, despite uncertainty in quantification, it is generally accepted that variables such as background concentrations and/or vehicle emission factors will improve to some degree in future years.

---

<sup>18</sup> Carslaw, et al. (2011). Trends in NO<sub>x</sub> and NO<sub>2</sub> emissions and ambient measurements in the UK.

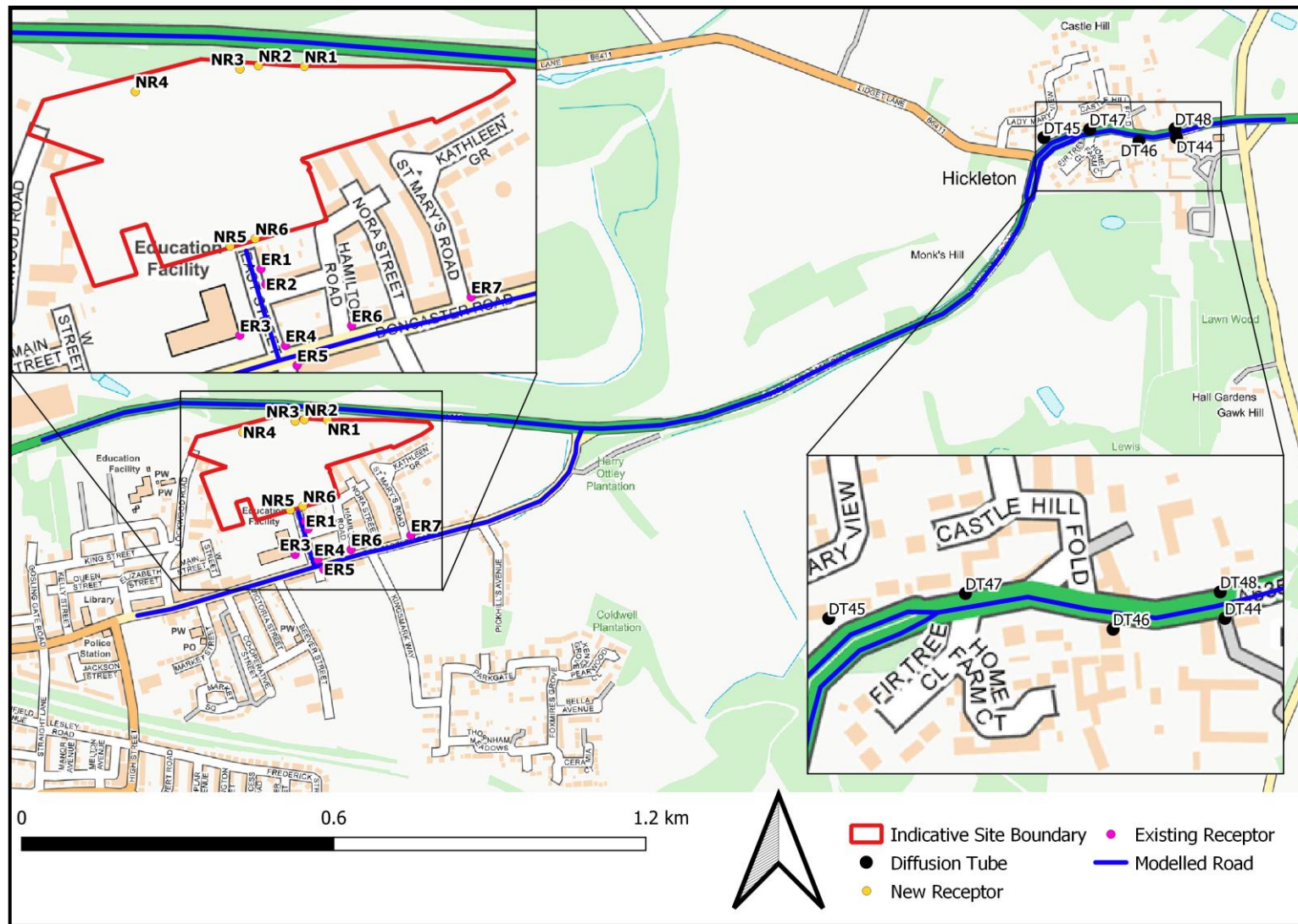


Figure 3-2  
 Dispersion Model Study Area

## 4.0 BASELINE ENVIRONMENT

### 4.1 Baseline Air Quality

Monitoring data collected prior to the COVID-19 pandemic (i.e. pre-2020) has been used to characterise the baseline environment, as pollutant concentrations monitored during 2020 and 2021 are expected to be atypical, and not representative of the local environment and have therefore not been considered.

#### 4.1.1 LAQM Review and Assessment

BMBC, in fulfilment of statutory requirements, has conducted an on-going exercise to review and assess air quality within their administrative area. The latest publicly available LAQM report for BMBC (not impacted by the COVID-19 pandemic) at the time of writing is the 2020 Annual Status Report<sup>19</sup> (ASR).

The Site is located 1.2km north east of AQMA No.7 (see Figure 4-1), which is located in Hickleton, within the jurisdiction of DMBC. In addition, six AQMAs have been declared within BMBC's administrative area for the exceedence of the annual mean NO<sub>2</sub> AQAL. The closest AQMA to the Site within BMBC's area of jurisdiction is the Barnsley AQMA No.7, located 11.4km west of the Site, and therefore has not been considered further within this assessment.

#### 4.1.2 Review of Air Quality Monitoring

##### Automatic Air Quality Monitoring

From review of both local and national automatic monitoring networks, the nearest automatic monitor is located approximately 10km from the Site. Given the separation distance, and anticipated differences in local environments, no automatic monitoring locations have been considered.

##### Passive Diffusion Tube Monitoring

Passive NO<sub>2</sub> diffusion tube monitoring is currently undertaken by both BMBC and DMBC within their administrative areas, at numerous locations – in fulfilment of their statutory LAQM obligations.

The details and results of the monitoring locations of relevance to the Site (i.e. within 5km of the Site) are presented in Table 4-1 and Table 4-2, respectively, whilst their locations are illustrated in Figure 4-1. All monitoring results presented have been ratified and adjusted (where necessary) by BMBC and DMBC.

<sup>19</sup> Barnsley Metropolitan Borough Council, 2020 Air Quality Annual Status Report (2020), June 2020.

**Table 4-1**  
**Local LAQM NO<sub>2</sub> Passive Diffusion Tube Monitoring Sites: Details**

Site ID	Site Type	NGR (m)		Height (m)	Within AQMA	Distance to Site (Km)
		X	Y			
<b>Barnsley Metropolitan Borough Council</b>						
DT45	Urban Background	445699	402140	3.2	N	2.5
<b>Doncaster Council</b>						
DT44	Kerbside	448221	405303	2.0	Y	1.5
DT45	Roadside	447966	405303	2.0	Y	1.3
DT46	Roadside	448149	405296	2.0	Y	1.5
DT47	Kerbside	448054	405319	2.0	Y	1.4
DT48	Kerbside	448218	405320	2.0	Y	1.5
DT49	Kerbside	451331	405219	2.0	N	4.6
DT58	Kerbside	451824	405228	2.0	N	5.0
DT59	Roadside	451514	405247	2.0	N	4.8

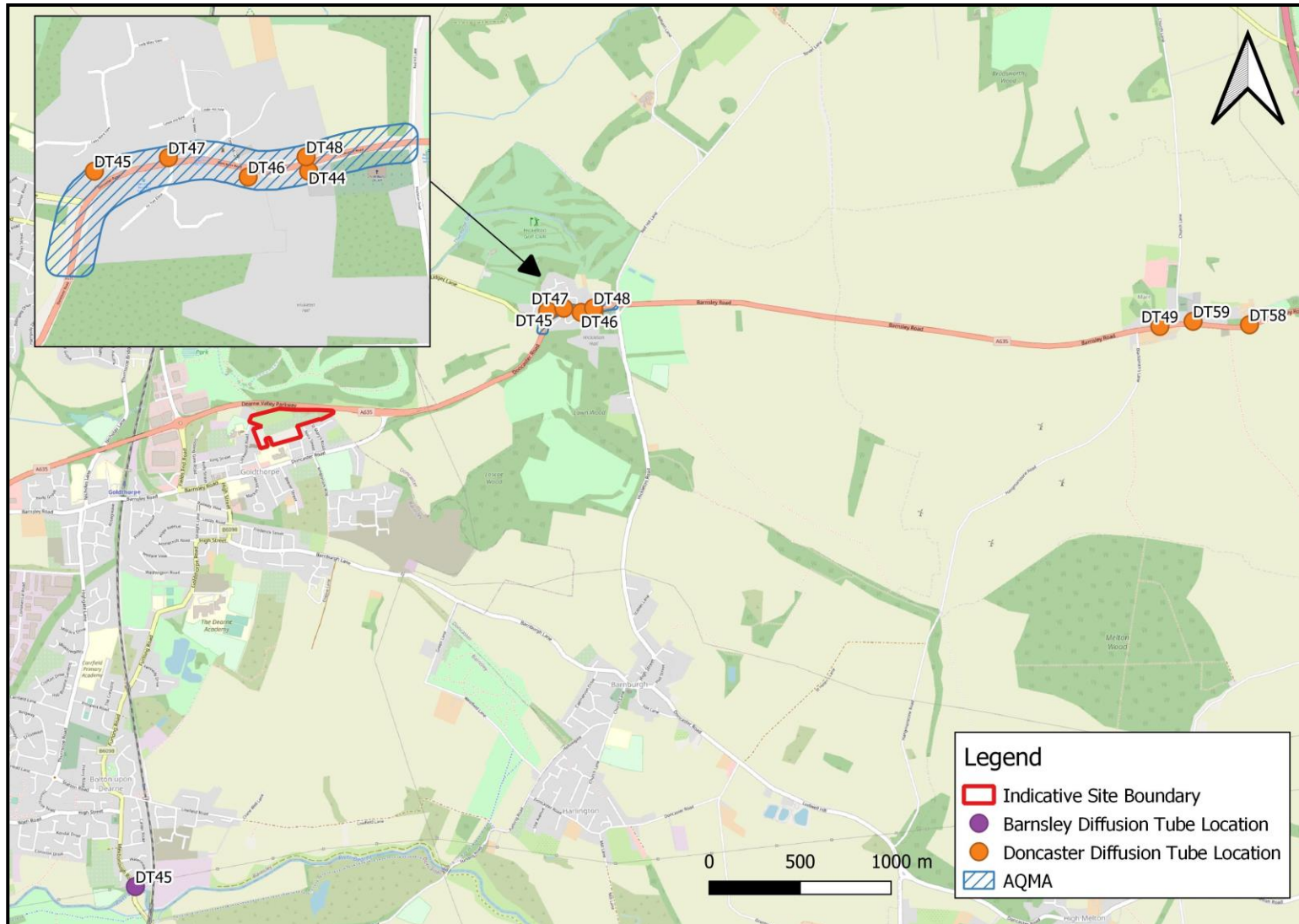
**Table 4-2**  
**Local LAQM NO<sub>2</sub> Passive Diffusion Tube Monitoring Sites: Results**

Site ID	2019 Data Capture %	Annual Mean NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )				
		2015	2016	2017	2018	2019
<b>Barnsley Metropolitan Borough Council</b>						
DT45	100	23.7	24.1	24.8	21.7	22.6
<b>Doncaster Council</b>						
DT44	100	66.0	78.0	79.0	70.0	67.0
DT45	100	18.0	23.0	25.0	25.0	22.0
DT46	100	32.0	41.0	37.0	40.0	35.0
DT47	100	87.0	106.0	100.0	91.0	76.0
DT48	100	80.0	93.0	90.0	87.0	80.0
DT49	100	34.0	44.0	46.0	43.0	37.0
DT58	100	-	-	46.0	43.0	38.0
DT59	75	-	-	22.0	23.0	20.0

As shown in Table 4-2, DT45, an urban background monitoring location within BMBC has historically reported annual mean NO<sub>2</sub> concentrations well-below the AQAL (40µg/m<sup>3</sup>) for the period assessed with a 2019 recorded concentration of 22.6µg/m<sup>3</sup>.

Of the monitoring locations within the AQMA No.7, four of the five monitors (DT44, DT46, DT47 and DT48) have historically recorded annual mean NO<sub>2</sub> concentrations above or close to the AQAL (40µg/m<sup>3</sup>) for the period assessed. The maximum recorded concentration in 2019 was 80.0µg/m<sup>3</sup> at DT48, a kerbside monitor located approximately 1.5km north-east of the Site along the A635 in Hickleton. The location of these monitors is within a declared AQMA where elevated NO<sub>2</sub> concentrations have been recorded, believed to be due to the influence of a road gradient and presence of a street canyon which is likely to be limiting dispersion, these conditions are not considered to be representative of baseline air quality conditions at the Site.

The empirical relationship given in LAQM.TG(16) states that exceedences of the 1-hour mean AQAL for NO<sub>2</sub> is unlikely to occur where annual mean concentrations are <60µg/m<sup>3</sup>. This indicates that an exceedence of the 1-hour mean AQAL is unlikely to have occurred at any of the monitoring sites outside of the AQMA between 2015 and 2019. Within AQMA No.7, DT44, DT47 and DT48 have all recorded annual mean NO<sub>2</sub> concentrations >60µg/m<sup>3</sup> between 2015-2019.



**Figure 4-1**  
**Local Monitoring Locations and AQMAs in Relation to the Site**

### 4.1.3 Defra Mapped Background Concentrations

Defra maintains a nationwide model of existing and future background air quality concentrations at a 1km grid square resolution which is routinely used to support LAQM requirements and air quality assessments. The data sets include annual average concentration estimates for NO<sub>x</sub>, NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> using a base year of 2018 (the year in which comparisons between modelled and monitoring are made).

The Defra mapped annual mean background concentrations for base year of 2019 and the predicted opening year of the development (2022) are presented in Table 4-3.

All the mapped background concentrations presented are well below the respective annual mean AQALs.

**Table 4-3**  
**Defra Background Pollutant Concentrations**

Grid Square (X, Y)	Year	Annual Mean Background Concentration (µg/m <sup>3</sup> )			
		NO <sub>x</sub>	NO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
446500, 404500	2019	15.3	11.5	12.1	7.7
	2022	13.4	10.2	11.6	7.3
<b>AQAL</b>	-	-	<b>40</b>	<b>40</b>	<b>25</b>

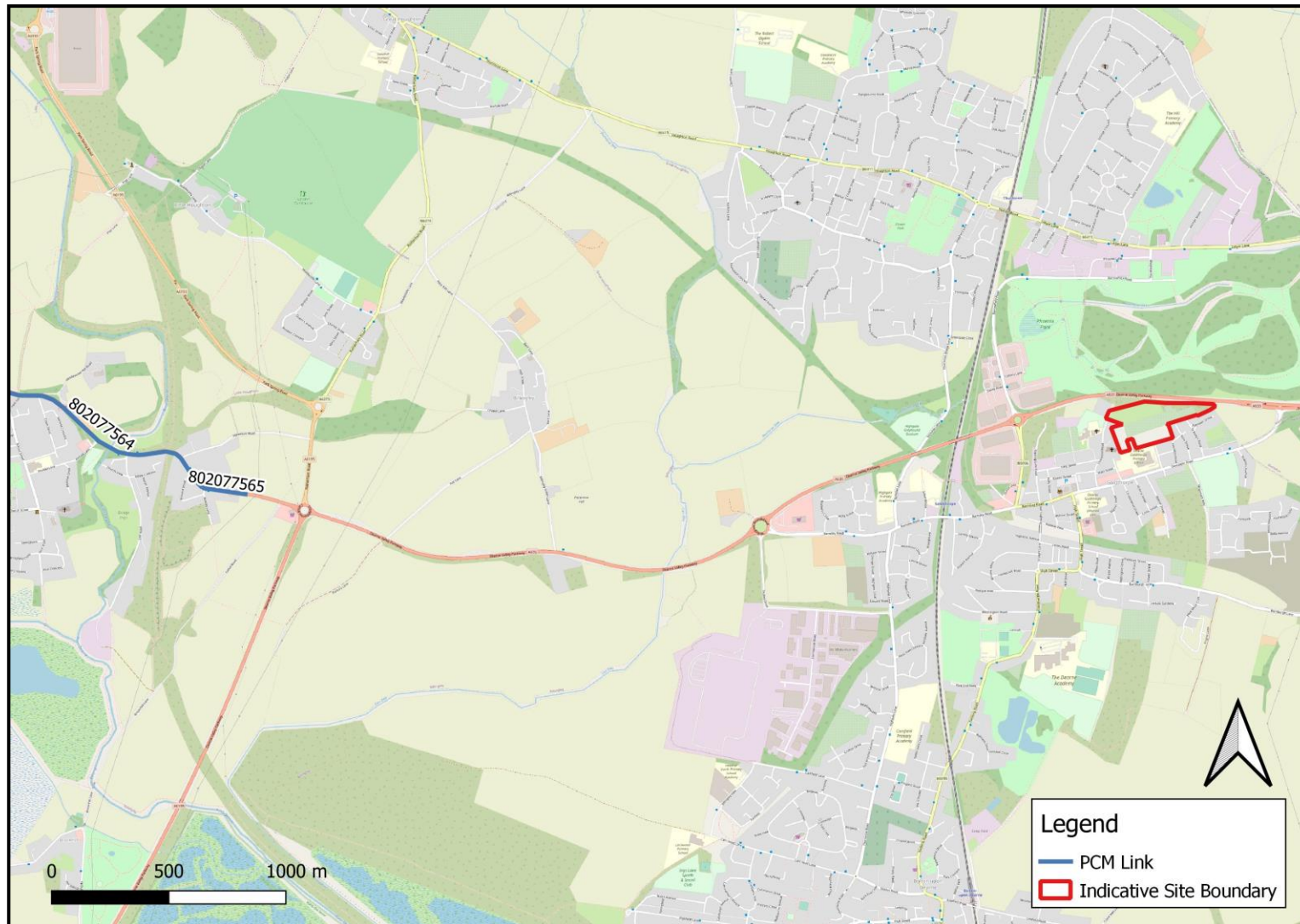
## 4.2 Defra’s Pollution Climate Mapping Model

The BMBC air quality guidance states that Defra’s National Pollutant Climate Mapping (PCM) GIS website<sup>20</sup> should be used to ascertain if the development is located within 20m of roads identified to be at, or above, the relevant AQAL. This can be used (among other sources) to determine whether future occupants of the scheme are likely to be exposed to existing levels of poor air quality. Whilst dispersion modelling has been undertaken for the purposes of determining the suitability of the Site for residential purposes, due consideration has been given to the Site’s location, relevant to sensitive PCM road links.

The latest PCM model data, released by Defra in 2020, has modelled concentrations incorporating the Defra action plan measures for 2018 (reference year), with projected concentrations up to 2030, taking into account policy interventions as well as future vehicle mixes.

The nearest PCM link (Census ID 802077565) is the A635 Doncaster Road which is located 3.7km west of the Site (Figure 4-2). The 2019 roadside NO<sub>2</sub> annual mean concentration for reported in relation to this PCM link is 22.5µg/m<sup>3</sup> – ‘well below’ the AQAL. The A635 Doncaster Road borders the northern Site boundary, and is considered the principal constraint with regards the suitability of the Site.

<sup>20</sup> <https://uk-air.defra.gov.uk/data/gis-mapping>.



**Figure 4-2**  
**PCM Links Relative to the Site**

## 5.0 CONSTRUCTION PHASE ASSESSMENT

This section presents the potential air quality impacts and effects associated with the construction of the Proposed Development.

### 5.1 Construction Dust Assessment

Where figures relating to area of the site, volume of the site, approximate number of construction vehicles or distances to receptors are given, these relate to thresholds as defined in the IAQM guidance to guide the assessor to define the dust emissions magnitude and sensitivity of the area.

#### 5.1.1 Assessment Screening

As shown in Figure 5-1, there are human receptors within 350m of the Site but no designated habitat sites within 50m of the Site boundary or within 50m of the roads anticipated to witness construction traffic movements up to 500m of the Site entrance(s). Therefore, an assessment of construction dust on human receptors only is required.

#### 5.1.2 Potential Dust Emissions Magnitude

##### Demolition

The Site contains some small buildings, such as greenhouses and sheds, associated with the previous Site use as allotments. These will be demolished as part of the Proposed Development. The total building volume for demolition is expected to be <math><20,000\text{m}^3</math>, and therefore the dust emission magnitude for earthworks is considered to be 'small'.

##### Earthworks

The proposals comprise the development of up to 137 residential dwellings, and associated infrastructure. Due to the typical phased nature of construction of residential schemes, the total Site area at any given time is not expected to be greater than  $10,000\text{m}^2$ , relative to what is proposed (i.e. 137 units). The dust emission magnitude for earthworks is therefore initially considered to be medium. The dust emission magnitude for earthworks is therefore initially considered to be 'medium'.

##### Construction

Construction activities at the Site will include a total building volume expected to be no greater than  $100,000\text{m}^3$ , relative to what is proposed (i.e. 137 units). The dust emission magnitude for construction is therefore initially considered to be 'medium'.

##### Trackout

Construction vehicles will most likely access the Site via the access off East Street to the south of the Site during the construction phase. No details are available at the time of assessment on the number of additional HDV movements associated with the construction works, however, there are expected to be less than 50 outward HDV movements on a worst-case day. The dust emission magnitude for trackout is therefore initially considered to be 'medium'.

##### Summary

A summary of the dust emission magnitude for the three activities is detailed in Table 5-1.

**Table 5-1**  
**Potential Dust Emission Magnitude**

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Medium

Activity	Dust Emission Magnitude
Construction	Medium
Trackout	Medium

### 5.1.3 Sensitivity of the Area

#### Dust Soiling Impacts

Overall, there are an estimated 10-100 highly sensitive residential receptors within 20m of the Site. There are also between 10-100 residential properties (highly sensitivity receptors) located less than 20m from the access routes within 200m of the Site entrance (East Street) - commensurate of a medium site<sup>21</sup>.

The sensitivity of the area with respect to dust soiling effects on people and property in relation to demolition, earthworks, construction and trackout activities is therefore 'high'.

#### Human Health Impacts

The maximum 2019 mapped background PM<sub>10</sub> concentration (2018 reference year) for the 1km<sup>2</sup> grid squares centred on the Site is estimated to be 12.1µg/m<sup>3</sup> (i.e. falls into the <24µg/m<sup>3</sup> class). As discussed in Section 4.1, no local background automatic monitoring exists within the development locale.

Given the above information regarding the number of residential receptors within 20m of the Site boundary and within 20m of the identified trackout route along East Street, the sensitivity of the area with respect to human health impacts in relation to demolition, earthworks, construction and trackout is therefore considered to be 'low'.

#### Summary

A summary of the sensitivity of the surrounding area is detailed in Table 5-2, whilst the spatial density of nearby receptors is provided in Figure 5-1.

**Table 5-2**  
**Sensitivity of the Area**

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

### 5.1.4 Risk of Impacts (Unmitigated)

The outcome of the assessment of the potential 'magnitude of dust emissions', and the 'sensitivity of the area' are combined in Table 5-3 below to determine the risk of impact (unmitigated) which is used to inform the selection of appropriate mitigation.

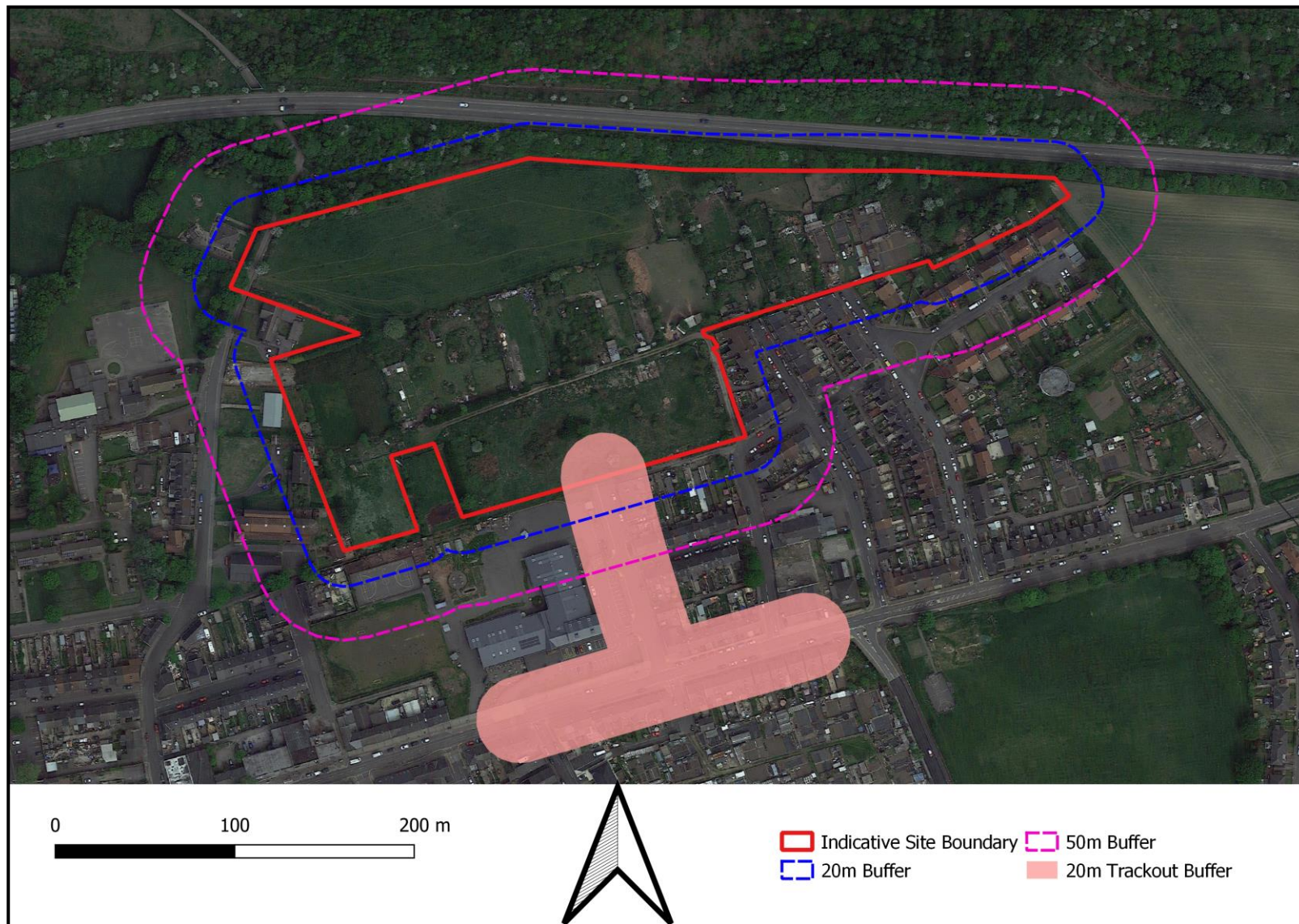
**Table 5-3**  
**Risk of Dust Impacts (Unmitigated)**

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

<sup>21</sup> As per the IAQM's 'Guidance on the Assessment of Dust from Demolition and Construction', without site-specific mitigation, trackout may occur along the public highway up to 500m from large sites, 200m from medium sites and 50m from small sites (determined by the calculated trackout dust emission magnitude), as measured from the site exit.

Following the construction dust assessment, the Site is found to be at worst, 'Medium Risk' in relation to dust soiling effects on people and property, and 'Low Risk' in relation to human health impacts (Table 5-3). However, potential dust effects during the construction phase are considered to be temporary in nature and may only arise at particular times (i.e. certain activities and/or meteorological conditions).

Nonetheless, commensurate with the above designation of dust risk, mitigation measures, as identified by IAQM guidance are required to ensure that any potential impacts arising from the construction phase of the Proposed Development are reduced and, where possible, completely removed. In accordance with IAQM guidance, providing effective mitigation measures are implemented, such as those outlined in Section 7.1, construction dust effects are considered to be not significant.



**Figure 5-1**  
**Construction Dust Assessment Buffers**

## 6.0 OPERATIONAL PHASE ASSESSMENT

This section presents the potential air quality impacts and effects associated with the operation of the Proposed Development.

### 6.1 NO<sub>2</sub> Modelling Results

Table 6-1 presents the annual mean NO<sub>2</sub> concentrations predicted at all assessed receptor locations for the 2022 DM and 2022 DS scenarios.

**Table 6-1**  
**Predicted Annual Mean NO<sub>2</sub> Concentrations – 2022 Development Opening Year**

Receptor	Predicted Annual Mean NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )		% Change of AQAL	% of 2022 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2022 DM	2022 DS			
<b>Existing Receptors</b>					
ER1	11.8	12.4	1.6	31.0	Negligible
ER2	11.9	12.6	1.6	31.5	Negligible
ER3	12.1	12.3	0.6	30.8	Negligible
ER4	14.9	15.6	1.9	39.0	Negligible
ER5	13.6	13.9	0.9	34.8	Negligible
ER6	14.0	14.3	0.8	35.8	Negligible
ER7	14.4	14.7	0.8	36.8	Negligible
<b>New Receptors</b>					
NR1	-	14.6	-	36.5	-
NR2	-	14.2	-	35.5	-
NR3	-	13.7	-	34.3	-
NR4	-	12.1	-	30.3	-
NR5	-	11.4	-	28.5	-
NR6	-	11.4	-	28.5	-

The maximum predicted annual mean NO<sub>2</sub> concentration at existing receptors with the Proposed Development in place (2022 DS) was at Receptor ER4 (a residential dwelling at the junction of East Street and Doncaster Road) with a predicted concentration of 15.6µg/m<sup>3</sup>; this represents 39.0% of the AQAL. The change in the annual mean NO<sub>2</sub> concentrations at this location, due to the Proposed Development (2022 DS vs. 2022 DM) relative to the AQAL was 1.9%. This is the maximum observed increase in annual mean NO<sub>2</sub> concentrations as a result of the Proposed Development (2022 DS vs. 2022 DM).

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean NO<sub>2</sub> concentrations at all assessed existing receptors is considered to be 'negligible'. Given the marginal increase in annual mean NO<sub>2</sub> concentrations associated with the Proposed Development, and that there are no predicted exceedences of the annual mean NO<sub>2</sub> AQAL, unmitigated effects associated with annual mean NO<sub>2</sub> concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

The maximum predicted annual mean NO<sub>2</sub> concentration (2022 DS) at all new receptors introduced by the Proposed Development was at Receptor NR1, located on the north façade of a residential dwelling nearest to the A635 on

the northern edge of the Site boundary, with a predicted concentration of 14.6µg/m<sup>3</sup>; this represents 36.5% of the AQAL (i.e. 'well-below').

The empirical relationship given in LAQM.TG(16) states that exceedences of the 1-hour mean NO<sub>2</sub> AQAL are unlikely to occur where annual mean concentrations are <60µg/m<sup>3</sup>. Annual mean NO<sub>2</sub> concentrations predicted at all receptor locations are well below this limit. Therefore, it is unlikely that an exceedance of the 1-hour mean objective will occur. Effects associated with likely 1-hour mean NO<sub>2</sub> concentrations at all assessed receptor locations (including those on Site) are therefore considered to be 'not significant'.

## 6.2 PM<sub>10</sub> Modelling Results

Table 6-2 presents the annual mean PM<sub>10</sub> concentrations predicted at all assessed receptor locations for the 2022 DM and 2022 DS scenarios.

**Table 6-2**  
**Predicted Annual Mean PM<sub>10</sub> Concentrations – 2022 Development Opening Year**

Receptor	Predicted Annual Mean PM <sub>10</sub> Concentration (µg/m <sup>3</sup> )		% Change of AQAL	% of 2022 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2022 DM	2022 DS			
<b>Existing Receptors</b>					
ER1	12.1	12.3	0.3	30.8	Negligible
ER2	12.1	12.3	0.4	30.8	Negligible
ER3	12.2	12.2	0.1	30.5	Negligible
ER4	12.8	13.0	0.4	32.5	Negligible
ER5	12.5	12.6	0.2	31.5	Negligible
ER6	12.6	12.7	0.2	31.8	Negligible
ER7	12.7	12.8	0.2	32.0	Negligible
<b>New Receptors</b>					
NR1	-	13.0	-	32.5	-
NR2	-	12.9	-	32.3	-
NR3	-	12.7	-	31.8	-
NR4	-	12.3	-	30.8	-
NR5	-	12.0	-	30.0	-
NR6	-	12.0	-	30.0	-

The maximum predicted annual mean PM<sub>10</sub> concentration at existing receptors with the Proposed Development in place (2022 DS) was at Receptor ER4 with a predicted concentration of 13.0µg/m<sup>3</sup>; this represents 32.5% of the AQAL. The change in the annual mean PM<sub>10</sub> concentrations at this location, due to the Proposed Development (2022 DS vs. 2022 DM) relative to the AQAL was 0.4%. This is the maximum observed increase in annual mean PM<sub>10</sub> concentrations as a result of the Proposed Development (2022 DS vs. 2022 DM).

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean PM<sub>10</sub> concentrations at all assessed existing receptors is considered to be 'negligible'. Given the marginal increase in annual mean PM<sub>10</sub> concentrations associated with the Proposed Development, and that there are no predicted exceedences of the annual mean PM<sub>10</sub> AQAL, unmitigated effects associated with annual mean PM<sub>10</sub> concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

The maximum predicted annual mean PM<sub>10</sub> concentration (2022 DS) at all new receptors introduced by the Proposed Development was at Receptor NR1, with a predicted concentration of 13.0µg/m<sup>3</sup>; this represents 32.5% of the AQAL (i.e. ‘well-below’).

Based upon the maximum predicted annual mean PM<sub>10</sub> concentration of 13.0µg/m<sup>3</sup> (predicted at Receptor NR1 and ER4 – 2022 DS), this equates to less than 1 day where 24-hour mean PM<sub>10</sub> concentrations are predicted to be greater than 50µg/m<sup>3</sup>. This is well below the 35 permitted exceedences, and therefore the number of maximum exceedences is in compliance with the 24-hour mean AQAL. Effects associated with likely 24-hour mean PM<sub>10</sub> concentrations at all assessed receptor locations (including those on Site) are therefore considered to be ‘not significant’.

### 6.3 PM<sub>2.5</sub> Modelling Results

Table 6-3 presents the annual mean PM<sub>2.5</sub> concentrations predicted at all assessed receptor locations for the 2022 DM and 2022 DS scenarios.

**Table 6-3**  
**Predicted Annual Mean PM<sub>2.5</sub> Concentrations – 2022 Development Opening Year**

Receptor	Predicted Annual Mean PM <sub>2.5</sub> Concentration (µg/m <sup>3</sup> )		% Change of AQAL	% of 2022 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2022 DM	2022 DS			
<b>Existing Receptors</b>					
ER1	7.6	7.7	0.3	30.8	Negligible
ER2	7.6	7.7	0.3	30.8	Negligible
ER3	7.6	7.6	0.1	30.4	Negligible
ER4	8.0	8.1	0.4	32.4	Negligible
ER5	7.8	7.9	0.2	31.6	Negligible
ER6	7.9	7.9	0.2	31.6	Negligible
ER7	7.9	8.0	0.2	32.0	Negligible
<b>New Receptors</b>					
NR1	-	8.1	-	32.4	-
NR2	-	8.0	-	32.0	-
NR3	-	7.9	-	31.6	-
NR4	-	7.7	-	30.8	-
NR5	-	7.5	-	30.0	-
NR6	-	7.5	-	30.0	-

The maximum predicted annual mean PM<sub>2.5</sub> concentration at existing receptors with the Proposed Development in place (2022 DS) was at Receptor ER4 with a predicted concentration of 8.1µg/m<sup>3</sup>; this represents 32.4% of the AQAL. The change in the annual mean PM<sub>2.5</sub> concentrations at this location, due to the Proposed Development (2022 DS vs. 2022 DM) relative to the AQAL was 0.4%. This is the maximum observed increase in annual mean PM<sub>2.5</sub> concentrations as a result of the Proposed Development (2022 DS vs. 2022 DM).

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean PM<sub>2.5</sub> concentrations at all assessed existing receptors is considered to be ‘negligible’. Given the marginal increase in annual mean PM<sub>2.5</sub> concentrations associated with the Proposed Development, and that there are no predicted exceedences of the

annual mean PM<sub>2.5</sub> AQAL, unmitigated effects associated with annual mean PM<sub>2.5</sub> concentrations at all assessed receptor locations are therefore considered to be 'not significant'.

The maximum predicted annual mean PM<sub>2.5</sub> concentration (2022 DS) at all receptors newly introduced by the Proposed Development was at NR1 and ER4 with a predicted concentration of 8.1µg/m<sup>3</sup>; this represents 32.4% of the AQAL (i.e. 'well-below').

## 7.0 MITIGATION MEASURES

This section presents any proportionate mitigation measures required during the construction and operational phases of the Proposed Development.

### 7.1 Construction Phase

As discussed in Section 5.1, construction impacts associated to the Proposed Development would result in the generation of dust and PM<sub>10</sub>.

IAQM guidance outlines a number of site-specific mitigation measures based on the assessed site risk. The measures are grouped into those which are highly recommended and those which are desirable. With the effective application of the dust mitigation measures, as detailed in Table 7-1, it is considered that the overall effect at all receptors will be 'not significant'.

**Table 7-1**  
**Construction Dust Mitigation Measures**

Site Application	Mitigation Measures
<b>Highly Recommended</b>	
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
Construction	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.
Demolition	Ensure effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
	Avoid explosive blasting, using appropriate manual or mechanical alternatives.
	Bag and remove any biological debris or damp down such material before demolition.
Monitoring	Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
	Agree dust deposition, dust flux, or real-time PM <sub>10</sub> 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. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
Operating Vehicle/Machinery and Sustainable Travel	Ensure all vehicles switch off engines when stationary - no idling vehicles.
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Site Application	Mitigation Measures
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.
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.
Site Management	Cover, seed or fence stockpiles to prevent wind whipping.
	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make the complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the logbook.
	Hold regular liaison meetings with other high risk construction sites within 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.
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
	Avoid dry sweeping of large areas.
	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Record all inspections of haul routes and any subsequent action in a site logbook.
	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible.	
Waste Management	Avoid bonfires and burning of waste materials.
<b>Desirable</b>	
Construction	Avoid scabbling (roughening of concrete surfaces) if possible.

Site Application	Mitigation Measures
	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.
Demolition	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
	Use Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
	Only remove the cover in small areas during work and not all at once.
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.
	With respect to operating vehicle/machinery and sustainable travel:
	Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

## 7.2 Operational Phase

In accordance with EPUK/IAQM guidance, the overall effect of the development on NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations at all assessed receptor locations is considered to be 'not significant'. In addition, predicted concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> within the Site at new receptor locations are considered to be 'well below' both the long and short-term AQALs. Effects associated with likely exposure of future occupants are therefore considered to be 'not significant'. As such, additional long-term scheme-specific mitigation measures are therefore not considered to be necessary.

Notwithstanding the above, in accordance with BMBC's air quality guidance, 'medium' developments are required to implement Type 1 and 2 mitigation measures as follows:

- One electric vehicle (EV) charging point per unit (dwelling with dedicated parking) or one charging point per 10 spaces;
- Travel Plan, including an agreed mechanism for discouraging high emission vehicle use and encouraging modal shift (i.e. of public transport, cycling and walking), as well as uptake of low emission fuels and technologies;
- Improved pedestrian access to public transport;
- New or improved bus stop infrastructure including shelters, raised kerbing and information displays;
- Site layout designed to encourage walking, cycle paths to link to local cycle network; and
- Improved, convenient and segregated cycle paths to link local cycle network

## 8.0 CONCLUSIONS

SLR has been commissioned by Gleeson Developments Ltd to undertake an air quality assessment to support a planning application for a proposed residential development comprising up to 137 dwellings, on land at Lockwood Road, Goldthorpe.

### 8.1 Construction Phase

A qualitative assessment of the potential dust impacts during the construction of the development has been undertaken following IAQM guidance.

Following the construction dust assessment, the Site is found to have at worst 'Medium Risk' in relation to dust soiling effects on people and property, and 'Low Risk' in relation to human health impacts. Providing mitigation measures are implemented, such as those outlined in Section 7.1 of this report, residual effects from dust emissions arising during the construction phase are considered to be 'not significant'.

Given the short-term nature of the construction phase, there is predicted to be an insignificant effect on air quality from construction-generated vehicle emissions.

### 8.2 Operational Phase

The assessment of operational phase effects considered impacts on all relevant existing and new receptors from road traffic emissions associated with the Proposed Development.

The ADMS-Roads dispersion model (version 5.0.0.1) was used to determine the likely NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations at all assessed receptor locations, in accordance with technical guidance presented in LAQM.TG(16). Predicted pollutant concentration changes at existing receptor locations as a result of the Proposed Development were assessed using the EPUK & IAQM significance criteria. Whereas concentrations modelled at new receptor locations associated with the Proposed Development were compared against the relevant AQALs, to establish the suitability of the Site for residential purposes.

In accordance with EPUK & IAQM guidance, the impacts of the Proposed Development on NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations at all assessed existing receptor locations are considered to be 'negligible'. Unmitigated effects associated with NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> concentrations at all assessed receptor locations are therefore considered 'not significant'.

Furthermore, the predicted concentrations of NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> within the Site are 'well below' both the annual mean and short term AQALs, and therefore the Site is considered to be suitable for its proposed residential use. As such, effects associated with likely exposure of future occupants are considered to be 'not significant'.

## APPENDIX A – Model Inputs and Verification

### Traffic Data

Table A-1 details the traffic data used within the assessment.

**Table A-1**  
**Traffic Data Used Within the Assessment**

Link	2019		2022 DM		2022 DS		Speed (kph) <sup>(A)</sup>
	AADT	% HDV	AADT	% HDV	AADT	% HDV	
A635 Doncaster Road	-	-	12,076	11.9	12,298	12	97
Doncaster Road east of Site Access	-	-	4,302	0.3	4,609	0.0	48
Doncaster Road west of Site Access	-	-	4,698	0.3	5,005	0.0	48
East Street	-	-	995	0.0	1,610	0.0	32
<b>Model Verification</b>							
A635 Doncaster Road	15,155	12.0	-	-	-	-	97
Traffic speeds have been adjusted to take into account queues and congestion in accordance with LAQM.TG(16).							

### Model Verification

The ADMS-Roads dispersion model has been widely validated for this type of assessment and is specifically listed in the Defra’s LAQM.TG(16) guidance as an accepted dispersion model.

Model validation undertaken by the software developer (CERC) will not have included validation in the vicinity of the Site. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

Prior to undertaking model verification, model setup parameters and input data were reviewed to maximise the performance of the dispersion model in relation to the real-world conditions.

Consistent with advice provided by Defra to local authorities across England, 2019 has been used for the purposes of model verification as relates to the most recent year of monitoring data available which hasn’t been impacted by the COVID-19 pandemic. Use of monitoring data recorded in 2020 for the purposes of model verification introduces an element of uncertainty into the final adjusted modelled predictions, as monitoring conditions experienced for the majority of 2020 are not deemed to be representative of long-term baseline conditions, and could lead to a systematic underprediction at modelled receptor locations.

### NO<sub>x</sub> / NO<sub>2</sub> Verification

NO<sub>x</sub> / NO<sub>2</sub> verification relates to the comparison and adjustment of modelled road-NO<sub>x</sub> (as output from the ADMS-Roads dispersion model), relative to monitored road-NO<sub>x</sub>.

For NO<sub>x</sub> / NO<sub>2</sub> model verification, 2019 LAQM DMBC monitoring data has been used for those roadside locations situated adjacent to a modelled link i.e. where traffic data exists (Table A-2). These sites are all located within the AQMA No.7 – where elevated concentrations have been recorded. Use of these sites for the purposes of model

verification is therefore conservative, as provides a higher benchmark (in terms of monitored NO<sub>x</sub>/NO<sub>2</sub>) for comparison with the modelled output.

**Table A-2**  
**Local Monitoring Data Used for Model Verification**

Site ID	X	Y	2019 Monitored NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )	2019 Data Capture (%)
DT44	448221	405303	67	100.0
DT45	447966	405303	22	100.0
DT46	448149	405296	35	100.0
DT47	448054	405319	76	100.0
DT48	448218	405320	80	100.0

As NO<sub>2</sub> concentrations are solely reported using diffusion tubes, NO<sub>x</sub> was back calculated using the latest version of Defra's NO<sub>x</sub> to NO<sub>2</sub> Calculator (v8.1). The NO<sub>x</sub> to NO<sub>2</sub> Calculator was also used to facilitate the conversion of modelled road-NO<sub>x</sub> (as output from the ADMS-Roads dispersion model) into road-NO<sub>2</sub>.

Verification was completed using the 2019 Defra background mapped concentrations (2018 base year) for the relevant 1km x 1km grid squares (i.e. those within which the model verification locations are located), as discussed in Section 4.1.3.

Comparison of the unadjusted modelled vs. monitored road NO<sub>x</sub> is provided in Table A-3. An adjustment factor of 3.660 has been derived, based on a linear regression forced through zero, as shown in Figure A-1. No further improvement to the ADMS-Roads dispersion model could be achieved.

**Table A-3**  
**NO<sub>x</sub>/ NO<sub>2</sub> Model Verification (3.660)**

Site ID	Monitored Road NO <sub>x</sub> (µg/m <sup>3</sup> )	Modelled Road NO <sub>x</sub> (µg/m <sup>3</sup> )	Ratio (Monitored vs. Modelled Road NO <sub>x</sub> )	Adjustment Factor	Adjusted Modelled Total NO <sub>2</sub> (µg/m <sup>3</sup> )	Monitored Total NO <sub>2</sub> (µg/m <sup>3</sup> )	% Difference (Adjusted Modelled NO <sub>2</sub> vs Monitored NO <sub>2</sub> )
DT44	132.5	46.9	2.8	3.660	80.1	67.0	19.5
DT45	23.3	8.8	2.7		26.4	22.0	20.0
DT46	50.3	13.5	3.7		34.5	35.0	-1.4
DT47	159.1	29.7	5.4		58.5	76.0	-23.0
DT48	171.2	44.4	3.9		77.1	80.0	-3.6
DT44	132.5	46.9	2.8		80.1	67.0	19.5



**Figure A-1**  
**Comparison of Modelled vs. Monitored Road NO<sub>x</sub> Contribution (3.660)**

LAQM.TG(16) states that:

*“In order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within 25% of the monitored concentrations as a minimum, preferably within 10%”.*

As noted in Table A-3, the difference between the adjusted modelled NO<sub>2</sub> and monitored NO<sub>2</sub> is within ±25 at all verification locations, and within ±10% at two. In addition, a verification factor of 3.660 reduces the Root Mean Square Error (RMSE) from a value of 35.6µg/m<sup>3</sup> to 10.1µg/m<sup>3</sup> – within the ideal LAQM.TG(16) prescribed limit (within 25% of the annual mean AQAL). On this basis, the derived verification factor (3.660) was considered acceptable and was subsequently applied to all road-NO<sub>x</sub> concentrations predicted (as output of the ADMS Roads dispersion model).

### PM<sub>10</sub> / PM<sub>2.5</sub> Verification

The adjustment factor of 3.660 was applied to road-PM<sub>10</sub> and PM<sub>2.5</sub> concentrations (as output of the ADMS Roads dispersion model), following recommendations of LAQM.TG(16) guidance, in the absence of representative local particulate monitoring.

## APPENDIX B – Sensitivity Analysis

In order to provide further assessment and sensitivities on the assessment inputs, an additional scenario has been assessed (as described in Section 3.2.7) which considers:

- 2019 NO<sub>x</sub> / NO<sub>2</sub>, background concentrations (2018 reference year); and
- 2019 NO<sub>x</sub> emission factors obtained from EFT v10.1.

Use of these variables therefore assumes that there is no improvement in either emission factors and / or background concentrations within Goldthorpe for future years, relative to 2019. These modelled scenarios are likely to represent an overly conservative approach as, despite uncertainty in quantification, it is generally accepted that variables such as background concentrations and/or vehicle emission factors will improve to some degree in future years.

The results of this sensitivity assessment with respect to annual mean NO<sub>2</sub> concentrations are presented in Table B-1 below.

**Table B-1**  
**Predicted Annual Mean NO<sub>2</sub> Concentrations: Sensitivity Test**

Receptor	Predicted Annual Mean NO <sub>2</sub> Concentration (µg/m <sup>3</sup> )		% Change of AQAL	% of 2019 DS Relative to AQAL	EPUK & IAQM Impact Descriptor
	2019 DM	2019 DS			
<b>Existing Receptors</b>					
ER1	13.7	14.5	2.0	36.3	Negligible
ER2	13.9	14.7	2.1	36.8	Negligible
ER3	14.0	14.3	0.8	35.8	Negligible
ER4	17.6	18.6	2.4	46.5	Negligible
ER5	15.9	16.4	1.2	41.0	Negligible
ER6	16.6	17.0	1.0	42.5	Negligible
ER7	17.0	17.4	1.0	43.5	Negligible
<b>New Receptors</b>					
NR1	-	17.8	-	44.5	-
NR2	-	17.3	-	43.3	-
NR3	-	16.6	-	41.5	-
NR4	-	14.3	-	35.8	-
NR5	-	13.1	-	32.8	-
NR6	-	13.2	-	33.0	-

The maximum predicted annual mean NO<sub>2</sub> concentration at existing receptors with the proposed development in place (2019 DS) was at Receptor ER4 with a predicted concentration of 18.6µg/m<sup>3</sup>; this represents 46.5% of the AQAL. The change in the annual mean NO<sub>2</sub> concentrations at this location, due to the Proposed Development (2019 DS vs. 2019 DM) relative to the AQAL was 2.4%. This is the maximum observed increase in annual mean NO<sub>2</sub> concentrations as a result of the Proposed Development (2019 DS vs. 2019 DM).

In accordance with EPUK & IAQM guidance, the impact of the development on annual mean NO<sub>2</sub> concentrations at all assessed existing receptors is considered to be 'negligible'. Given the marginal increase in annual mean NO<sub>2</sub> concentrations associated with the Proposed Development, and that there are no predicted exceedences of the

annual mean NO<sub>2</sub> AQAL, unmitigated effects associated with annual mean NO<sub>2</sub> concentrations at all assessed receptor locations are therefore considered to be 'not significant', despite the overly conservative methodology applied.

The maximum predicted annual mean NO<sub>2</sub> concentration (2019 DS) at all new receptors introduced by the Proposed Development was at Receptor NR1, located north on the façade of a residential dwelling nearest to the A635 on the north of the Site boundary, with a predicted concentration of 17.8µg/m<sup>3</sup>; this represents 44.5% of the AQAL (i.e. 'well-below'). Effects associated with likely exposure of future occupants are considered to be 'not significant', despite the overly conservative methodology applied.

The empirical relationship given in LAQM.TG(16) states that exceedences of the 1-hour mean NO<sub>2</sub> AQAL are unlikely to occur where annual mean concentrations are <60µg/m<sup>3</sup>. Annual mean NO<sub>2</sub> concentrations predicted at all receptor locations are well below this limit. Therefore, it is unlikely that an exceedance of the 1-hour mean objective will occur. Effects associated with likely 1-hour mean NO<sub>2</sub> concentrations at all assessed receptor locations (including those on Site) are therefore considered to be 'not significant', despite the overly conservative methodology applied.

## EUROPEAN OFFICES

### United Kingdom

#### AYLESBURY

T: +44 (0)1844 337380

#### BELFAST

belfast@slrconsulting.com

#### BRADFORD-ON-AVON

T: +44 (0)1225 309400

#### BRISTOL

T: +44 (0)117 906 4280

#### CARDIFF

T: +44 (0)29 2049 1010

#### CHELMSFORD

T: +44 (0)1245 392170

#### EDINBURGH

T: +44 (0)131 335 6830

#### EXETER

T: + 44 (0)1392 490152

#### GLASGOW

glasgow@slrconsulting.com

#### GUILDFORD

guildford@slrconsulting.com

#### LONDON

T: +44 (0)203 805 6418

#### MAIDSTONE

T: +44 (0)1622 609242

#### MANCHESTER (Media City)

T: +44 (0)161 872 7564

#### NEWCASTLE UPON TYNE

T: +44 (0)191 261 1966

#### NOTTINGHAM

T: +44 (0)115 964 7280

#### SHEFFIELD

T: +44 (0)114 245 5153

#### SHREWSBURY

T: +44 (0)1743 23 9250

#### STIRLING

T: +44 (0)1786 239900

#### WORCESTER

T: +44 (0)1905 751310

### France

#### GRENOBLE

T: +33 (0)6 23 37 14 14

### Ireland

#### DUBLIN

T: + 353 (0)1 296 4667