Kairus Ltd

Air Quality Assessment

Land off Barkby Road

Syston

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1 Introduction

1.1 Overview

Kairus Ltd was commissioned by Taylor Wimpey UK Ltd to carry out an air quality assessment in support of the outline application (Application reference P/21/2639/2) for up to 195 dwellings on land to the north of Barkby Road, Syston (the 'Site').

In response to the application the following comment was received from Charnwood Development Control on 9th March 2022:

'Impact of the development on local air quality has not been assessed. Impacts of traffic generated by the proposed development on local air quality should be assessed by the applicant, to include the impacts on future and existing receptors, with the potential for cumulative effects from other local development also considered'

This report addresses the impact of the proposed development on local air quality in the vicinity of the Site. Potential sources of emissions are identified and assessed in the context of existing air quality and emission sources and the nature and location of receptors.

A glossary of common air quality terminology is provided in Appendix A.

1.2 Scope of Assessment

The development would provide up to 195 dwellings which would generate additional vehicle movements on the road network within Syston. Based on the criteria set out in current air quality planning guidance published by the Institute of Air Quality Management (IAQM)[1], significant impacts on local air quality are unlikely to occur where a development results in a change in light duty vehicles (LGV) of less than 100 per day within or adjacent to an Air Quality Management Area (AQMA) and less than 500 per day in other locations. Data provided by David Tucker Associates (DTA) indicates an increase in vehicles of over 500 per day along Barkby Road and over 100 per day in the centre of the town, including within the Syston AQMA. The trip generation therefore exceeds the screening criteria and a detailed assessment of operational traffic impacts has been carried out.

The assessment has concentrated on nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 µm and 2.5µm (PM_{10}/$PM_{2.5}$)), the pollutants most associated with traffic emissions and which can be harmful and cause discomfort to humans.

An assessment of air quality impacts associated with the construction of the proposed development has also been undertaken.

The scope of the assessment has been discussed and agreed with Beverley Green, Environmental Health practitioner at Charnwood District Council (CDC).

1 EPUK & IAQM (2017) Land Use Planning & Development Control: Planning for Air Quality, January 2017

2 Site Description

2.1 The Existing Site

Syston is a town located approximately 5 km to the north-east of the Leicester city centre. The Site is approximately 892,000 m^2 in area and is located on the eastern edge of Syston on land bounded by Barkby Road to the south and Queniborough Road to the east.

The Site is currently agricultural land and is bounded to the north by further agricultural land and grassland. To the west is the Empingham residential area.

The location of the Site is shown below in Figure 2.1.

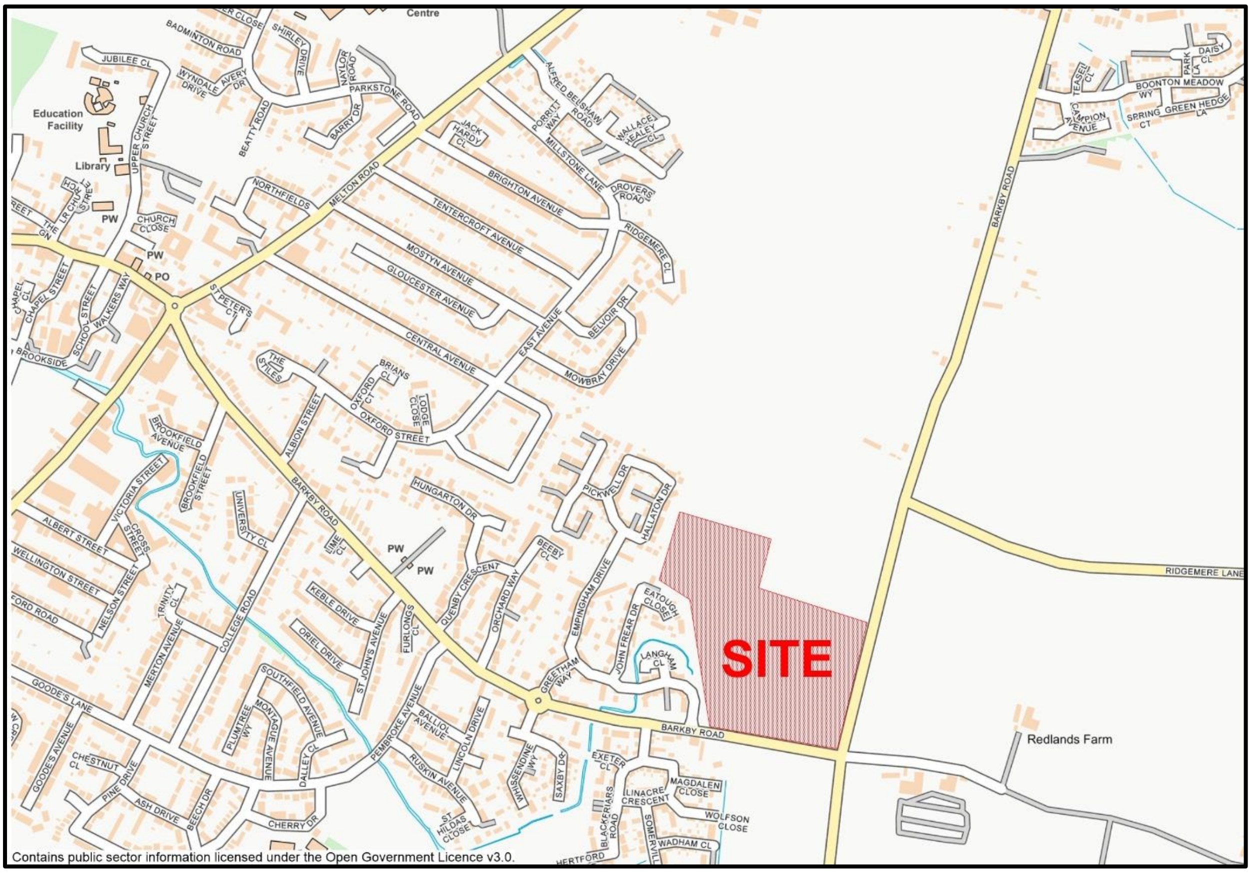

Figure 2.1: Location of Application Site

2.2 The Proposed Development

The application is for outline planning permission to provide up to 195 residential dwellings with associated infrastructure, landscaping and public open space.

An indicative concept plan for the Site is provided in Figure 2.2.

Figure 2.2: Indicative Masterplan

3 Legislation, Policy and Guidance

3.1 International Air Quality Policy

3.1.1 EU Directive 2008

The EU Directive 2008/50/EC[2] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for a number of pollutants and the dates by which these objectives should be met. The Air Quality Standards Regulations 2010[3] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

3.2 National Air Quality Policy

3.2.1 The UK Air Quality Strategy

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[4] , pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C4H6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

For some pollutants, there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

2 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
3 Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001
4 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

Of the pollutants included in the AQS, NO_2 and PM_{10} would be particularly relevant to this project as these are the primary pollutants associated with road traffic. The current statutory standards and objectives for NO_2 and PM_{10} in relation to human health are set out in Table 3.1.

In relation to $PM_{2.5}$ the 2019 Clean Air Strategy[5] includes a commitment to set 'new, ambitious, long-term targets to reduce people's exposure to $PM_{2.5}$' which the proposed Environment Bill 2019-2021 commits the Secretary of State to setting. For the purposes of this assessment the EU Directive Stage 2 limit value for $PM_{2.5}$ (as provided in Table 3.1) is considered to be appropriate to apply and consideration given to future potential changes.

Table 3.1: Relevant Objectives set out in the Air Quality Strategy

Pollutant	Concentrations	Measured As	Date to be Achieved By
Nitrogen Dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times per year	1 hour mean	31 December 2005
	40 μgm^{-3}	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 μgm^{-3}	Annual mean	31 December 2004
Particulate Matter ($PM_{2.5}$)	25 $\mu g/m^3$	Annual Mean	31 December 2010

The statutory standards and objectives apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2016 (LAQM.TG(16))[6] issued by DEFRA for Local Authorities on where the objectives apply, as detailed in Table 3.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

5 Defra. (2019). Clean Air Strategy. London: HMSO

6 DEFRA (2016) Local Air Quality Management. Technical Guidance LAQM.TG(16)

Table 3.2: Locations Where Air Quality Objectives Apply		
Averaging Period	**Objectives should apply at:**	**Objectives should generally not apply at:**
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care home etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
24 Hour Mean	All locations where the annual mean objective would apply together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1 Hour Mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside Sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2.2 National Air Quality Plan for Nitrogen Dioxide (NO_2) in the UK

The National Air Quality Plan[7] was written as a joint venture between the Defra and the Department for Transport (DfT) and aims to tackle roadside concentrations of NO_2 in the UK. It includes a number of measures such as those aimed at investing in Ultra Low Emission Vehicles (ULEVs) charging infrastructure, public transport and grants to help local authorities in improving air quality.

The plan requires all local authorities (LAs) in England with areas expected not to meet the Limit Values by 2020 (known as 'air quality hotspots') to develop plans to bring concentrations within these values in "the shortest time possible". These plans are to be reviewed by the government and suggestions included in the plan include actions such as utilising retrofitting technologies, changing road layout and encouraging public transport and ULEV use. Where these approaches are not considered sufficient, the LA may need to consider implementation of a Clean Air Zone (CAZ) which places restrictions on vehicle access to an area and may include charging certain (or all) vehicles or restrictions on the type of vehicle allowed to access an area.

7 Defra and DfT. (2017). UK plan for tackling roadside nitrogen dioxide concentrations. London: HMSO

3.2.3 Road to Zero Strategy

The 'Road to Zero' strategy[8] set out the governments aims regarding zero emissions vehicles. These include the aim that all new cars and vans have zero tailpipe emissions by 2040 and for almost every car to be zero emission by 2050. Measures are aimed at encouraging uptake of the cleanest vehicles and support for the electric charging infrastructure.

3.2.4 Clean Air Strategy

The Clean Air Strategy[9] sets out policies to lower national emissions of pollutants in order to reduce background pollution and human exposure. It aims to create a strong framework to tackle air pollution and to reduce the number of people living in locations with $PM_{2.5}$ concentrations exceeding 10 µg/m^3 by 50% by 2025.

3.3 Planning Policy

3.3.1 National Planning Policy

The National Planning Policy Framework (NPPF)[10] sets out the Government's planning policies for England and how these are expected to be applied. At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the NPPF with the objective of contributing to the achievement of sustainable development.

The NPPF states that the planning system has three overarching objectives in achieving sustainable development including a requirement to *'contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy*.'

Under Section 15: Conserving and Enhancing the Natural Environment, the NPPF (paragraph 174) requires that *'planning policies and decisions should contribute to and enhance the natural local environment by …preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible help to improve local environmental conditions such as air and water quality*.'

In dealing specifically with air quality the NPPF (paragraph 186) states that *'planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*.'

8 HM Government. (2018). Road to Zero Strategy. London: HMSO

9 Defra. (2019). Clean Air Strategy. London: HMSO

10 Ministry of Housing, Communities and Local Government: National Planning Policy Framework (July 2021)

Paragraph 188 states that *'the focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively'*.

3.4 Control of Dust and Particulates Associated with Construction

Section 79 of the Environmental Protection Act (1990)[11] states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

- *'any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and*
- *'any accumulation or deposit which is prejudicial to health or a nuisance'.*

Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses. In the context of the proposed development, the main potential for nuisance of this nature would arise during the construction phase - potential sources being the clearance, earthworks, construction and landscaping processes.

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist - 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates. However, impacts remain subjective and statutory limits have yet to be derived.

3.5 Local Planning Policy

3.5.1 Charnwood Local Plan 201 to 2028 Core Strategy

The Charnwood Local Plan 2001 to 2028 Core Strategy[12], adopted in November 2015, sets out the vision, objectives and strategic policies for delivering growth for Charnwood. There are no policies within the Core Strategy that deal specifically with air quality. In the previous local plan air quality was dealt with under policy EV/39: Development and Pollution. This policy has been replaced within the Core Strategy by Policy CS 2 High Quality Design which sets out the following:

'We will require new developments to make a positive contribution to Charnwood resulting in places where people would wish to live through high quality, inclusive design and, where appropriate, architectural excellence. Proposals should respond positively to their context and reinforce a sense of place.

We will require new developments to:

- *Respect and enhance the character of the area, having regard to scale, density, massing, height, landscape, layout, materials and access arrangements;*
- *Protect the amenity of people who live or work nearby and those who will live in the new development;*
- *Function well and add to the quality of an area, not just in the short term, but over the lifetime of the development;*

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11 Secretary of State, The Environment Act 1990 HMSO

12 Charnwood District Council, Charnwood Local Plan 2011 to 2028, Core Strategy, Adopted 9th November 2015

- *Provide attractive, well managed and safe public and private spaces;*
- *Provide well defined and legible streets and spaces that are easy to get around for all, including those with disabilities; and*
- *Reduce their impacts upon and be resilient to the effects of climate change in accordance with Policy CS16.*

We will do this by requiring independent design reviews for major or sensitive developments and using national design assessments to determine quality of new developments.'

In addition to the above Policy CS 16 Sustainable Construction and Energy sets out the following in relation to air quality:

'We will adapt to and mitigate against the effects of climate change by encouraging sustainable design and construction and the provision of renewable energy where it does not make development unviable. We will do this by……

- *Supporting new development that protects environmental resources including air quality'.*

3.6 Air Quality Guidance

3.6.1 DEFRA Technical Guidance, LAQM.TG(16)

Local authorities are seen to play a particularly important role in the improvement of air quality. Section 82 of the Environment Act 1995 requires every local authority to conduct a review of the air quality from time to time within the authority's area. The recently released DEFRA technical guidance, LAQM.TG(16), describes a new streamlined approach to the Local Air Quality Management (LAQM) regime, whereby every authority has to undertake and submit a single Annual Status Report/Annual Progress Report within its area, to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an Air Quality Management Area (section 83 of the Act) and prepare an action plan (section 84) which identifies measures that will be introduced in pursuit of the objectives.

3.6.2 IAQM Land-Use Planning and Development Control: Planning for Air Quality

The Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) have published joint guidance on the assessment of air quality impacts for planning purposes[13] . This includes information on when an air quality assessment is required, what should be included in an assessment and criteria for assessing the significance of any impacts.

3.6.3 IAQM Guidance on the Assessment of Dust from Demolition and Construction

Guidance produced by the IAQM on assessing impacts from construction and demolition activities[14] includes a methodology for identifying the risk magnitude of potential dust sources associated with demolition, construction, earthworks and trackout. This is then used to identify the level of mitigation necessary in order for the impacts to be not significant.

13 EPUK & IAQM (2017) Land Use Planning & Development Control: Planning for Air Quality, January 2017

14 IAQM (2014) Guidance on the Assessment of Dust from Demolition and Construction Version 1.1 , February 2014

4 Methodology

4.1 Construction Impact Assessment

4.1.1 Construction Traffic

During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery may also work on site including generators and cranes. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

Based on the development proposals it is anticipated that there would be no more than 15-20 additional Heavy-Duty Vehicles (HDV) generated on the adjacent road network on any given day.

The IAQM air quality planning guidance sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are unlikely to occur where a development results in less than 25 HDV movements per day in locations within or adjacent to an AQMA and less than 100 HDV outside of an AQMA. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment.

4.1.2 Construction/Fugitive Dust Emissions

Construction phase activities associated with the Proposed Development may result in the generation of fugitive dust emissions (i.e. dust emissions generated by site-specific activities that disperse beyond the construction site boundaries).

If transported beyond the site boundary, dust can have an adverse impact on local air quality. The IAQM has published a guidance document for the assessment of demolition and construction phase impact[15].The guidance considers the potential for dust nuisance and impacts to human health and ecosystems to occur due to activities carried out during the following stages of construction:

- Demolition (removal of existing structures);
- Earthworks (soil-stripping, ground-leveling, excavation and landscaping);
- Construction (activities involved in the provision of a new structure); and
- Trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

A qualitative assessment of air quality impacts due to the release of fugitive dust and particulates (PM_{10}) during the construction phase was undertaken in accordance with the methodology detailed in the IAQM guidance.

The assessment takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels, thus enabling a level of risk to be assigned. Risks are described in terms of there being a low, medium or high risk of dust impacts.

Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined.

The IAQM assessment is undertaken where there are:

15 IAQM (June 2016) Guidance on the assessment of dust from demolition and construction Version 1.1

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

It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

A summary of the IAQM assessment methodology is provided in Appendix B.

4.1.3 Assessment of Significance

The IAQM assessment methodology recommends that significance criteria are only assigned to the identified risk of dust impacts occurring from a construction activity following the application of appropriate mitigation measures. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effects will normally be negligible.

4.2 Operational Impact Assessment

4.2.1 Introduction

Potential impacts on air quality due to local traffic emissions have been predicted using the ADMS dispersion model (version 5.0.0.1, released March 2020, updated September 2020). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from the East Midlands Meteorological Station for 2019 has been used for the assessment.

Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in Table 3.1 for NO_2, PM_{10} and $PM_{2.5}$.

4.2.2 Emissions Data

The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) and particulate matter (PM_{10} and $PM_{2.5}$) at selected receptors.

The assessment has predicted air quality during 2019 for model verification. The emission factors released by Defra in November 2021, provided in the emissions factor toolkit EFT2021_v11.0[16] have been used to predict traffic related emissions of PM and NO_x.

Emission factors and background data used in the prediction of future air quality concentrations predict a gradual decline in pollution levels over time due to improved emissions from new vehicles and the gradual renewal of the vehicle fleet. In recent years the Defra emission factors published within the Emission Factor Toolkits (EFT) have been found to predict lower NO_x concentrations in

16 https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

future years compared to concentrations measures at roadside locations across the UK. However, research carried out by Air Quality Consultants Ltd (AQC) has now shown that emissions of NO_x from vehicles within the recently released EFT are now matching concentrations recorded at roadside locations between 2013 to 2019. The report[17] concludes that '*the EFT is now unlikely to over-state the rate at which NOx emissions decline into the future at an 'average' site in the UK. Indeed, the balance of evidence suggests that, on average, NOx concentrations are likely to decline more quickly in the future than predicted by the EFT'.* This has removed the need for the use of any sensitivity tests for future year scenarios.

In light of the above the relevant future year EFT emissions data have been used to predict concentrations in the 2024 future year scenario.

4.2.3 Background Concentrations

The ADMS model estimates concentrations arising as a result of vehicle emissions. It is necessary to add an estimate of local background concentrations to obtain the total concentration for comparison against the air quality objectives.

There is no background monitoring carried out by CDC in Syston of=r the surrounding area, the nearest being located in Loughborough. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ have therefore been taken from the Defra background maps[18.] For 2019 and 2024. To ensure a worst-case assessment 2019 background concentrations have been used for the 2024 assessment scenario.

The background data used in the modelling assessment is provided in Table 5.3.

4.2.4 Traffic Data

Traffic data for use in the assessment has been provided by DTA. The data is based on traffic surveys undertaken in 2017 and have been factored forward to 2019 and 2024 using appropriate TEMPro factors, to take account of expected growth from other development in the area.

Due to the Covid-19 pandemic it is not possible to make used of monitoring data from 2020 or 2021 for the model verification. Model verification, as discussed in section 4.2.6 below, therefore needs to be carried out using 2019 monitoring data, hence the provision of 2019 base data.

Trips associated with the proposed development, based on a total of 195 residential dwellings, which is anticipated to be the maximum number of properties for the Site, have been added to the 2024 base flows to provide the 'do something' scenario.

The traffic data used within the assessment are provided in Appendix C.

4.2.5 Model Outputs and Results Processing

The ADMS Model has predicted traffic related annual mean emissions of NO_x and PM at a number of receptors along the road links set out in Table 4.1. Relevant background concentrations have subsequently been added to the model outputs to provide the total concentrations of each pollutant.

The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator (Version 8.1, released August 2020) available on the Defra air quality website[19].

17 https://www.aqconsultants.co.uk/news/march-2020/defra%E2%80%99s-emission-factor-toolkit-now-matching-measu

18 https://uk-air.defra.gov.uk/data/laqm-background-home

19 http://uk-air.defra.gov.uk

Analysis of long-term monitoring data[20] suggests that if the annual mean NO_2 concentration is less than 60 µg/m^3 then the one-hour mean NO_2 objective is unlikely to be exceeded where road transport is the main source of pollution. Therefore, in this assessment the annual mean concentration has been used to screen whether the one-hour mean objective is likely to be achieved as recommended within LAQM.TG(16). Similar to NO_2, an annual mean PM_{10} concentrations below 32 µg/m^3 is used to screen whether the 24-hour PM_{10} mean objective is likely to be achieved, the approach also recommended within LAQM.TG(16).

4.2.6 Verification of Model Results

It is recommended that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

To verify the model results, the ADMS model has been used to predict NO_x concentrations at four monitoring sites located in the centre of Syston (Sites DT20, Dt21, DT32 and DT33, as detailed in the CDC 2021 Air Quality Annual Status Report[21]). See Appendix D for further details on the verification method.

There is no suitable monitoring of PM data to allow verification of the PM model results. However, LAQM.TG (16) suggests applying the NO_x adjustment factor to modelled road-PM where no appropriate verification against PM data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

4.2.7 Selection of Receptors

As set out in Table 3.2, LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations *'where members of the public are regularly present'* should be considered. At such locations, members of the public would be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

For instance, on a footpath, where exposure would be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term standards (such as 24-hour mean or annual mean) may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

For the completion of this assessment, air quality has been predicted at sensitive receptors (residential properties and educational facilities) located adjacent to the road links set out in Table

20 D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003).

21 Charnwood District Council, 2021 Air Quality Annual Status Reprot, Augist 2021

C1, Appendix C. Each receptor has been selected to represent worst-case exposure to local traffic emissions.

The details of each receptor are presented below in Table D1 and their locations shown in Figure D1, Appendix D.

4.2.8 Significance Criteria

The guidance issued by EPUK & IAQM relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

The guidance suggests expressing the magnitude of incremental change in concentrations as a proportion of an Air Quality Assessment Level (AQAL) such as the air quality objectives set out in Table 3.1.

The significance of impact is then identified based on the incremental change in the context of the new total concentrations and its relationship with the assessment criteria, noting whether the impact is adverse or beneficial based on a positive or negative change in concentrations. The criteria suggested for assigning significance is set out in Table 4.3 below.

To assess the overall significance of the predicted impact the assessment draws on the approach used for undertaking environmental impact assessments where a moderate and major impact is deemed to be significant while a minor or negligible impact would not be classed as significant.

Table 4.3: Impact Descriptors for Individual Receptors

Long-term Average Concentration at Receptor in Assessment Year	% Change in Concentrations Relative to Air Quality Assessment Level (AQAL)			
	1	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% of AQAL	Moderate	Substantial	Substantial	Substantial

AQAL – Air Quality Assessment Level which in this assessment refers to the Air Quality Objectives set out in Table 3.1

The percentage change in concentration should be rounded to a whole number

The table should only be used with annual mean concentrations

The descriptors are for individual receptors only: overall significance should be based on professional judgment

When defining the concentrations as a percentage of the AQAL use the 'without scheme' concentration where there is a decrease in pollutant concentrations and the 'with scheme' concentrations for an increase

The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure, less than 75% of this value i.e. well below, the degree of harm is likely to be small. As exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL

It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year, it is impossible to define the new total concentrations without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

5 Baseline Assessment

5.1 Charnwood Review and Assessment of Air Quality

CDC has completed a number of detailed assessments of air quality which has identified exceedances of the annual mean NO_2 objective limit at a number of locations across the district. This has resulted in the Council declaring two AQMA, one in the town centre of Loughborough and one covering residential properties on Melton Road and Sandford Road in the centre of Syston.

The Council have also declared an AQMA in the vicinity of the Great Central Railway due to exceedances of the Sulphur Dioxide (SO_2) 15-minute mean objective limit and on Mountsorrel due to exceedances of the 24-hour PM_{10} objective.

A map showing the location of the Syston AQMA is provided in Figure 5.1 below.

The Site does not fall within the AQMA and air quality outside of the AQMA has been found to be comfortably meeting the relevant air quality objective limits.

Figure 5.1: Location of Syston AQMA

5.2 Air Quality Monitoring

5.2.1 Nitrogen Dioxides

NO_2 is monitored by CDC extensively across the borough using diffusion tubes. six of these sites are located in Syston, within the town centre. The location of the sites are shown in Figure 5.2.

Details of the sites and data recorded since 2016 is presented in Table 5.1.

Due to the Covid-19 pandemic and associated country-wide lockdowns, which resulted in a significant suppression of traffic movements, there was a significant reduction in air quality during both 2020 and 2021. The data for both years is not therefore representative of normal conditions. Although data for 2020 has been presented in Table 5.1 for consistency, only data up to and including 2019 has been used to inform the baseline assessment.

Diffusion tubes are a passive form of monitoring, which, due to their relative in-expense, allow for a much greater spatial coverage than with automatic monitoring sites. Diffusion tubes are acknowledged as a less accurate method of monitoring ambient air pollutants than automatic monitors, with diffusion tubes over or under estimating concentrations by as much as 30 %.

To allow the results to be reliably compared with the AQ Objectives, the data should be bias corrected using data collected from tubes co-located with continuous monitoring sites. The data provided below has been bias adjusted by CDC following recommended guidance.

Data recorded at all six monitoring locations shows annual mean NO_2 concentrations below the annual mean objective of 40 µg/m^3 since 2016 both within and outside the AQMA.

The data shows no continuous trend in concentrations since 2016 with some years recording a decline and others recoding an increase, however, overall concentrations in 2019 were lower than recorded in 2016.

It is not possible to monitor short-term NO_2 concentrations using diffusion tubes, however, as discussed previously, research has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations are below 60 µg/m^3. Based on the monitoring data presented in Table 5.1, it is unlikely that the short-term objective is being exceeded.

Table 5.1: Diffusion Tube annual average nitrogen dioxide concentrations (µgm^{-3})

Site	Classification	Year				
		2016	2017	2018	2019	2020[1]
DT19 – Melton Road Town Centre	R	31.7	33.2	26.1	27.0	19.1
DT20 – 1123 Melton Road	R	27.3	29.8	24.1	24.1	17.5
DT21 – 1116 Melton Road	R	35.8	37.2	32.1	34.2	23.7
DT32 – High Street	R	28.5	32.2	26.0	25.7	18.3
DT33/34/35 – Syston AQMS 3	R	29.8	34.1	26.8	28.1	21.1
DT44 – 3 Simpson Close	R	26.5	28.0	20.8	21.5	15.2

R – Roadside

[1] during 2020 there was a significant decline in pollution levels across the country due to the Covid-19 pandemic and associated lockdowns and travel restrictions. Data recorded during 2020 is not therefore considered representative of 'normal' conditions. Data for 2020 has therefore been presented for consistency but has not been used to assess baseline air quality for assessment purposes.

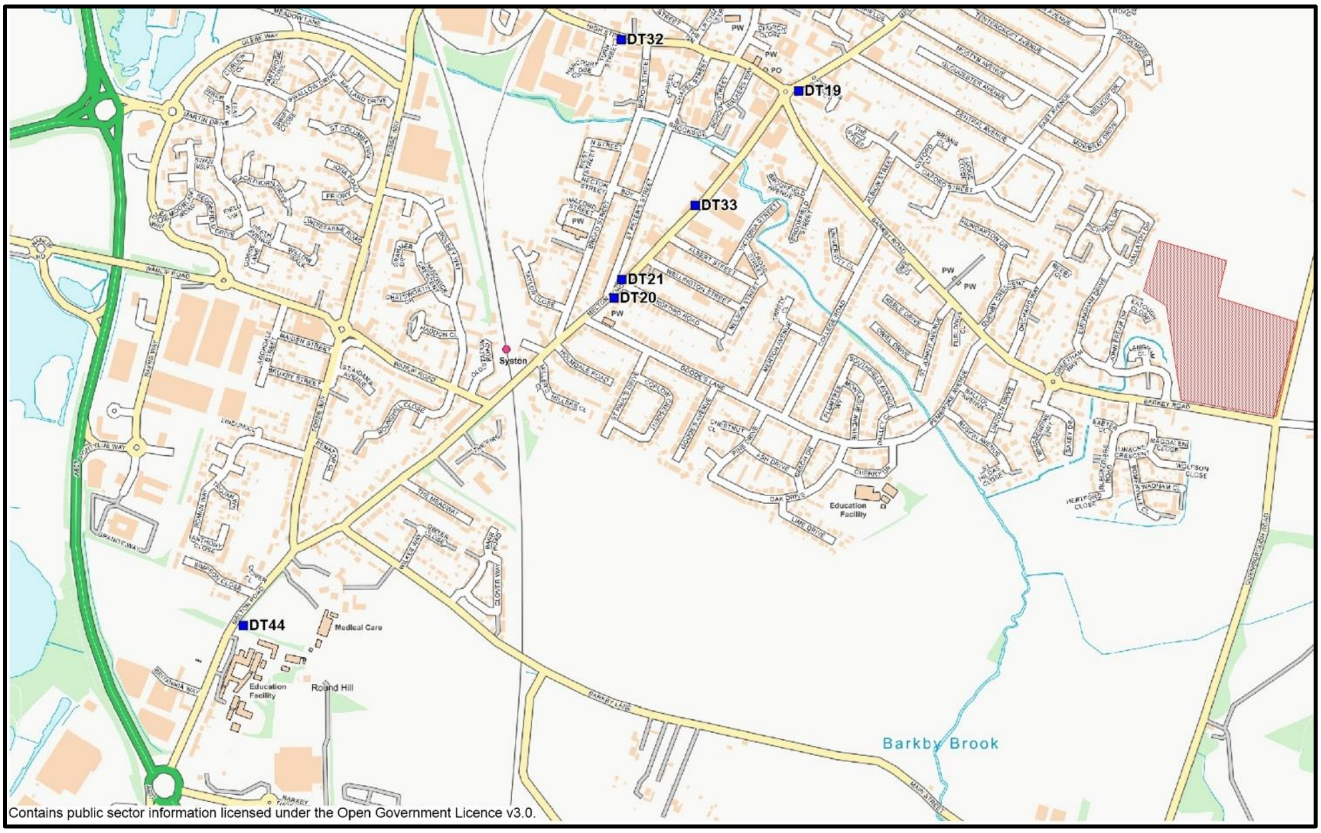


Figure 5.2: Location of Monitoring Sites

5.2.2 Particulate Matter

CDC do not undertake any monitoring of PM_{10} or $PM_{2.5}$ concentrations within Syston. The monitor PM_{10} concentrations in Mountsorrel, however this is classed as an industrial site due to significant industrial sources close by. This site is not therefore considered representative of conditions within Syston.

The air quality review and assessment process, carried out by CDC over a significant period of years has not identified any exceedances of either pollutant within the district.

5.3 Predicted Baseline Concentrations

Pollutant concentrations predicted as part of the detailed modelling exercise in 2019 and the future 2024 Do Minimum scenario are set out in Table 5.2.

The data shows that predicted annual mean PM_{10} and $PM_{2.5}$ concentrations are meeting the relevant objective limits set out in Table 3.1 across the study area (Receptors presented in Figure D1, Appendix D). Annual mean NO_2 concentrations are also predicted to be below the objective limit at all receptor locations in the 2019 base year with the exception of receptor 31, located on the High Street with the building façade fronting immediately onto the road. However, by 2024 concentrations are predicted to have declined to below the objective at this location.

As annual mean NO_2 concentrations are predicted to be below 60 µg/m^3, concentrations are also meeting the short-term objective limit for NO_2.

Predicted annual mean PM_{10} concentrations are predicted to be less than 32 µg/m^3, concentrations are also meeting the short-term objective limit for PM_{10}.

The data shows no change in concentrations of PM_{10} and $PM_{2.5}$ between the 2019 and 2024 base years. In contrast NO_2 are predicted to decline between the two base years at all receptor locations. This is due to improvements within the emissions of fuel driven vehicles in conjunction with an increase in the number of low emissions and electric vehicles within the vehicle fleet in future years. As vehicle related emissions make up a significant smaller proportion of total PM matter compared to NO_2, the reductions in vehicle emissions are not seen to such an extend in future PM concentrations.

Table 5.2: Predicted Annual Mean Baseline Air Quality μg/m³)(						
Receptor	**2019 Baseline**			**2024 Do Minimum**		
	NO_2	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
R1	19.8	15.3	9.2	18.2	15.3	9.2
R2	15.5	15.0	9.2	14.4	15.0	9.2
R3	179	15.8	9.6	15.9	15.8	9.6
R4	15.3	15.3	9.4	14.2	15.3	9.4
R5	16.4	15.5	9.5	14.9	15.5	9.5
R6	18.3	15.9	9.7	16.1	15.9	9.7
R7	17.6	15.8	9.6	15.7	15.8	9.6
R8	22.7	15.2	10.0	20.0	15.2	9.9
R9	22.1	15.1	9.9	19.7	15.1	9.9
R10	30.6	16.5	10.7	25.1	16.5	10.6
R11	28.4	16.1	10.5	23.5	16.1	10.4
R12	24.4	15.4	10.1	20.9	15.4	10.0
R13	23.4	15.3	10.0	20.3	15.3	10.0
R14	22.7	15.2	9.9	19.9	15.2	9.9
R15	30.5	16.7	10.8	24.8	16.7	10.7
R16	30.8	16.7	10.8	24.9	16.7	10.8
R17	29.1	16.4	10.6	23.9	16.4	10.6
R18	29.4	16.4	10.7	24.1	16.4	10.6
R19	27.1	15.8	10.3	22.6	15.8	10.2
R20	27.2	16.5	10.4	22.4	16.5	10.4
R21	23.1	15.7	10.0	20.0	15.7	9.9
R22	23.4	15.3	10.0	20.4	15.3	10.0
R23	19.4	14.7	9.6	18.0	14.7	9.6
R24	17.2	15.9	9.7	16.2	16.0	9.7

Table 5.2: Predicted Annual Mean Baseline Air Quality µg/m³)(						
Receptor	**2019 Baseline**			**2024 Do Minimum**		
	NO_2	**PM_{10}**	**$PM_{2.5}$**	**NO_2**	**PM_{10}**	**$PM_{2.5}$**
R25	15.8	15.1	9.8	14.6	15.1	9.8
R26	14.9	14.9	9.4	14.0	14.9	9.4
R27	16.3	15.5	9.5	14.9	15.5	9.5
R28	24.6	15.4	10.1	20.9	15.4	10.0
R29	28.8	16.1	10.5	23.4	16.1	10.4
R30	27.7	16.1	10.5	22.8	16.1	10.4
R31	**40.8**	18.7	12.0	31.0	18.7	11.8
R32	32.0	16.9	11.0	25.5	16.9	10.9
R33	28.4	16.3	10.6	23.2	16.2	10.5
R34	31.9	16.9	10.9	25.4	16.9	10.8
R35	25.0	16.4	10.4	21.7	16.4	10.4
R36	28.2	17.0	10.8	23.7	17.0	10.7
R37	23.4	16.1	10.3	20.7	16.1	10.2

5.4 DEFRA Background Maps

Additional information on estimated background pollutant concentrations has been obtained from the DEFRA background maps provided on UK-AIR, the Air Quality Information Resource (http://uk-air.defra.gov.uk). Estimated air pollution concentrations for oxides of nitrogen (NO_x), NO_2, PM_{10} and $PM_{2.5}$ have been extracted from the 2018 based background pollution maps for the UK, which were published in August 2020[22]. The maps are available in 1 km x 1 km grid squares and provide an estimate of concentrations between 2018 and 2030. Concentrations have been taken from the 2019 and 2024 maps from the grid squares which represent the Site and road network considered within the assessment.

The NO_x and PM background maps are provided not only as total concentrations but are also broken down into sector contributions (i.e. primary A roads and brake tyre). However, as this assessment is considering the impact of the proposed development on existing air quality, background concentrations from all sources should be considered. Therefore, data presented in Table 5.3 provides total background concentrations for all three pollutants.

The data indicates that background concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the vicinity of the Site are well below the annual mean objectives.

22 https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

Table 5.3: Annual Mean Background Air Pollution Concentrations						
OS Grid Square	2019			2024		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
461500, 310500	14.8	14.4	9.2	12.3	13.5	8.6
462500, 310500	14.4	15.6	9.5	12.3	14.6	8.9
463500, 310500	12.4	14.6	9.2	10.6	13.7	8.3
461500, 311500	16.9	15.1	9.7	13.9	14.2	9.0
462500, 311500	15.6	14.1	9.3	13.3	13.2	8.6
463500, 311500	12.4	15.0	9.2	10.5	14.1	8.5

5.5 Air Quality at the Development Site

The Site is located on the eastern edge of the town. Pollution concentrations along the eastern boundary of the Site will be most influenced by emissions associated with vehicles using Queniborough Road while concentrations along the southern boundary of the Site will be most influenced by vehicles using Barkby Road. However, pollutant levels are known to decline rapidly away from an emission source, falling to background levels within 100-200 m of a roadside location. Annual mean NO_2 concentrations along the eastern and southern boundaries of the Site are expected to be no higher than concentrations recorded at the monitoring sites presented in Table 5.1 and therefore are expected to be below the annual mean and 1-hour NO_2 objectives.

In terms of PM_{10} and $PM_{2.5}$, based on the outcome of the CDC air quality review and assessment process, concentrations of both pollutants are also expected to be meeting the relevant objective limits across the Site.

6 Construction Impacts

6.1 Site and Surroundings

A summary of the proposed development is provided in Section 2 of this report.

The Site covers an area of approximately 892,000 m^2 and there are residential properties located within 350 m of the Site. An assessment of construction related impacts in relation to human receptors has therefore been undertaken.

Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50 m from the site boundary. A review of data held on the DEFRA MAGIC website[23] shows that there are no designated nature conservation areas within 50 m of the Site boundary. Impacts on ecological receptors would not therefore be significant and has been scoped out for further assessment.

As discussed in Section 5, the PM_{10} concentrations, taken from the Defra background maps, in the vicinity of the Site are expected to be below the relevant objective limits (Table 5.2). The data indicates background concentrations in the region of 14-16 µg/m^3 at the Site. Based on professional judgment, it is anticipated that PM_{10} concentrations at the Site and at adjacent properties are unlikely to be much higher than background, therefore PM_{10} concentrations are expected to be below 24µg/m^3.

The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

A windrose from the East Midlands Airport Meteorological Station is provided in Figure 6.1, which shows that prevailing winds are from the south-west. Areas most consistently affected by dust are influenced by prevailing winds that are generally located downwind of an emission source. Therefore, the highest risk of impacts would occur at receptors to the north-east of the Site. The mainland-use to the north-east is grass and agricultural land which has a low sensitivity to dust effects.

23 http://magic.defra.gov.uk/

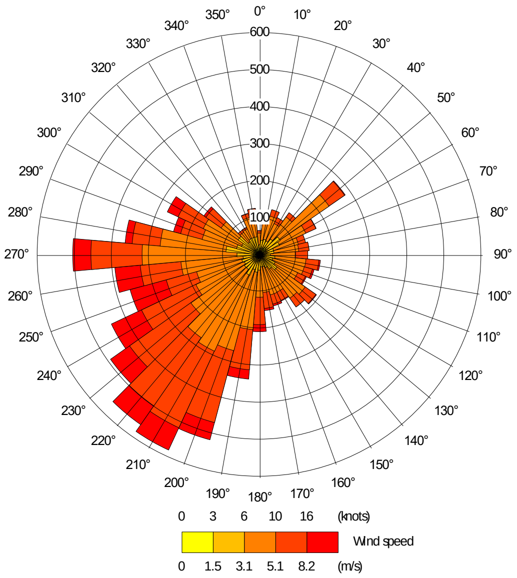


Figure 6.1: Windrose from East Midlands Airport Meteorological Station (2019)

6.2 Risk Assessment of Dust Impacts

6.2.1 Defining the Dust Emission Magnitude

With reference to the criteria detailed in Appendix B, the dust emission magnitude for each of the category's demolition, earthworks, construction and trackout have been determined. These have been summarised in Table 6.1.

Table 6.1: Dust Emission Magnitudes		
Activity	**Criteria**	**Dust Emission Magnitude**
Demolition	No properties need demolishing within the Site	**n/a**
Earthworks	Building site area approximately 892,000 m^2, expected >10 HDV on site.	**Large**
Construction	Building volume >100,000m^3, main construction material brick and concrete	**Large**
Trackout	Between 15-20 HDV (>3.5t) movements per day	**Medium**

6.2.2 Sensitivity of Surrounding Area

Using the criteria set out in Tables B2 to B4 in Appendix B, the sensitivity of the surrounding area to impacts from dust emissions has been determined and are set out in Table 6.2.

Dust Soiling

There are residential properties in close proximity to the Site, although only 2-3 are within 20 m of the Site boundary, with 18-20 within 50 m. The sensitivity of the surrounding area in relation to dust soiling effects is therefore considered to be medium.

It is anticipated that there will be between 15-20 HDV (>3.5t) movements per day during the construction phase which will travel to and from the Site along Barkby Road. As a general guide, significant impacts from trackout may occur up to 500 m from large sites, 250 m from medium sites and 50 m from small sites, as measured from the site exit. There are residential receptors located along Barkby Road to the west of the Site within 20 m of the roadside and within 500 m of the Site access point. The sensitivity of the area to dust soiling effects from trackout is therefore considered to be high.

PM_{10} Effects

As previously discussed, annual mean PM_{10} concentrations in the vicinity of the Site are expected to be below 24 µg/m^3. Based on the proximity of sensitive receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be low with regards human health impacts.

Table 6.2: Sensitivity of Receptors		
Potential Impact		**Sensitivity at Site**
Dust Soiling (earthworks and construction)	Receptor Sensitivity	High
	Number of Receptors	2-3 within 20 m, >10 within 50 m
	Sensitivity of the area	**Medium**
Dust Soiling (trackout)	Receptor Sensitivity	High
	Number of Receptors	>10 within 20 m and within 500 m of site access point
	Sensitivity of the area	**High**
Human Health (earthworks and construction)	Receptor Sensitivity	High
	Annual Mean PM_{10} Concentration	< 24 µg/m^3
	Number of Receptors	2-3 within 20 m, >10 within 50 m
	Sensitivity of the area	**Low**
Human Health (trackout)	Receptor Sensitivity	High
	Annual Mean PM_{10} Concentration	< 24 µg/m^3
	Number of Receptors	>10 within 20 m and within 500 m of site access point
	Sensitivity of the area	**Low**

6.3 Defining the Risk of Impacts

The dust emission magnitude as set out in Table 6.1 is combined with the sensitivity of the area (Table 6.2) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site. The risk of impacts associated with each activity is provided in Table 6.3 below and has been used to identify site-specific mitigation measures, which are discussed in Section 9.1.1 and set out in Appendix E.

Table 6.3: Summary of Effects Without Mitigation		
Source	**Dust Soiling**	**PM_{10} Effect**
Demolition	n/a	n/a
Earthworks	Medium Risk	Low Risk
Construction	Medium Risk	Low Risk
Trackout	Medium Risk	Low Risk

7 Operational Impacts

7.1.1 Existing Receptors

Nitrogen Dioxide

Annual mean NO_2 concentrations predicted at the selected existing receptor locations are presented below in Table 7.1.

The modelling assessment is predicting annual mean NO_2 concentrations below the annual mean objective of 40 µg/m^3 (AQAL) at all the selected receptors in both the DM and DS scenarios.

Traffic generated by the operational development is predicted to increase annual mean NO_2 concentrations by up to 0.5 µg/m^3. This equates to an increase of no more than 1 % of the AQAL and are classed as being of negligible significance based on the criteria set out in Table 4.3.

The highest impacts are predicted at receptors adjacent to Barkby Road, which would experience the highest increase in vehicle movements as a result of the operational development.

With predicted annual mean concentrations being less than 60 µg/m^3, it is expected that the hourly objective of 200 µg/m^3 will also be met at all locations and impacts in terms of short-term NO_2 would be negligible.

Table 7.1: Predicted Annual Mean NO_2 Concentrations at Existing Receptors (µg/m^3)

Receptor	2024 Do Minimum	2024 Do Something	Change due to Proposed Development as a % of AQAL	Significance of Impact
R1	18.2	18.2	0	Negligible
R2	14.4	14.7	1	Negligible
R3	15.9	16.4	1	Negligible
R4	14.2	14.4	0	Negligible
R5	14.9	15.1	0	Negligible
R6	16.1	16.3	1	Negligible
R7	15.7	15.9	0	Negligible
R8	20.0	20.3	1	Negligible
R9	19.7	19.8	0	Negligible
R10	25.1	25.5	1	Negligible
R11	23.5	23.7	1	Negligible
R12	20.9	21.0	0	Negligible
R13	20.3	20.3	0	Negligible
R14	19.9	19.9	0	Negligible
R15	24.8	24.8	0	Negligible
R16	24.9	25.0	0	Negligible

Table 7.1: Predicted Annual Mean NO_2 Concentrations at Existing Receptors (µg/m^3)				
Receptor	2024 Do Minimum	2024 Do Something	Change due to Proposed Development as a % of AQAL	Significance of Impact
R17	23.9	24.0	0	Negligible
R18	24.1	24.3	0	Negligible
R19	22.6	22.7	0	Negligible
R20	22.4	22.6	0	Negligible
R21	20.0	20.1	0	Negligible
R22	20.4	20.6	0	Negligible
R23	18.0	18.1	0	Negligible
R24	16.2	16.3	0	Negligible
R25	14.6	14.8	0	Negligible
R26	14.0	14.1	0	Negligible
R27	14.9	15.0	0	Negligible
R28	20.9	21.1	0	Negligible
R29	23.4	23.6	0	Negligible
R30	22.8	23.0	1	Negligible
R31	31.0	31.4	1	Negligible
R32	25.5	25.7	0	Negligible
R33	23.2	23.4	1	Negligible
R34	25.4	25.6	0	Negligible
R35	21.7	21.8	0	Negligible
R36	23.7	23.8	0	Negligible
R37	20.7	20.8	0	Negligible

***PM_{10}* Concentrations**

Predicted annual mean PM_{10} concentrations at the selected existing receptor locations are presented below in Table 7.2.

The ADMS model is predicting annual mean PM_{10} concentrations at less than 75% of the AQAL of 40 µg/m^3 at all receptor locations.

Traffic generated by the operational development is predicted to increase annual mean PM_{10} concentrations by no more than 0.1 µg/m^3, which is less than 1% of the AQAL and therefore classed as a negligible impact based on criteria set out in Table 4.3.

As discussed in section 4.2.5, where annual mean PM_{10} concentrations fall below 32 µg/m^3, exceedance of the 24-hour objective is considered unlikely. As annual mean concentrations are below this threshold at all the selected receptors, concentrations are predicted to be meeting the 24-hour objective limit of 50 µg/m³.

Table 7.2: Predicted Annual Mean PM_{10} Concentrations at Existing Receptors (µg/m³)				
Receptor	**2024 Do Minimum**	**2024 Do Something**	**Change due to Proposed Development as a % of AQAL**	**Significance of Impact**
R1	15.3	15.3	0	Negligible
R2	15.0	15.1	0	Negligible
R3	15.8	15.9	0	Negligible
R4	15.3	15.3	0	Negligible
R5	15.6	15.6	0	Negligible
R6	15.9	16.0	0	Negligible
R7	15.8	15.8	0	Negligible
R8	15.2	15.3	0	Negligible
R9	15.1	15.1	0	Negligible
R10	16.5	16.6	0	Negligible
R11	16.1	16.1	0	Negligible
R12	15.4	15.4	0	Negligible
R13	15.3	15.3	0	Negligible
R14	15.2	15.2	0	Negligible
R15	16.7	16.7	0	Negligible
R16	16.7	16.7	0	Negligible
R17	16.4	16.4	0	Negligible
R18	16.4	16.4	0	Negligible
R19	15.8	15.8	0	Negligible
R20	16.5	16.5	0	Negligible
R21	15.7	15.7	0	Negligible
R22	15.3	15.3	0	Negligible
R23	14.7	14.7	0	Negligible
R24	16.0	16.0	0	Negligible
R25	15.1	15.1	0	Negligible
R26	14.9	14.9	0	Negligible
R27	15.5	15.5	0	Negligible

Table 7.2: Predicted Annual Mean PM_{10} Concentrations at Existing Receptors (µg/m^3)				
Receptor	2024 Do Minimum	2024 Do Something	Change due to Proposed Development as a % of AQAL	Significance of Impact
R28	15.4	15.4	0	Negligible
R29	16.1	16.1	0	Negligible
R30	16.1	16.1	0	Negligible
R31	18.7	18.8	0	Negligible
R32	16.9	17.0	0	Negligible
R33	16.2	16.3	0	Negligible
R34	16.9	17.0	0	Negligible
R35	16.4	16.4	0	Negligible
R36	17.0	17.0	0	Negligible
R37	16.1	16.1	0	Negligible

7.1.2 $PM_{2.5}$ Concentrations

Predicted annual mean $PM_{2.5}$ concentrations at the selected existing receptor locations are presented below in Table 7.3.

The ADMS model is predicting annual mean $PM_{2.5}$ concentrations at less than 75% of the AQAL of 25 µg/m^3 at all receptors.

The operational development is predicted to increase/decrease annual mean PM_{10} concentrations by no more than 0.1 µg/m^3, which is less than 1% of the AQAL and therefore classed as a negligible impact.

Table 7.3: Predicted Annual Mean $PM_{2.5}$ Concentrations at Existing Receptors (µg/m^3)				
Receptor	2024 Do Minimum	2024 Do Something	Change due to Proposed Development as a % of AQAL	Significance of Impact
R1	9.2	9.2	0	Negligible
R2	9.2	9.2	0	Negligible
R3	9.6	9.7	0	Negligible
R4	9.4	9.4	0	Negligible
R5	9.5	9.5	0	Negligible
R6	9.7	9.7	0	Negligible
R7	9.6	9.6	0	Negligible

Table 7.3: Predicted Annual Mean $PM_{2.5}$ Concentrations at Existing Receptors ($\mu g/m^3$)				
Receptor	2024 Do Minimum	2024 Do Something	Change due to Proposed Development as a % of AQAL	Significance of Impact
R8	9.9	9.9	0	Negligible
R9	9.9	9.9	0	Negligible
R10	10.6	10.7	0	Negligible
R11	10.4	10.4	0	Negligible
R12	10.0	10.0	0	Negligible
R13	10.0	10.0	0	Negligible
R14	9.9	9.9	0	Negligible
R15	10.7	10.7	0	Negligible
R16	10.8	10.8	0	Negligible
R17	10.6	10.6	0	Negligible
R18	10.6	10.6	0	Negligible
R19	10.2	10.2	0	Negligible
R20	10.4	10.4	0	Negligible
R21	9.9	9.9	0	Negligible
R22	10.0	10.0	0	Negligible
R23	9.6	9.6	0	Negligible
R24	9.7	9.7	0	Negligible
R25	9.8	9.8	0	Negligible
R26	9.4	9.4	0	Negligible
R27	9.5	9.5	0	Negligible
R28	10.0	10.0	0	Negligible
R29	10.4	10.4	0	Negligible
R30	10.4	10.4	0	Negligible
R31	11.8	11.9	0	Negligible
R32	10.9	10.9	0	Negligible
R33	10.5	10.5	0	Negligible
R34	10.8	10.8	0	Negligible
R35	10.4	10.4	0	Negligible
R36	10.7	10.7	0	Negligible
R37	10.2	10.2	0	Negligible

7.1.3 Proposed Receptors (Exposure Assessment)

Annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations have been predicted at three receptor locations represented the development site, as detailed in Appendix D. The predicted concentrations are set out in Table 7.4.

Concentrations of all three pollutants are predicted to be well below the relevant annual mean and short-term objective limits at these three receptors, indicating that concentrations at the Site will be well below the objectives. The impact of the development in terms of new exposure would therefore be negligible.

Table 7.4: Predicted Annual Mean Concentrations at Proposed Development Site in 2024 with Development in Operation (µg/m³)

Receptor	NO_2	PM_{10}	$PM_{2.5}$
P1	14.7	15.1	9.5
P2	16.7	15.6	9.8
P3	15.3	15.7	9.6

8 Mitigation Measures

8.1 Mitigation Measures

8.1.1 Construction Phase

The control of dust emissions from construction site activities relies upon management provisions and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

The proposed development has been identified as a medium risk site for dust soiling effects during earthworks, construction and track and a negligible risk site during demolition as set out in Table 6.3.

The developer should therefore implement appropriate dust and pollution control measures as set out within the IAQM guidance. A summary of these measures is set out in Appendix F. The proposed measures should be set out within a CMP and approved by CDC prior to commencement of any work on site.

Following implementation of the measures recommended for inclusion within the CMP the impact of emissions during construction of the proposed development would be negligible.

8.1.2 Operational Phase

The impact of emissions associated with operational traffic has been assessed as not significant due to local pollution levels remaining below the relevant air quality objectives for NO_2, PM_{10} and $PM_{2.5}$. No mitigation of operational impacts is therefore considered necessary. However, the current concept plan, as set out in Figure 2.2 incorporates pedestrian and cycle links with both the adjacent road network to the south and the adjoining residential areas which will encourage the use of more sustainable travel modes by future occupants of the Site. It is also anticipated that the final development will incorporate EV charging points in accordance with local policy and will have a travel plan in place to encourage alternative modes of transport and further reduce emissions generated by the Site.

8.2 Residual Effects

8.2.1 Construction Phase

The greatest potential for dust nuisance problems to occur would generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

By following the mitigation measures outlined within this appraisal the impact would be substantially minimised and residual impacts are unlikely to be significant.

8.2.2 Operational Phase

Residual impacts of the development are considered to be not significant with regards human health at the Site and during the operational phase of the development

9 Conclusion

Kairus Ltd was commissioned by Taylor Wimpey UK Ltd to carry out an air quality assessment for the proposed development of land to the north of Barkby Road, Syston to provide up to 195 new residential dwellings.

It is inevitable that with any development construction activities would cause some disturbance to those nearby and the assessment has predicted a medium risk of significant effects impact prior to the implementation of any on-site mitigation. However, following the implementation of appropriate mitigation measures, which would be set out within a CMP, impacts associated with the construction of the development are likely to be insignificant.

The ADMS dispersion model has been used to predict the impact of the operational development on local NO_2, PM_{10} and $PM_{2.5}$ concentrations. The assessment concluded impacts on NO_2, PM_{10} and $PM_{2.5}$ concentrations would be not significant. Furthermore, the exposure assessment has concluded that the development would not introduce new receptors into a location or poor air quality and impacts associated with new exposure would be negligible.

Appendix A – Air Quality Terminology

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
μgm^{-3} micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B – IAQM Construction Dust Assessment Procedure

In order to assess the potential impacts, the activities on construction sites are divided into four categories. These are:

- demolition (removal of existing structures);
- earthworks (soil-stripping, ground-leveling, excavation and landscaping);
- construction (activities involved in the provision of a new structure); and
- trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

For each activity, the risk of dust annoyance, health and ecological impact is determined using three risk categories: low, medium and high risk. The risk category may be different for each of the four activities. The risk magnitude identified for each of the construction activities is then compared to the number of sensitive receptors in the near vicinity of the site in order to determine the risks posed by the construction activities to these receptors.

Step 1: Screen the Need for an Assessment

The first step is to screen the requirement for a more detailed assessment. An assessment is required where there is:

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

Step 2A: Define the Potential Dust Emission Magnitude

This is based on the scale of the anticipated works and the proximity of nearby receptors. The risk is classified as small, medium or large for each of the four categories.

Demolition: The potential dust emission classes for demolition are:

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

Earthworks: This involves excavating material, haulage, tipping and stockpiling. The potential dust emission classes for earthworks are:

- Large: Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;
- Medium: Total site area 2,500 m^2 – 10,000m^2, moderately dusty soil (e.g. silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4m – 8m in height, total material moved 20,000 tonnes- 100,000 tonnes; and
- Small: Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.

Construction: The important issues here when determining the potential dust emission magnitude include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. The categories are:

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

Trackout: The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout. The categories are:

- Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length > 100m;
- Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content, unpaved road length 50-100m; and
- Small: <10 HDV (>3.5t) outward movements 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 (PM_{10}) and ecological receptors. The sensitivity of the area takes into account the following factors:

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

Table B1 is used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Based on the sensitivities assigned to the different receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification can be defined for each. Tables B2 to B4 indicate the criteria used to determine the sensitivity of the area to dust soiling, human health and ecological impacts.

Table B1: Example of Factors Defining Sensitivity of an Area			
Sensitivity of Area	**Dust Soiling**	**Human Receptors**	**Ecological Receptors**
High	Users can reasonably expect 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. E.g. dwellings, museums and other important collections, medium and long term car parks and car showrooms.	10 – 100 dwellings within 20 m of site. Local PM_{10} concentrations close to the objective (e.g. annual mean 36 -40 µg/m^3). E.g. residential properties, hospitals, schools and residential care homes.	Locations with an international or national designation and the designated features may be affected by dust soiling. Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red List for Great Britain. E.g. A Special Area of Conservation (SAC).
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. E.g. parks and places of work.	Less than 10 receptors within 20 m. Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 µg/m^3). E.g. office and shop workers but will generally not include workers occupationally exposed to PM_{10} as protection is covered by the 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 E.g. 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. E.g. playing fields, farmland unless commercially sensitive horticultural, footpaths, short lived car [parks and roads.	Locations where human exposure is transient. No receptors within 20 m. Local PM_{10} concentrations well below the objectives (less than 75%). E.g. public footpaths, playing fields, parks and shopping streets.	Locations with a local designation where the features may be affected by dust deposition. E.g. Local Nature Reserve with dust sensitive features.

Table B2: Sensitivity of the Area to Dust Soiling on People and Property					
Receptor Sensitivity	**Number of Receptors**	**Distance 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 B3: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration**	**Number of Receptors**	**Distance from Source (m)**				
			<20	**<50**	**<100**	**<200**	**<350**
High	>32 µg/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	>32 µg/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 B4: Sensitivity of the Area to Ecological Impacts		
Receptor Sensitivity	**Distance from the Source (m)**	
	<20	**<50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Define the Risk of Impacts

The final step is to combine the dust emission magnitude determined in step 2A with the sensitivity of the area determined in step 2B to determine the risk of impacts with no mitigation applied. Tables B5 to B7 indicate the method used to assign the level of risk for each construction activity. The identified level of risk is then used to determine measures for inclusion within a site-specific Construction Management Plan (CMP) aimed at reducing dust emissions and hence reducing the impact of the construction phase on nearby receptors. The mitigation measures are drawn from detailed mitigation set out within the IAQM guidance document.

Table B5: Risk of Dust Impacts from Demolition			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

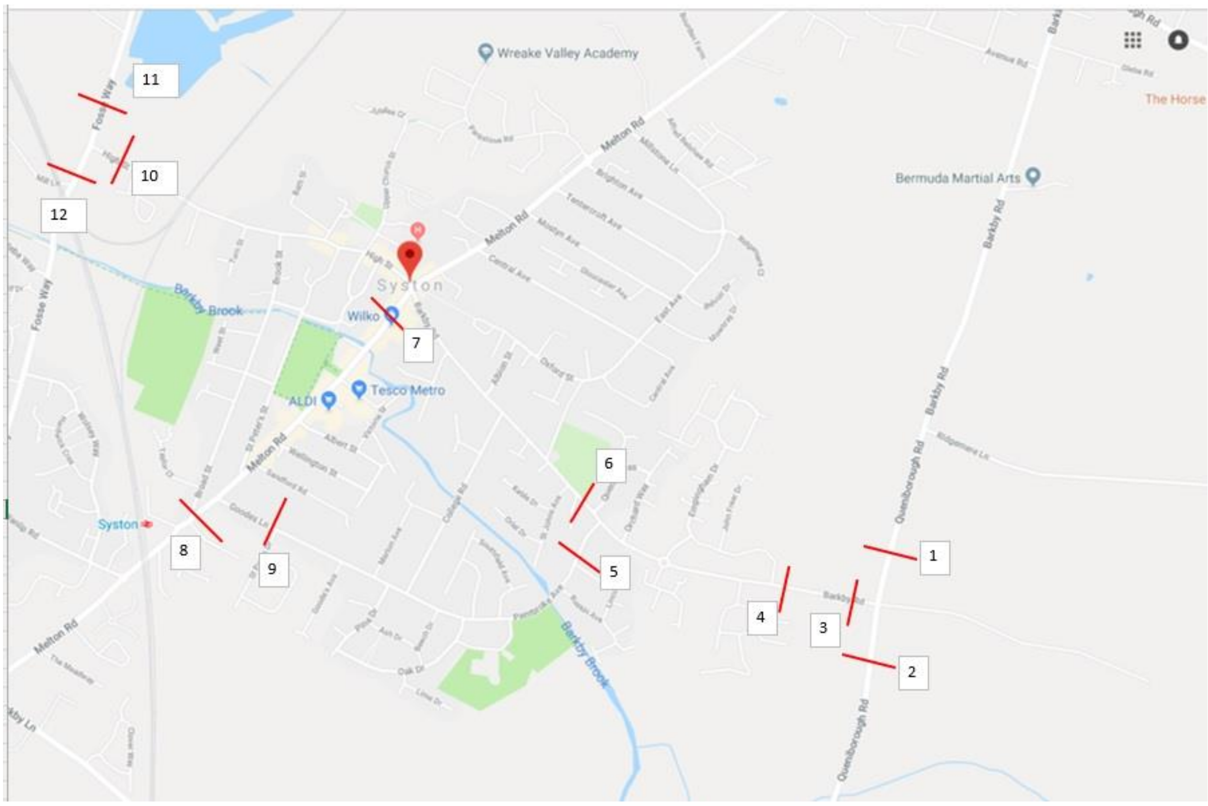
Table B6: Risk of Dust Impacts from Earthworks/ Construction			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table B7: Risk of Dust Impacts from Trackout			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Appendix C– traffic Data used in Modelling Assessment

Table C1: AADT traffic Flows used in ADMS Modelling Assessment							
Road Link	Speed (kph)	2019 Base		2024 Do Minimum		2024 Do Something	
		AADT	%HGV	AADT	%HGV	AADT	%HGV
Link 1 – Queniborough Road N		6,766	2.9	7,115	2.9	7,190	2.9
Link 2 – Queniborough Road S		9,355	2.3	9,838	2.3	10,217	2.3
Link 3 – Barkby Road E of Access		3,947	0.7	4,151	0.7	4,604	0.6
Link 4 – Barkby Road W of Access		3,947	0.7	4,151	0.7	4,811	0.6
Link 5 – Pembroke Avenue		3,613	1.6	3,800	1.6	4,097	1.5
Link 6 – Barkby Road W of Pembroke Avenue		5,731	2.2	6,026	2.2	6,389	2.1
Link 7 – Melton Road (S of Barkby Road)		12,761	4.3	13,419	4.3	13,451	4.3
Link 8 – Melton Road (S of Goodes Lane)		13,118	3.9	13,795	3.9	14,092	3.9
Link 9 – Goodes Lane		4,237	0.4	4,456	0.4	4,753	0.4
Link 10 – High Street		10,794	6.3	11,351	6.3	11,682	6.1
Link 11 – Fosse Way N		7,848	5.6	8,253	5.6	8,286	5.5
Link 12 – Fosse Way S		11,024	5.3	11,593	5.3	11,891	5.2

Figure C1: Location of Links Used in Roads Modelling

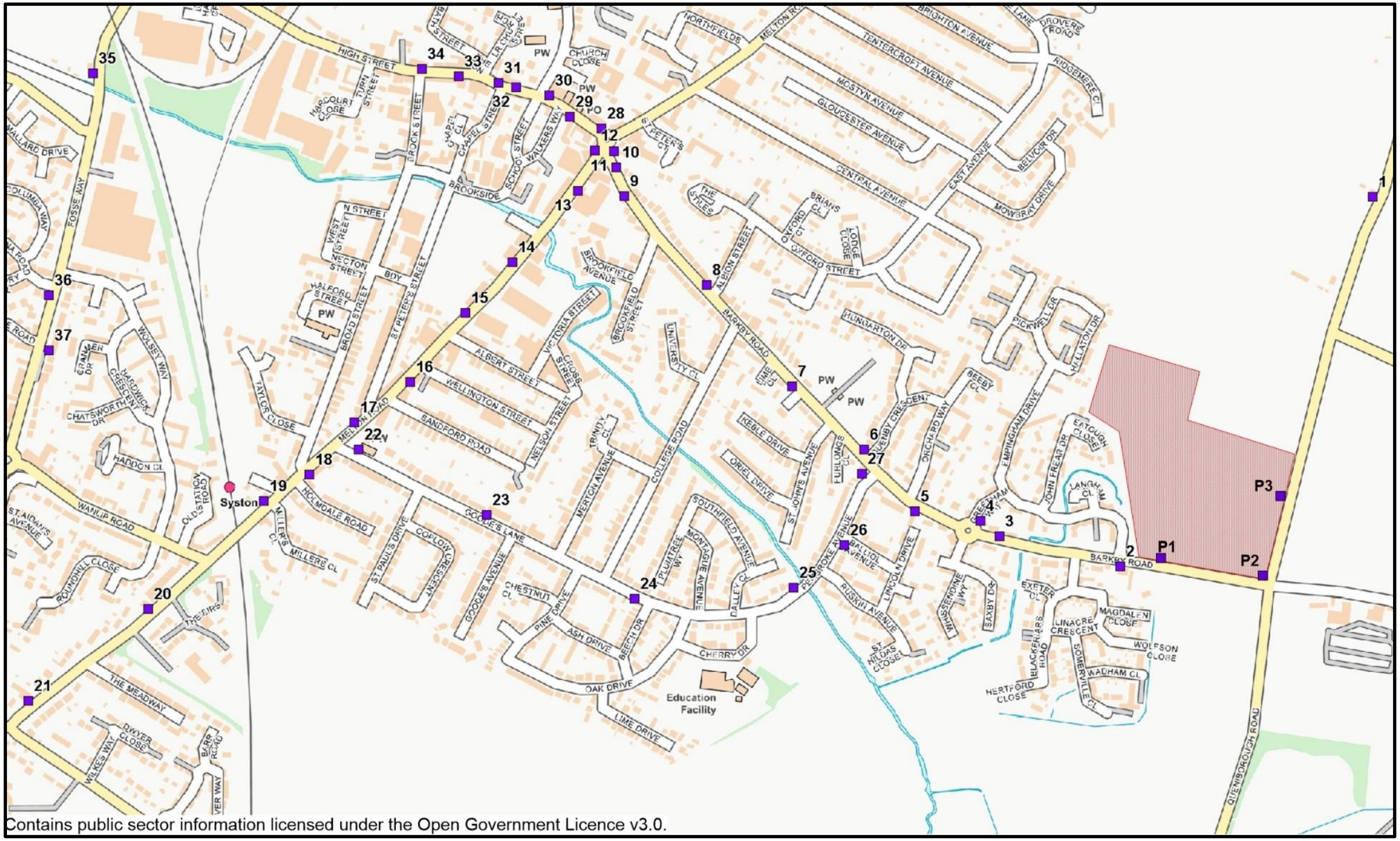


Appendix D– Receptors Used in ADMS Modelling

Table D1: Location of Receptors used in ADMS Modelling Assessment			
Receptor Number	**Receptor Location**	**OS Grid Reference**	**Receptor Height (m)**
R1	147 Barkby Road	464054, 311592	1.5
R2	Barkby Court	463623, 310960	1.5
R3	187a Barkby Road	463417, 311012	1.5
R4	1 Greetham Way	463384, 311038	1.5
R5	26 Lincoln Drive	463273, 311054	1.5
R6	2 Quenby Crescent	463186, 311160	1.5
R7	126 Barkby Road	463063, 311268	1.5
R8	73 Barkby Road	462918, 311441	1.5
R9	14 Barkby Road	462777, 311593	1.5
R10	9 Barkby Road	462763, 311642	1.5
R11	1259 Melton Road	462760, 311669	1.5
R12	4b Town Square	462727, 311671	4
R13	1235 Melton Road	462698, 311602	4
R14	Milton Travel 1st Floor	462586, 311480	4
R15	1166 Melton Road	462506, 311394	1.5
R16	8 Trafalgar Close	462412, 311276	1.5
R17	1108 Melton Road	462317, 311206	1.5
R18	1093 Melton Road	462240, 311117	1.5
R19	6 Courtyard Close	462162, 311072	1.5
R20	1068 Melton Road	461965, 310887	1.5
R21	1028 Melton Road	461760, 310731	1.5
R22	Syston Evangelical Church	462324, 311160	1.5
R23	41 Goodes Lane	462543, 311048	1.5
R24	Syston Lodge Farm	462795, 310905	1.5
R25	47 Pembroke Avenue	463066, 310924	1.5
R26	18 Pembroke Avenue	463153, 310997	1.5
R27	3 Pembroke Avenue	463183, 311119	1.5
R28	Fox 7 Hounds	462738, 311708	4
R29	21 High Street	462684, 311728	1.5
R30	Methodist Church	462649, 311765	1.5

Table D1: Location of Receptors used in ADMS Modelling Assessment			
Receptor Number	**Receptor Location**	**OS Grid Reference**	**Receptor Height (m)**
R31	36 High Street	4252, 31178	1.5
R32	28 High Street	462592, 31179	1.5
R33	67 High Street	46245, 3179	1.5
R34	64 High Street	462432, 31810	1.5
R35	201 Fosse Way	461871, 311805	1.5
R36	1 Iona Road	461795, 311423	1.5
R37	124 Fosse Way	461796, 311330	1.5
P1	Proposed Development	463698, 310972	1.5
P2	Proposed Development	463867, 310944	1.5
P3	Proposed Development	463890, 311033	1.5

Figure D1: Location of Receptors used in Modelling



Appendix E– Verification and Adjustment of Modelled Concentrations

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions.

Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

Verification of the model results has been carried out against the four monitoring sites located in the centre of Syston (Sites DT20, DT21, DT32 and DT33).

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Figure E1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the DEFRA NO_x from NO_2 calculator available on the UK-AIR website.

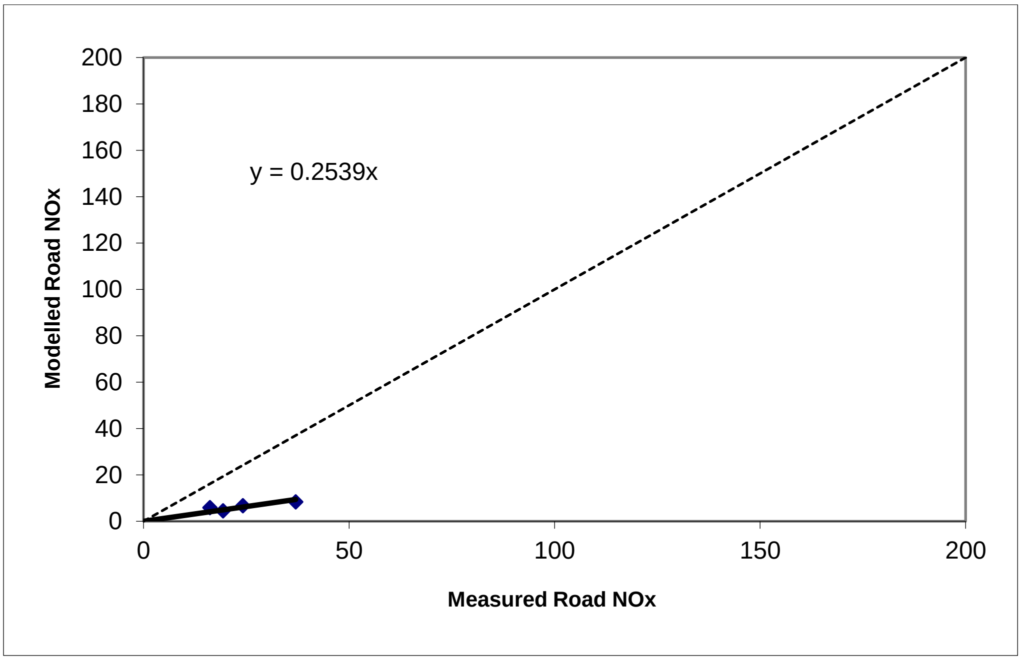


Figure E1: Comparison of Modelled Road NO_x with Measured Road NO_x

Figure D1 shows that the ADMS model is under-predicted the road-NO_x concentrations at the monitoring site. An adjustment factor has therefore been determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.2539 = 3.94). This factor has been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the DEFRA NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration.

Figure E2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO_2, was calculated (1/1.0118=0.988).

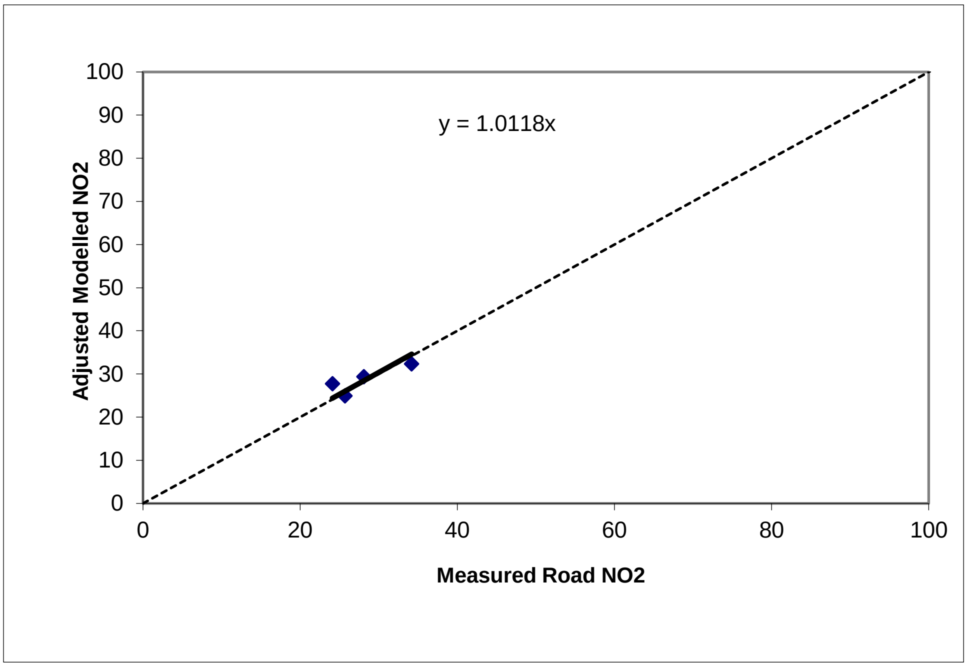


Figure D2: Comparison of Modelled NO_2 with Measured NO_x

After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO_2. The final adjustment modelled values are shown in Figure D3.

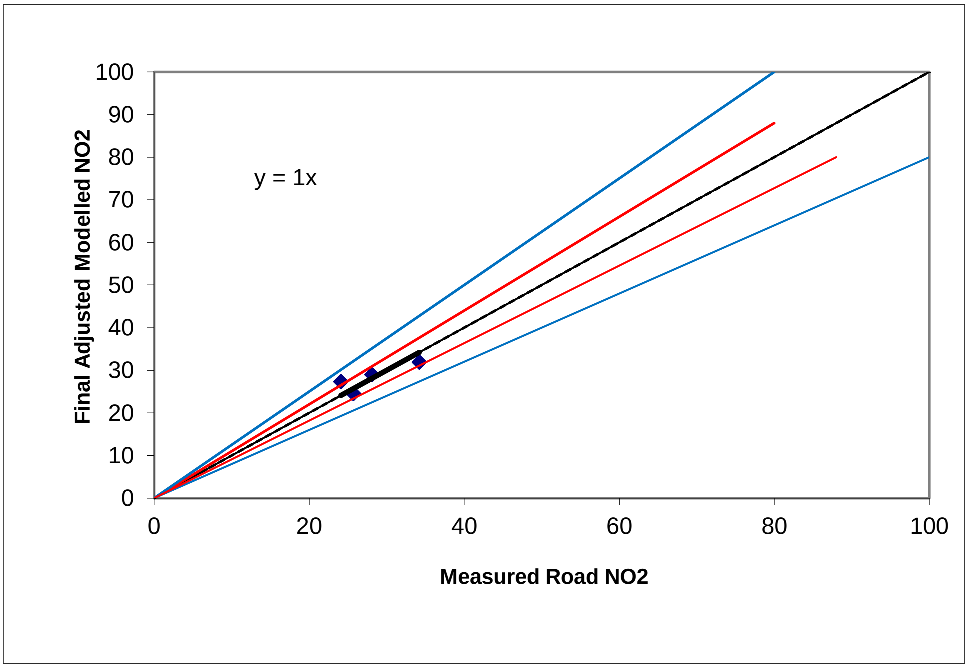


Figure E3: Comparison of Adjusted Modelled NO_2 with Measured NO_x

Further review of the verification process was undertaken to determine the uncertainty of the model results and subsequent adjusted model results. The Root Mean Square Error (RMSE) was calculated for both the unadjusted and adjusted model results. LAQM.TG(16) recommends that the RMSE should be within 10% of the air quality objective, which equates to 4 µg/m^3 for NO_2.

The RMSE of the unadjusted results was calculated as 9.6 µg/m^3. However, following adjustment using both the primary and secondary adjustment factors set out above the RMSE was reduced to 2.1 µg/m^3, below the preferred 4 µg/m^3.

The adjustment factor of 3.94 has been applied to the modelled NO_x-road concentrations predicted at the selected receptors. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 and adjusted by 0.988 to provide the final predicted annual mean NO_2 concentrations at each receptor.

These factors have also been used to adjust the predicted PM_{10} and $PM_{2.5}$ concentrations.

Appendix F - Construction Mitigation Measures

It is recommended that the 'highly recommended' measures set out below are incorporated into a CMP and approved by CDC prior to commencement of any work on site:

- develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, 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;
- carry out regular site inspections to monitor compliance with the CMP, record inspection results and make inspection log available to TDC when asked;
- increase frequency of site inspection 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 periods of dry or windy conditions;
- 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;
- fully enclose site or specific operations where there is a high potential for dust production and the activities are being undertaken 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 being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;
- 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 logistic plan to manage the sustainable delivery of goods and materials;
- 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 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;
- avoid bonfires and burning of waste materials;
- re-vegetate earthworks and exposed areas/soil stockpiles to stabile surface as soon as practicable;
- use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
- only remove the cover in small areas during works and not all at once;
- 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;
- avoid scabbling, if possible;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surfaces as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;
- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- impose and signpost a maximum speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud);
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit.
- access gates to be located at least 10 m from receptors where possible.