

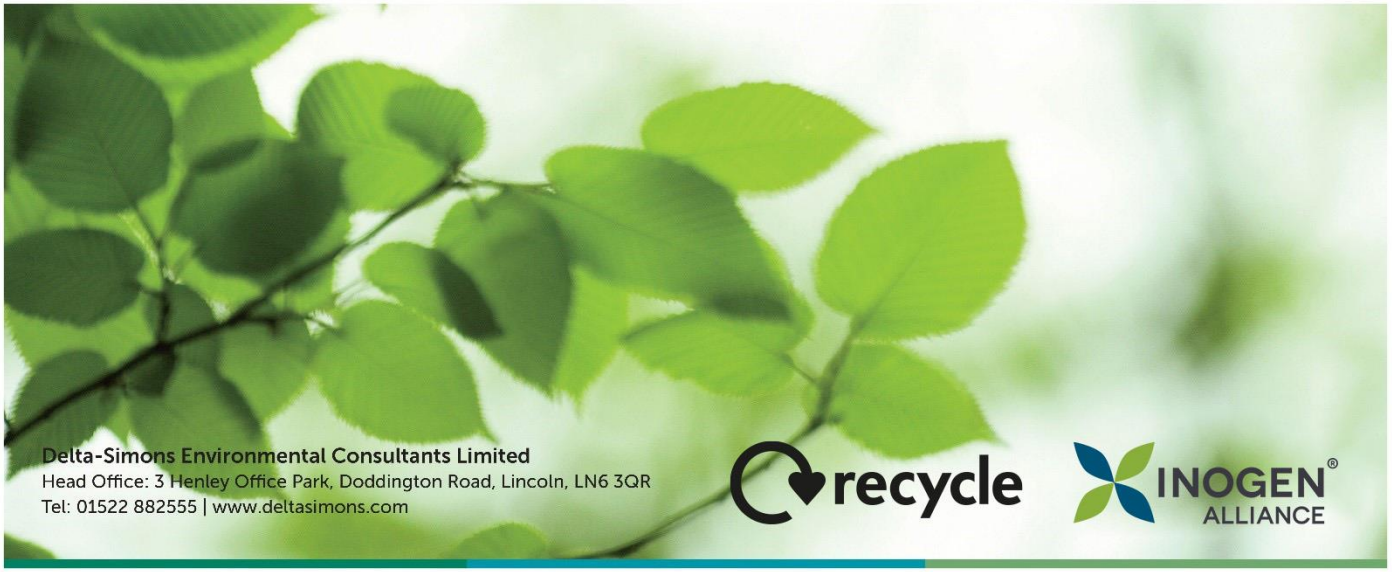
Air Quality Assessment

Land off Wood Walk, Hoyland, Barnsley

Presented to **Yelcon Limited**

Issued: August 2021

Delta-Simons Project No. 16-0406.05



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Report Details

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Executive Summary

Site and Report Context	Delta-Simons, was instructed by Yelcon Limited (the 'Client') to undertake an Air Quality Assessment in support of a planning application for a proposed residential development comprising up to 84 dwellings (the 'Proposed Development'), located at land off Wood Walk in Hoyland, Barnsley (the 'Site'). The Site is located in an area where air quality is mainly influenced by road traffic emissions along the A6195 Dearne Valley Parkway and the local road network and as such, elevated pollutant concentrations may be experienced at this location. Subsequently, the development may lead to the exposure of future occupants to poor air quality, as well as adverse impacts at nearby sensitive receptors, as a result of fugitive dust emissions during construction and road vehicle exhaust emissions during operation. As such, an Air Quality Assessment is required to determine baseline conditions at the Site, consider its suitability for the proposed residential end use and to assess potential impacts associated with the Proposed Development, in accordance with the requirements of the National Planning Policy Framework (NPPF). The Air Quality Assessment will therefore consider ambient pollutant concentrations namely nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), across and in the vicinity of the Site. This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational phases of the Proposed Development. For both phases, the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed.
Summary	The assessment of construction phase impacts associated with emissions of fugitive dust and fine particulate matter with an aerodynamic diameter of less than 10 and 2.5 microns (PM_{10} and $PM_{2.5,}$ respectively), has been undertaken in line with the relevant Institute of Air Quality Management (IAQM) guidance. This identified that there is a **medium** to **negligible risk** of dust soiling impacts and a **low** to **negligible risk** of increases in particulate matter concentrations due to unmitigated construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and particulate matter releases would be significantly reduced. The residual effects of the construction phase on air quality are considered to be **not significant**. The Proposed Development is expected to result in an overall **negligible** impact associated with the operational phase traffic on nearby receptors and the residual effects are considered to be **not significant.** An assessment of the potential for future users of the Proposed Development to be exposed to poor air quality has also been undertaken. Pollutants considered in this assessment were NO_2, PM_{10} and $PM_{2.5}$. The results indicate that pollutant concentrations at relevant proposed receptors are likely to meet the annual mean objectives for NO_2, PM_{10} and $PM_{2.5}$. The residual effect of air quality on future occupiers of the Proposed Development is judged to be **not significant**.
Conclusions and Recommendations	It is therefore concluded that the Proposed Development will not result in any significant loss of local residential amenity. Based on the results of the assessment and the implementation of the proposed mitigation measures during the construction phase, it is considered that, the Proposed Development complies with national and local planning policies and there are no air quality constraints considered to restrict planning consent.
This is intended as a summary only. Further detail and limitations of the assessment are provided within the main body of the report.	

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1.0 Introduction

1.1 Appointment

1.1.1 Delta-Simons Environmental Consultants Limited ('Delta-Simons'), was instructed by Yelcon Limited (the 'Client') to undertake an Air Quality Assessment in support of a planning application for a proposed residential development comprising up to 84 dwellings (the 'Proposed Development'), located at land off Wood Walk in Hoyland, Barnsley (the 'Site').

1.1.2 Reference should be made to **Figure 1** for a map of the Site and surrounding area.

1.2 Site Location and Context

1.2.1 The Site is located in an area where air quality is mainly influenced by road traffic emissions along the A6195 Dearne Valley Parkway and the local road network and as such, elevated pollutant concentrations may be experienced at this location. Subsequently, the development may lead to the exposure of future occupants to poor air quality, as well as adverse impacts at nearby sensitive receptors, as a result of fugitive dust emissions during construction and road vehicle exhaust emissions during operation. As such, an Air Quality Assessment was required to determine baseline conditions at the Site, to consider its suitability for the proposed residential end-use and to assess potential impacts associated with the Proposed Development in accordance with the requirements of the National Planning Policy Framework (NPPF)[1]. The Air Quality Assessment will therefore consider ambient pollutant concentrations namely nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), across and in the vicinity of the Site.

1.2.2 The main potential sources of air pollution were identified as emissions from road transport using the A6195 Dearne Valley Parkway and the local road network. There are no combustion sources identified within the immediate vicinity of the Site that will influence the local air quality.

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

1.2.4 The standard limitations associated with this assessment are presented in **Appendix A**.

1.2.5 A glossary of terms used in this report is provided in **Appendix B**.

[1] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework.

2.0 Legislation and Policy

2.1 Air Quality Legislation and Policy

2.1.1 A summary of the relevant air quality legislation and policy is provided below.

UK Air Quality Strategy (2007)

2.1.2 The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)[2]. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation.

2.1.3 Under the European Union (Withdrawal) Act 2018 (as amended), domestic legislation derived from EU law, which was in force immediately prior to the end of the transition period on 31st December 2020, continues to form part of UK domestic law thereafter. This new body of law resulting from the Withdrawal Act is referred to as 'retained EU Law'.

2.1.4 The AQS also sets standards and objectives for nine key air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Appendix C**.

2.1.5 The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.

2.1.6 The air quality objectives (AQOs) 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.

2.1.7 For the pollutants considered in this assessment, there are both long-term (annual mean) and short-term standards. 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, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

2.1.8 The AQS contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}. Local authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area. However, there is no statutory objective given in the AQS for $PM_{2.5}$ at this time.

Air Quality Regulations (2016)

2.1.9 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000[3] and the Air Quality (England) (Amendment) Regulations 2002[4] for the purpose of Local Air Quality Management (LAQM).

2.1.10 These Regulations require that likely exceedances of the AQS objectives are assessed in relation to:

> '[…] the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present […]'

[2] Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2).
[3] The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928.
[4] The Air Quality (England) (Amendment) Regulations 2002 - Statutory Instrument 2002 No.3043.

2.1.11 The Air Quality Standards (Amendment) Regulations 2016[5] amends the Air Quality Standards Regulations 2010 that transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The limit values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS objectives and the limit value for $PM_{2.5}$ is a concentration of 25µg/m^3.

Environmental Protection Act 1990 - Control of Dust and Particulates Associated with Construction

2.1.12 Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

> 'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance'; and
>
> 'Any accumulation or deposit which is prejudicial to health or a nuisance'.

2.1.13 Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.1.14 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.

Environment Act 1995

2.1.15 Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

Clean Air Strategy (2019)

2.1.16 In 2019, the UK government released its Clean Air Strategy 2019[6], part of its 25 Year Environment Plan[7]. The Strategy sets out the comprehensive action that is considered to be required from across all parts of government and society.

2.1.17 The primary focus of air quality management has primarily related to NO_2, and its principal source in the UK, road traffic. The 2019 Strategy aims to broaden the focus to other areas, including actions on clean growth, and emissions from domestic wood burning stoves, industry and agriculture.

2.2 Planning Policy

2.2.1 A summary of the national and local planning policy relevant to the Proposed Development and air quality is provided below.

National Planning Policy

National Planning Policy Framework (as revised 2021)

2.2.2 The Government's overall planning policies for England are described in the NPPF. The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as:

> '[…] meeting the needs of the present without compromising the ability of future generations to meet their own needs.'

5 The Air Quality Standards (Amendment) Regulations 2016 - Statutory Instrument 2016 No. 1184.
6 Department for Environment, Food and Rural Affairs (Defra) (2019) Clean Air Strategy 2019.
7 Department for Environment Food and Rural Affairs (Defra) (2018) A Green Future: Our 25 Year Plan to Improve the Environment.

2.2.3 One of the three overarching objectives of the NPPF, is that the planning system should 'protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.'

2.2.4 In relation to air quality, the following paragraphs in the document are relevant:

- Paragraph 55, which states 'Local planning authorities should consider whether otherwise unacceptable development could be made acceptable through the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.';
- Paragraph 105, which states 'Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.';
- Paragraph 174, which states 'Planning policies and decisions should contribute to and enhance the natural and local environment by: […] e) 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, taking into account relevant information such as river basin management plans.';
- Paragraph 185, which states 'Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.';
- Paragraph 186, which states 'Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.'; and
- Paragraph 188, which states '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. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities'.

Local Planning Policy

2.2.5 A summary of relevant local policies is outlined below, however their compliance and soundness in relation to national policy has not been assessed in this instance.

Barnsley Local Plan 2019

2.2.6 The Barnsley Metropolitan Borough Council (BMBC) Local Plan[8] was adopted in January 2019 and sets out the key elements of the planning framework for Barnsley, and the approach to its long term physical development to achieve the Council's vision of what sort of place Barnsley wants to become.

[8] Barnsley Metropolitan Borough Council (2019) Barnsley Local Plan 2019 [Online] Available at: https://www.barnsley.gov.uk/services/planning-and-buildings/local-planning-and-development/our-local-plan/barnsleys-local-plan/ [Accessed on 24/02/2021].

2.2.7 In terms of air quality, Policy 30: 'Pollution' is relevant to the Proposed Development:

> 'Development proposals will not be permitted where, taking account of any proposed mitigation measures, they would lead to unacceptable adverse impacts upon:
>
> 1. health and safety of the public;
> 2. the amenities of the area; or
> 3. the natural, historic and built environment;
>
> by way of:
>
> 4. air quality, including fumes and odour […].'
>
> Planning applications, except for development within the curtilage of a dwelling house, must include an assessment of:
>
> 9. impact on the proposed development from poor air quality from identified sources;
> 10. impact on air quality from the proposed development; and
> 11. impact on amenity from existing uses.
>
> Suitable mitigation measures will be provided, if required. Proposals will be refused if impacts cannot be suitably mitigated or avoided. […]'

2.2.10 The above policy relating to air quality is considered within this assessment.

2.3 Guidance

2.3.1 A summary of the publications referred to in the undertaking of this assessment is provided below.

Local Air Quality Management Review and Assessment Technical Guidance (2021)

2.3.2 The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their review and assessment work[9]. This guidance, referred to in this document as LAQM.TG16, has been used where appropriate in the assessment presented herein.

Land-Use Planning & Development Control: Planning for Air Quality (2017)

2.3.3 Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance[10] that offers comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures that may be implemented to minimise these impacts.

Guidance on the Assessment of Dust from Demolition and Construction (2016)

2.3.4 This document[11] published by the IAQM was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

[9] Department for Environment, Food and Rural Affairs (Defra) (2021) Part IV of the Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG16.
[10] Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017) Land Use Planning & Development Control: Planning for Air Quality.
[11] Institute of Air Quality Management (Version 1.1 Updated June 2016) Guidance on the Assessment of Dust from Demolition and Construction.

National Planning Practice Guidance - Air Quality (2019)

2.3.5 This guidance[12] provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, it explains how much detail air quality assessments need to include for proposed developments, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by local authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

Barnsley MBC Air Quality Action Plan (2019)

2.3.6 This document[13] outlines the actions that BMBC will deliver between 2017 and 2021, and is designed to improve air quality in the air quality management areas and in the Borough as a whole. These actions are developed under five key themes. These are:

- Reduce traffic;
- Behavioural change;
- Increase efficiency;
- Improve fleet; and
- Regulation.

Barnsley MBC Air Quality and Emissions Good Practice Planning Guidance (2020)

2.3.7 This guidance[14], published in March 2020, provides a template for integrating air quality considerations into land-use planning and development management policies that can influence the reduction of road transport emissions. This guidance is therefore included in the BMBC Air Quality Action Plan.

'This guidance has been developed to:

- Introduce an air quality assessment scheme which includes the quantification of impacts, formulating damage costs and identifying mitigation measures to be implemented to negate the impact;
- Tackle cumulative impact; and
- Provide clarity and consistency of the process to developers, planners and local communities. […]

The air quality assessments follow a three stage process:

- Stage 1: Determining the classification of the development proposal;
- Stage 2: Assessing and quantifying the impact on local air quality; and
- Stage 3: Determining the level of a mitigation required by the proposal to meet Local Development Plan requirements.'

[12] Department of Communities and Local Government (DCLG) (Updated November 2019) National Planning Practice Guidance.
[13] Barnsley Metropolitan Borough Council (2020) Barnsley MBC Air Quality Action Plan (2019) [Online] Available at: https://www.barnsley.gov.uk/media/16803/air-quality-action-plan.pdf [Accessed on 25/02/2021].
[14] Barnsley Metropolitan Borough Council (2020) Barnsley MBC Air Quality and Emissions Good Practice Guidance (2020) [Online] Available at: https://www.barnsley.gov.uk/media/16257/pdc-2020-mar-bmbc-aqe-technical-planning-guidance-v12.pdf [Accessed on 25/02/2021].

3.0 Scope and Methodology

3.1 Scope

3.1.1 The scope of the assessment has been determined in the following way:

- Review of BMBC's latest available Air Quality Annual Status Report[15] (ASR) and air quality data for the area surrounding the Site, including data from BMBC, Defra[16] and the Environment Agency (EA)[17];
- Desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality, and a review of the masterplan for the Proposed Development to establish the location of new sensitive receptors; and
- Review of the traffic data provided by the Project Transport Consultant (the 'PTC') and the Department for Transport's (DfT) Road Traffic Statistics[18], where applicable.

3.1.2 The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:

- Dust and particulate matter generated by on-site activities during the construction phase;
- Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant;
- Increases in pollutant concentrations as a result of exhaust emissions arising from traffic generated by the Proposed Development once operational; and
- Exposure of future occupants to poor air quality should elevated pollution levels be experienced at the Site.

3.2 Methodology

Construction Phase

3.2.1 Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity to the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

3.2.2 The smaller particles of dust, are known as particulate matter (PM), with less than 10µm in aerodynamic diameter (PM_{10}) representing only a small proportion of total dust released; this includes a finer fraction, known as $PM_{2.5}$ (with an aerodynamic diameter less than 2.5µm). As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, they can therefore be transported by wind over a wider area. PM_{10} and $PM_{2.5}$ are small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health. However, it is worth noting that, according to the IAQM guidance, the majority of fugitive particulate emissions arising from construction sites are expected to relate to the coarser fractions (i.e. $PM_{2.5-10}$) with just 10-15% expected to comprise $PM_{2.5}$. The IAQM guidance therefore focusses on PM_{10} for the purposes of assessment.

[15] Barnsley Metropolitan Borough Council (2020) 2020 Air Quality Annual Status Report (ASR) [Online] Available at: https://www.barnsley.gov.uk/media/16804/air-quality-status-report-2020.pdf [Accessed on 24/02/2021].
[16] Department for Environment, Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) Support Pages. [Online] Available at: http://laqm.defra.gov.uk/ [Accessed on 24/02/2021].
[17] Environment Agency (2021) Pollution Inventory [Online] Available at: https://data.gov.uk/dataset/cfd94301-a2f2-48a2-9915-e477ca6d8b7e/pollution-inventory [Accessed on 24/02/2021].
[18] Department for Transport (DfT) (2020) Road Traffic Statistics [Online] Available at: https://roadtraffic.dft.gov.uk/#6/55.254/-6.064/basemap-regions-countpoints [Accessed on 24/02/2021].

3.2.3 An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM, the available information for this phase of the Proposed Development provided by the Client and Project Team, and professional judgement.

3.2.4 The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition, earthworks, general construction activities and track-out. It 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 to assign a level of risk. 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. A summary of the IAQM assessment methodology is provided in **Appendix D**.

3.2.5 In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the application Site and in the vicinity of the application Site itself. As information on the number of vehicles and plant associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:

- The number and type of construction traffic and plant likely to be generated by this phase of the development;
- The number and proximity of sensitive receptors to the application Site and along the likely routes to be used by construction vehicles; and
- The likely duration of the construction phase and the nature of the construction activities undertaken.

Operational Phase Assessment

3.2.6 Of the pollutants included in the AQS, concentrations of NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) have been considered in this assessment as road traffic is a major source of these pollutants and their concentrations tend to be close to, or in exceedance of, the objectives in urban locations.

3.2.7 In order to predict NO_2 and PM concentrations across the Site, the advanced dispersion model ADMS-Roads (version 5.0.0.1) has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness and local meteorological conditions to predict pollutant concentrations. Details of the model input parameters are presented in **Appendix E**.

Meteorological Data

3.2.8 Meteorological data, such as wind speed and direction, are used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model were obtained from the observing station at Doncaster Sheffield Airport in 2019. This station is considered to provide representative data for the assessment. A wind rose generated from the meteorological data used for the dispersion modelling of operational phase impacts is provided in **Appendix F.**

Traffic Data

Traffic Flows

3.2.9 A summary of traffic data and pollutant emission factors used in the assessment can be found in **Appendix E**. It includes details of the Annual Average Daily Traffic (AADT) flows, vehicle speeds (km/h) and the percentage of Heavy Duty Vehicles (HDVs) for the local road network in all assessment years considered. Traffic speeds were reduced at junctions in line with guidance provided in LAQM.TG16, and using professional judgement.

3.2.10 For the assessment, three scenarios were modelled, as follows:

- 2019 - Model Verification;
- 2023 - Assumed Opening Year Without Development; and
- 2023 - Assumed Opening Year With Development.

3.2.11 Reference should be made to **Figure 1** for a graphical representation of the modelled road link locations.

Vehicle Emission Factors

3.2.12 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (EFT) (version 10.1). This has been produced by Defra and incorporates COPERT 5.3 vehicle emission factors and fleet information.

3.2.13 There is current uncertainty over NO_2 concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2019 emission factors were utilised in preference to the Site development year in order to provide robust concentration predictions. As predictions for 2019 were verified, it is considered results are an indication of worst-case concentrations during the operation of the proposal.

Selection of Background Concentrations

3.2.14 Background pollutant data for the operational phase assessment have been taken from the national maps provided on the Defra website[19], where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK. Estimated background concentrations are available for all years between 2018 and 2030. The maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions, and emissions from other sources. Due to the uncertainty discussed above, and in line with the findings of many local authorities that measured concentrations have not reduced as anticipated, 2019 background concentrations for NO_x, NO_2, PM_{10} and $PM_{2.5}$ have been utilised in this assessment for 2023. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

Model Verification and Result Processing

3.2.15 The ADMS-Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. Model validation undertaken by the software developer will not have included validation in the vicinity of the Proposed Development.

3.2.16 To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results, and was carried out following the methodology specified in Chapter 7, Section 4, of LAQM.TG16.

3.2.17 Details of the verification factor calculations are presented in **Appendix E**. A factor of **2.04** was obtained during the verification process, which indicated that the model was under-predicting. This factor was applied to the model road-NO_x (oxides of nitrogen) outputs prior to conversion to annual mean NO_2 concentrations utilising the NO_x to NO_2 Calculator (version 8.1, 26th June 2020) provided by Defra[20]. The NO_2 diffusion tube monitoring results recorded by BMBC were subsequently used to derive an indicative baseline annual mean NO_2 concentration for each site in the vicinity of the Proposed Development. Reference should be made to **Figure 1**, which shows the diffusion tube monitoring locations within the assessment extents.

3.2.18 As local roadside monitoring data within the assessment extents are not available for PM_{10} or $PM_{2.5}$, the modelled road-PM_{10} and road-$PM_{2.5}$ components have been adjusted by the verification factor obtained for NO_x before adding to the appropriate background concentration. The number of days with PM_{10} concentrations greater than 50µg/m^3 was then estimated using the relationship with the annual mean concentration described in LAQM.TG16.

3.2.19 Once processed, the predicted concentrations were compared against the relevant AQS objective levels for NO_2, PM_{10} and $PM_{2.5}$ set out in **Appendix C**.

[19] Department for Environment, Food and Rural Affairs (Defra) (2021) Background Concentrations [Online] Available at https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018 [Accessed on 24/02/2021].

[20] Department for Environment, Food and Rural Affairs (Defra) NO_x to NO_2 Calculator. 26/06/2020. Available at https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v8.1.xlsm [Accessed on 24/02/2021].

3.2.20 The air quality modelling generates pollutant estimates of road source contributed NO_x, PM_{10} and $PM_{2.5}$ at specified receptors. To permit comparison with the relevant air quality objectives for NO_2, PM_{10} and $PM_{2.5}$ it has been necessary to combine the model outputs data with the background concentrations.

3.2.21 To consider compliance with the 1-hour mean air quality objective for NO_2, Defra's guidance suggests that in locations where the annual mean NO_2 concentration exceeds 60µg/m^3 then the 1-hour mean objective may be exceeded. Where annual mean concentrations are less than 60µg/m^3 then exceedance of the 1-hour mean objective is considered unlikely. The risk of non-compliance with the 1-hour mean objective, where up to 18 exceedances of a 1-hour mean concentration of 200µg/m^3 are allowed in a calendar year, is therefore considered likely when the annual mean concentration is greater than 60µg/m^3 but unlikely when not. This approach has been adopted for this assessment.

3.2.22 To estimate total annual mean concentrations for PM_{10} and $PM_{2.5}$, for comparison with the annual mean air quality objectives (40 and 25µg/m^3 respectively) the model output concentrations are simply added to the background concentrations for these pollutants.

3.2.23 To consider compliance with the 24-hour mean air quality objective for PM_{10}, Defra's guidance gives the following equation that relates the annual mean concentration to the number of exceedances of the 24-hour mean concentration of 50µg/m^3, where up to 35 exceedances are allowed:

- No. 24-hour mean exceedances = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

3.2.24 This approach has been adopted for 24-hour mean PM_{10} for this assessment.

3.3 Selection of Sensitive Receptors

3.3.1 Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Proposed Development. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure as a result of on-site construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the exhausts of construction and operational traffic associated with the Proposed Development.

Construction Phase

3.3.2 The IAQM assessment is undertaken where there are: 'human receptors' within 350m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or 'ecological receptors' within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, 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.

Operational Phase

3.3.3 In terms of locations that are sensitive to pollutants emitted from engine exhausts, these will include places where members of the public are likely to be regularly present over the period of time prescribed in the AQS. For instance, on a footpath where exposure will be transient (for the duration of passage along that path) comparison with a short-term standard (i.e. 15-minute mean or 1-hour mean) may be relevant. At a school or adjacent to a private dwelling, where exposure may be for longer periods, comparison with a long-term standard (such as 24-hour mean or annual mean) may be more appropriate. Box 1.1 of LAQM.TG16 provides examples of the locations where the air quality objectives should/should not apply.

3.3.4 To complete the assessment of operational phase impacts, a number of 'receptors' representative of locations of relevant public exposure were identified at which pollution concentrations were predicted. Receptors have been located adjacent to the roads that are likely to experience the greatest change in traffic flows or composition, and therefore NO_2 and particulate matter concentrations, as a result of the Proposed Development.

3.3.5 The locations of the assessment receptors are shown on **Figure 1** and listed in **Table 1**.

Table 1 - Receptor Locations Used in the Assessment

Receptor	Description / Address	Grid Reference		Height above Ground Level (m)
		X (m)	Y (m)	
R1	The Cottage	437681.5	401822.4	1.5
R2	84 Wombwell Lane	437263.9	401602.7	1.5
R3	101 Wombwell Lane	437279.7	401595.1	1.5
R4	5 Wombwell Lane	437124.8	401433.5	1.5
R5	1 Woodlands Rd	437109.3	401484.5	1.5
R6	75 Barnsley Rd	437010.7	401709.1	1.5
R7	203 Barnsley Road	436972.4	401797.1	1.5
R8	2 Market Street	436986.7	401149.9	1.5
R9	98 Hawshaw Lane	436512.1	401004.5	1.5
R10	71 Hawshaw Lane	436455.4	400987.2	1.5
R11	141 Hoyland Road	436088.7	400493.2	1.5
R12	110 Hoyland Road	436043.1	400488.6	1.5
R13	86 Sheffield Road	435563.9	400156.7	1.5
R14	88 Sheffield Road	435573.9	400145.2	1.5
PR1	Proposed Residential Receptor	437315.4	401652.3	1.5
PR2	Proposed Residential Receptor	437295.5	401656.7	1.5
PR3	Proposed Residential Receptor	437454.4	401684.5	1.5
PR4	Proposed Residential Receptor	437427.5	401703.1	1.5
PR5	Proposed Residential Receptor	437492.0	401755.1	1.5
PR6	Proposed Residential Receptor	437400.7	401767.9	1.5
PR7	Proposed Residential Receptor	437447.7	401761.8	1.5

3.4 Significance Criteria

Construction Phase

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

3.4.2 For the assessment of the impact of exhaust emissions from plant used on-site and construction vehicles accessing and leaving the Site on local concentrations of NO_2 and particulate matter, the significance of residual effects has been determined using professional judgement and the principles outlined in the EPUK/IAQM guidance, which are described below.

Operational Phase

3.4.3 The approach provided in the EPUK/IAQM guidance has been used within this assessment to assist in describing the air quality effects of additional emissions from traffic generated by the Proposed Development once operational.

3.4.4 This guidance recommends that the degree of an impact is described by expressing the magnitude of incremental change in pollution concentration as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion, as summarised in **Table 2**.

Table 2 - Road Vehicle Exhaust Emissions - Significance of Impact

Long Term Average Concentration at Receptors in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL)			
	1	2 - 5	6 - 10	> 10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76 - 94% of AQO	Negligible	Slight	Moderate	Moderate
95 - 102% of AQO	Slight	Moderate	Moderate	Substantial
103 - 109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial

Notes

AQAL = air quality assessment level, which for this assessment related to the UK Air Quality Strategy objectives.

Where the %change in concentrations is <0.5%, the change is described as 'Negligible' regardless of the concentration.

When defining the concentration as a percentage of the AQAL, 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme;' concentration where there is an increase.

Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

3.4.5 The matrix shown in **Table 2** is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which makes it clearer which cell the impact falls within. It should be noted that changes of 0%, i.e. less than 0.5%, are described as negligible.

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

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

3.4.7 The EPUK/IAQM guidance states that for most road transport related emissions, long-term average concentrations are the most useful for evaluating the impacts. The guidance does not include criteria for determining the significance of the effect on hourly mean NO_2 concentrations or daily mean PM_{10} concentrations. The significance of effects of hourly mean NO_2 and daily mean PM_{10} concentrations arising from the operational phase have therefore been determined qualitatively using professional judgement and the principles described above.

3.4.8 The EPUK/IAQM guidance says that 'Where the air quality is such that an air quality objective at the building facade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.'

3.4.9 The EPUK/IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. It should be noted that this is a binary judgement of either it is significant or it is not significant.

Future Exposure

3.4.10 The Proposed Development has the potential to expose future users of the Site to poor air quality. Pollutant concentrations were therefore quantified across the Site using dispersion modelling as detailed previously. The results were subsequently compared with the relevant AQOs to determine the potential for any exceedance.

4.0 Baseline

4.1 Introduction

4.1.1 Existing air quality conditions in the vicinity of the Site were identified in order to provide a baseline for consideration. These are detailed in the following sections.

4.2 Local Air Quality Management

4.2.1 According to the latest Air Quality ASR from BMBC[15] and Defra[21], there are seven AQMAs designated across the Borough, all of which were declared due to exceedances of the annual mean NO_2 AQO. The closest AQMA to the site is Barnsley AQMA No.1, located approximately 3km to the west of the Site. Due to the distance of the AQMA away from the Site, potential effects associated with the Proposed Development have not been considered at sensitive receptors within this area.

4.3 Local Emission Sources

4.3.1 The Site is located in an area where air quality is mainly influenced by emissions from road transport using the A6195 Dearne Valley Parkway and the local road network. There are no industrial pollution sources identified within the immediate vicinity of the Site that will influence the local air quality.

4.4 Air Quality Monitoring

4.4.1 Monitoring of pollutant concentrations is undertaken by BMBC throughout their area of jurisdiction utilising both automatic (continuous) and non-automatic (passive) methods. Recent diffusion tube monitoring results recorded in the vicinity of the development are shown in **Table 3**. There are no continuous monitoring locations in the vicinity of the Site**.**

Table 3 - Diffusion Tube Monitoring Results

Monitoring Site			**Monitored NO_2 Concentration (µg/m^3)***				
ID	**Location**	**Type**	**2015**	**2016**	**2017**	**2018**	**2019**
DT24	A6135 Hoyland	Kerbside	35.4	32.5	**40.0**	30.2	30.3
DT25	A61 Sheffield Road Birdwell	Roadside	**45.0**	**42.9**	**40.2**	34.3	38.6
DT26	A61 Sheffield Road, Birdwell	Roadside	**44.3**	**44.8**	**43.2**	**40.1**	**40.3**
DT27	A61 Sheffield Road, Birdwell	Roadside	**43.3**	39.5	38.6	39.1	39.8
DT28	Tankersley School	Roadside	22.5	25.5	22.6	23.9	23.6
DT29	Moor Lane, Birdwell	Urban Background	32.7	31.3	32.1	27.6	28.3
DT30	The Walk, Birdwell	Roadside	34.7	32.6	36.2	29.5	33.4
DT31	Sheffield Road - Birdwell	Roadside	33.2	33.2	31.8	29.7	29.7
DT32	Sheffield Road - Chapel Street, Birdwell	Roadside	38.1	37.9	38.5	32.8	35.5

*Exceedances of the relevant AQO are highlighted in **bold**.

4.4.2 As shown in **Table 3**, the annual mean NO_2 concentrations exceeded the relevant AQO at monitoring site DT26, during the most recent monitoring year, 2019. Exceedances were also recorded between 2015 - 2018 at DT26, between 2015 - 2017 at DT25 and in 2017 at DT24. Reference should be made to **Figure 1** for a map of the diffusion tube positions.

4.4.3 No monitoring of PM_{10} or $PM_{2.5}$ is undertaken in the vicinity of the Site.

[21] Defra (undated) Local Authority Details - Barnsley Metropolitan Borough Council [Online] Available at: https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=10 [Accessed on 24/02/2021].

4.5 Background Pollutant Concentrations

4.5.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by Defra for the entire of the UK to assist Local Authorities in their Review and Assessment of air quality. The Site is located in grid square NGR: 437500, 401500. Data for this location and the assessment extents were downloaded from the Defra website[19] for the purpose of the project. These data are summarised in **Table 4** below.

Table 4 - Predicted Background Pollutant Concentrations (2019)

OS Grid Reference (X, Y; m)	NO_2	NO_X	PM_{10}	$PM_{2.5}$
437500, 401500	11.9	15.8	11.0	7.2
436500, 401500	13.2	17.9	11.5	7.3
436500, 400500	12.1	16.1	11.1	7.2
435500, 400500	13.0	17.3	11.7	7.4

4.5.2 As shown in **Table 4**, predicted background NO_2, PM_{10} and $PM_{2.5}$ concentrations are below the relevant AQOs across the assessment extents.

5.0 Assessment

5.1 Introduction

5.1.1 There is the potential for air quality impacts as a result of the construction and operation of the Proposed Development. These are assessed in the following sections.

5.2 Construction Phase Assessment

Dust and PM_{10} Arising from On-Site Activities

5.2.1 Construction activities that have the potential to generate and/or re-suspend dust and PM_{10} include:

- Site clearance and preparation including demolition activities;
- Preparation of temporary access/egress to the Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Site (including excavators and dumper trucks);
- Use of crushing and screening equipment/plant;
- Exhaust emissions from plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment;
- Trackout, whereby earth is carried from the Site on vehicle tyres, deposited on roads and may later become suspended in the air as a result of vehicle movements; and
- Site landscaping after completion.

5.2.2 The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

Assessment of Potential Dust Emission Magnitude

5.2.3 The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition, earthworks, construction, and trackout. The findings of the assessment are presented below.

Demolition

5.2.4 The Site is currently vacant; therefore, the associated demolition activities are considered to be nominal. As such, the potential dust emission magnitude for demolition activities is not considered further within this assessment.

Earthworks

5.2.5 The total area of the Site is greater than 10,000m^2 and while it is not assumed that more than 10 heavy earth moving vehicles will be active at any one time, in order to represent a robust assessment, the potential dust emission magnitude is considered to be **large** for earthwork activities, based on the size of the Site.

Construction

5.2.6 The total volume of buildings to be constructed on the Site is assumed to be between 25,000m^3 - 100,000m^3. Therefore, the potential dust emission magnitude is considered to be **medium** for construction activities.

Trackout

5.2.7 Information on the number of HDVs associated with this phase of the Proposed Development is not available and therefore professional judgement has been used. It has been assumed that given the size of the development area there are likely to be fewer than10 HDV outward movements in any one day, with the unpaved road length in the Site likely to be between less than 50m, as such it is considered that the potential dust emission magnitude is **small** for trackout.

5.2.8 **Table 5** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 5 - Potential Dust Emission Magnitude

Activity	**Dust Emission Magnitude**
Demolition	N/A
Earthworks	Large
Construction Activities	Medium
Trackout	Small

Assessment of Sensitivity of the Study Area

5.2.9 A wind rose generated using the meteorological data used for the dispersion modelling of operational phase impacts is provided in **Appendix F**. This shows that the prevailing wind direction is mainly from the south-west through to the west. Therefore, receptors located to the north-east through to the east of the Site are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase.

5.2.10 Under low wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. Receptors north-east through to the east of the Site are expected to be affected the most as a result of the prevailing wind direction. It has been assumed that the construction traffic will access the Site via the local road network.

5.2.11 There are no ecological receptors within the vicinity of the Site considered to be sensitive to dust of PM, and as such these effects are not considered further within this assessment.

5.2.12 Taking the above into account and following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in **Table 6**.

Table 6 - Sensitivity of the Study Area

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

Risk of Impacts

5.2.13 The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 7** below provides a summary of the risk of dust impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 7 - Summary Dust Risk Table to Define Site Specific Mitigation

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

Construction Vehicles and Plant

5.2.14 The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the Site access road. Construction traffic will access the Site via the local road network. Due to the size of the Site, it is considered likely that the construction traffic will be low in comparison to the existing traffic flows on these roads.

5.2.15 Final details of the exact plant and equipment likely to be used on-site will be determined by the appointed contractor, it is considered likely to comprise dump trucks, tracked excavators, diesel generators, asphalt spreaders, rollers, compressors and trucks. The number of plant and their location within the Site are likely to be variable over the construction period.

5.2.16 Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, and the likely numbers of construction vehicles and plant that will be used, the impacts are therefore considered to be **negligible** according to the assessment significance criteria.

5.3 Operational Phase Assessment

5.3.1 Vehicle movements associated with the operation of the proposal will generate exhaust emissions on the local and regional road networks. An assessment was therefore undertaken using dispersion modelling in order to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the Site.

5.3.2 The assessment considered the following three scenarios:

- 2019 - Model Verification;
- 2023 - Assumed Opening Year Without Development; and
- 2023 - Assumed Opening Year With Development.

5.3.3 The 2023 scenarios included anticipated baseline traffic data, inclusive of anticipated growth for the relevant assessment year, in addition to predicted vehicle trips associated with the operation of the proposals.

5.3.4 It is reiterated that for the purpose of the assessment, traffic data for 2023 were utilised as the development opening year. Air quality is predicted to improve in the future based on expected reduction in roadside levels as a result of technological advancements as stated in **Section 3.2.13**. However, in order to provide a robust assessment, emission factors and background concentrations for 2019 were utilised within the dispersion model. The use of 2023 traffic data and 2019 emission factors and background concentrations is considered to provide a worst-case scenario and therefore a sufficient level of confidence can be placed within the predicted pollution concentrations.

Road Vehicle Exhaust Emission Impacts

5.3.5 Full results of the dispersion modelling are presented in **Appendix G** and a summary is provided below.

5.3.6 It should be noted that all presented results have been verified in accordance with the methodology outlined within **Appendix E.**

Nitrogen Dioxide

Annual Mean

5.3.7 Annual mean NO_2 concentrations were not predicted to exceed the AQO of 40µg/m^3 at any sensitive receptor location. In 2023, the anticipated opening year of the Proposed Development, the highest concentrations of 38.2µg/m^3 and 38.4µg/m^3 are predicted at receptor R13 '86 Sheffield Road', in the 'Without Development' and 'With Development' scenarios, respectively. This results in a **slight adverse** impact from the additional traffic associated with the operation of the Proposed Development leading to an effect which is considered to be **not significant**, in accordance with the EPUK/IAQM assessment criteria.

5.3.8 The maximum predicted increase as a result of the Proposed Development is 0.3µg/m^3 at receptor R14 '88 Sheffield Road'.

5.3.9 The predicted changes in annual mean NO_2 concentrations are all less than 1.0% of the relevant AQS objective. Based on the EPUK/IAQM guidance, all identified sensitive receptors within the assessment extents, apart from R13, are predicted to experience a **negligible** impact on annual mean NO_2 concentrations, with no exceedances as a result of the Proposed Development.

5.3.10 Based on the extent of predicted population exposure to the impacts on annual mean NO_2 concentrations and the guidance provided by the IAQM, the overall effect of the Proposed Development is considered to be **not significant.**

1-hour Mean

5.3.11 The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3, and therefore hourly mean NO_2 concentrations are unlikely to cause a breach of the hourly mean AQS objective. The impact of the Proposed Development on hourly mean NO_2 concentrations at existing sensitive receptors is considered to be **negligible.**

Particulate Matter (PM_{10})

Annual Mean

5.3.12 Annual mean PM_{10} concentrations were predicted to be well below the AQO of 40µg/m^3 at all sensitive receptor locations in each of the modelled 2023 scenarios. The highest concentration of 15.8µg/m^3 is predicted at receptor R13 '86 Sheffield Road' in both the 'Without Development' and 'With Development' scenarios.

5.3.13 The maximum predicted increase as a result of the Proposed Development is 0.1µg/m^3 at receptors R3 '101 Wombwell Lane', R7 '203 Barnsley Road', R11 '141 Hoyland Road' and R14 '88 Sheffield Road'.

5.3.14 The predicted changes in annual mean PM_{10} concentrations are all less than 0.5% of the relevant AQS objective. Based on the EPUK/IAQM guidance, the impact of the increased emissions associated with the Proposed Development on annual mean PM_{10} concentrations is considered to be **negligible**.

5.3.15 Based on the extent of predicted population exposure to the impacts on annual mean PM_{10} concentrations and the guidance provided by the IAQM, the overall effect of the Proposed Development is considered to be **not significant.**

24-hour Mean

5.3.16 There has been no predicted increase in the number of days exceeding the daily PM_{10} limit in the 'with development' scenario, without the risk of exceedance of the AQS objective. As such, the impacts of increased emissions associated with the operational phase of the Proposed Development are **negligible**.

Particulate Matter ($PM_{2.5}$)

5.3.17 Annual mean $PM_{2.5}$ concentrations were predicted to be well below the AQO of 25µg/m^3 in each of the modelled 2023 scenarios. The highest modelled concentration of 9.9µg/m^3 is predicted at receptor R13 '86 Sheffield Road' in both the 'Without Development' and 'With Development' scenarios.

5.3.18 The maximum predicted increase as a result of the Proposed Development is 0.1µg/m^3 at receptors R8 '2 Market Street', R12 '110 Hoyland Road' and R14 '88 Sheffield Road'.

5.3.19 The predicted changes in annual mean $PM_{2.5}$ concentrations are all less than 0.5% of the relevant AQS objective. Based on the EPUK/IAQM guidance, the impact of the increased emissions associated with the Proposed Development on annual mean $PM_{2.5}$ concentrations is considered to be **negligible**.

5.3.20 Based on the extent of predicted population exposure to the impacts on annual mean $PM_{2.5}$ concentrations and the guidance provided by the IAQM, the overall effect of the Proposed Development is considered to be **not significant.**

Future Exposure

5.3.21 The Proposed Development has the potential to expose future residents to elevated air pollutant levels. Dispersion modelling was therefore undertaken with the inputs described in **Section 3.2** and **Appendix E** to quantify air quality conditions at the Site. This included consideration of vehicle exhaust emissions on the local road network, as well as other background sources. Reference should be made to **Appendix G** for full results of the dispersion modelling.

5.3.22 It should be noted that all presented results have been verified in accordance with the methodology outlined within **Appendix E.**

5.3.23 Predicted concentrations of all pollutants considered, are well below the relevant objectives at proposed residential receptor locations within the Site boundary. The highest predicted annual mean concentration for NO_2 at relevant proposed receptors is 24.2µg/m^3 at proposed residential receptor PR3. The highest predicted annual mean PM_{10} concentration is 13.3µg/m^3 at proposed residential receptor PR3, and the highest predicted $PM_{2.5}$ concentration is 8.5µg/m^3, at proposed residential receptor PR3.

5.3.24 The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3 at the Site and therefore hourly mean NO_2 concentrations are unlikely to cause a breach of the hourly mean AQS objective.

Summary

5.3.25 Based on the extent of predicted population exposure to the impacts on pollutant concentrations and the guidance provided by the IAQM, the overall effect of the Proposed Development is considered to be **not significant.**

5.3.26 Predicted concentrations of all pollutants considered during both assessment scenarios for the operational phase, are well below the relevant objectives without the risk of exceedance at proposed residential receptor locations within the Site boundary.

5.3.27 Based on the assessment results, the Site is considered suitable for the Proposed Development without the implementation of mitigation measures during the operational phase.

6.0 Mitigation and Residual Effects

6.1 Construction Phase

Mitigation

6.1.1 Based on the assessment results, mitigation will be required during the construction phase of the Proposed Development. Recommended mitigation measures are given below.

General Communication

- A stakeholder communications plan that includes community engagement before work commences on-site should be developed and implemented.
- The name and contact details of person(s) accountable for air quality and dust issues should be displayed on the Site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.

Site Management

- All dust and air quality complaints should be recorded and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in-place to avoid reoccurrence.
- The complaints log should be made available to the Local Authority on request.
- Any exceptional incidents that cause dust and/or air emissions, either on or off-site should be recorded, and then the action taken to resolve the situation recorded in the log book.

Monitoring

- Daily on-site and off-site inspections should be undertaken, where receptors (including roads) are nearby to monitor dust. The inspection results should be recorded and made available to the Local Authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the Site boundary, with cleaning to be provided if necessary.
- The frequency of Site inspections should be increased when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and Maintaining the Site

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

Operating Vehicle/Machinery and Sustainable Travel

- Make sure that all vehicle operators 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.

- A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Make sure that an adequate water supply is available on the Site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Make sure that equipment is readily available on-site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Earthworks

- Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up.
- Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Site and the surroundings.
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind pick-up.

Measures Specific to Construction

- Make sure that 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 make sure that that appropriate additional control measures are in place.
- For smaller supplies of fine powder materials make sure that bags are sealed after use and stored appropriately to prevent dust.
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

Measures Specific to Trackout

- Make sure that vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Record all inspections of haul routes and any subsequent action in a site logbook.

6.1.2 Detailed mitigation measures to control construction traffic should be discussed with the Local Authority to establish the most suitable access and haul routes for the Site traffic. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc.) where possible, and that vehicles are kept clean (through the use of wheel washers, etc.) and sheeted when on public highways. Timing of large-scale vehicle movements to avoid peak hours on the local road network will also be beneficial.

Residual Effects

6.1.3 The residual effects of dust and PM_{10} generated by construction activities following the application of the mitigation measures described above and good site practice are considered to be **not significant**.

6.1.4 The residual effects of emissions to air from construction vehicles and plant on local air quality are considered to be **not significant**.

6.2 Operational Phase

Mitigation

6.2.1 The changes in pollutant concentrations attributable to traffic emissions associated with the operational phase of the Proposed Development (i.e. impacts on local air quality) are **negligible** and therefore in accordance with the assessment criteria, mitigation is not required. Additionally, pollutant concentrations at the Site are predicted to be below the relevant AQOs and as such additional mitigation is not required.

6.2.2 However, the BMBC Good Practice Guidance[14] does provide some mitigation measures for Type 1 (Minor) proposals:

> 'If the proposal meets the exposure criteria in Stage 2, further mitigation is required to reduce the level of exposure. This will be in the form of:
>
> - Possible short term screening monitoring or utilising the distance calculation provided by Defra (Defra Distance) at the proposed location to identify the level of exposure;
> - Redesigning the proposal to reduce the ingress of pollution; and
> - Including a stand-off distance and/or vegetation boundary from the development.'

6.2.3 An additional mitigation option specific to residential proposals included in the guidance is the inclusion of '1 charging point per unit (dwelling with dedicated parking) and 1 charging point per 10 spaces (unallocated parking)'.

Residual Effects

6.2.4 The Proposed development is expected to result in an overall **negligible** impact associated with the operational phase traffic on nearby receptors.

6.2.5 The residual effects of the Proposed Development on air quality are **not significant** for NO_2, PM_{10} and $PM_{2.5}$ according to the EPUK/IAQM assessment criteria.

6.2.6 The residual effect of air quality on future occupiers of the Proposed Development is also judged to be **not significant**.

7.0 Summary and Conclusions

7.1.1 Delta-Simons was appointed to prepare this Air Quality Assessment in support of a full detailed planning application for a proposed residential development, comprising up to 84 dwellings, located at land off Wood Walk in Hoyland, Barnsley.

7.1.2 A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Proposed Development using the IAQM methodology. This identified that there is a **medium** to **negligible risk** of dust soiling impacts and a **low** to **negligible risk** of increases in particulate matter concentrations due to unmitigated construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM_{10} releases would be significantly reduced. The residual effects of dust and PM_{10} generated by construction activities on air quality are therefore considered to be **not significant**. The residual effects of emissions to air from construction vehicles and plant on local air quality are considered to be **not significant**.

7.1.3 The Proposed Development is expected to result in an overall **negligible** impact associated with the operational phase traffic on nearby receptors and the residual effects are considered to be **not significant.**

7.1.4 An assessment of the potential for future users/residents of the Proposed Development to be exposed to poor air quality has been undertaken. The Site lies within an area where air quality is mainly influenced by emissions associated with traffic along the local road network. Pollutants considered in this assessment were NO_2, PM_{10} and $PM_{2.5}$.

7.1.5 The results indicate that pollutant concentrations at proposed receptor locations within the Site boundary meet the relevant air quality objectives for NO_2, PM_{10} and $PM_{2.5}$. The residual effect of air quality on future occupiers of the Proposed Development is judged to be **not significant**.

7.1.6 Based on the assessment significance criteria, the residual effects of the Proposed Development are considered to be **not significant** for all pollutants assessed.

7.1.7 Furthermore, it is considered that the Proposed Development complies with national and local policy for air quality.

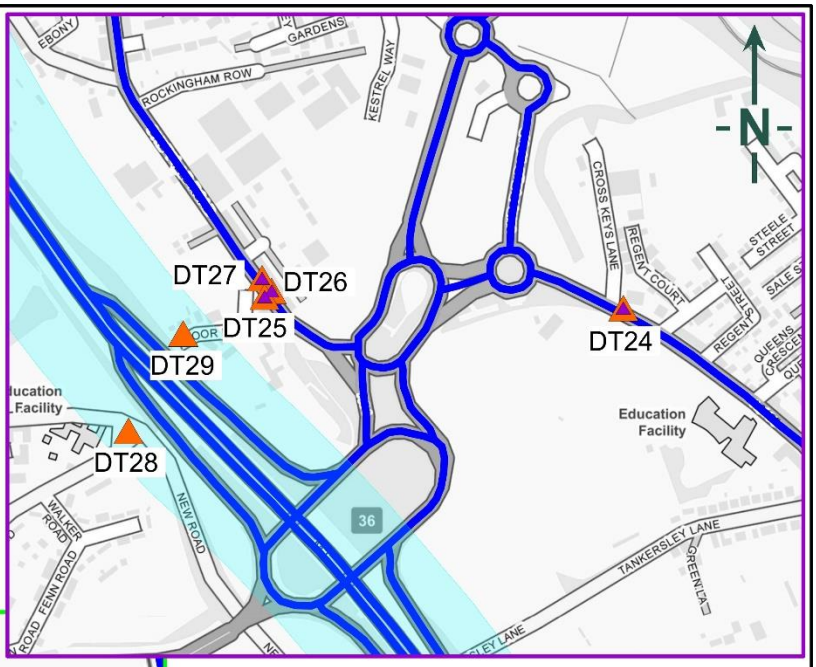
7.1.8 Based on the assessment results, air quality issues are not considered a constraint to planning consent.

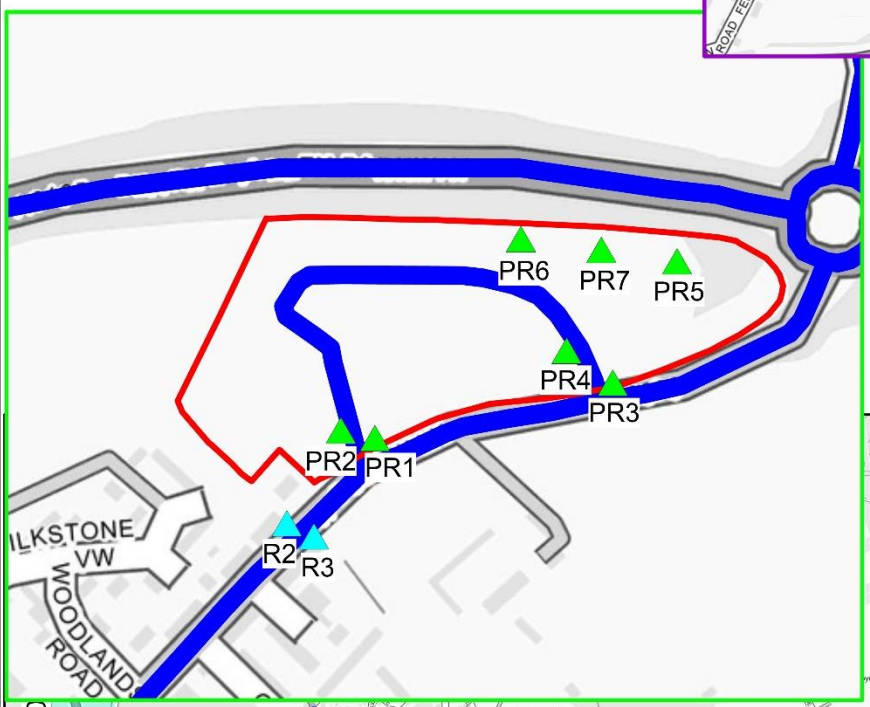
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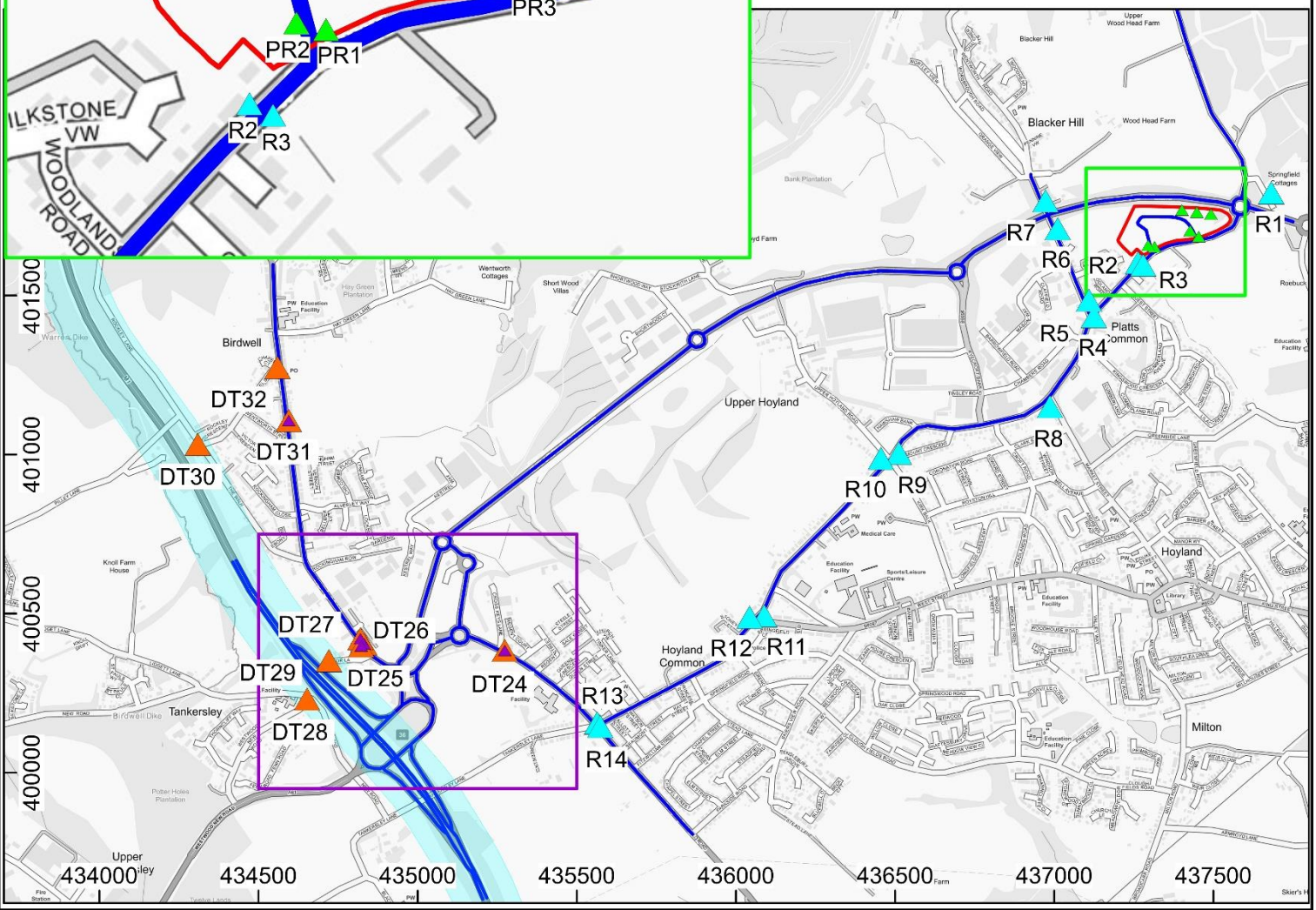
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LEGEND

- Site Boundary
- Modelled Road Link
- BMBC Diffusion Tube Location
- Model Verification Location
- Sensitive Human Receptor Location
- Proposed Sensitive Human Receptor Location
- Barnsley AQMA No.1 Boundary







deltasimons Environment - Health & Safety - Sustainability	TITLE: Site Location and Assessment Extents	DRAWN BY: HS / SCALE: NTS	PROJECT NO: 16-0406.05
		CHECKED BY: PH / REVISION: -	FIGURE NO: 1
		DATE: 2nd August 2021	

Appendices

Appendix A - Limitations

Limitations

The recommendations contained in this Report represent Delta-Simons' professional opinions, based upon the information listed in the Report, exercising the duty of care required of an experienced Environmental Consultant. Delta-Simons does not warrant or guarantee that the Site is free of hazardous or potentially hazardous materials or conditions.

Delta-Simons obtained, reviewed and evaluated information in preparing this Report from the Client and others. Delta-Simons' conclusions, opinions and recommendations have been determined using this information. Delta-Simons does not warrant the accuracy of the information provided to it and will not be responsible for any opinions which Delta-Simons has expressed, or conclusions which it has reached in reliance upon information which is subsequently proven to be inaccurate.

This Report was prepared by Delta-Simons for the sole and exclusive use of the Client and for the specific purpose for which Delta-Simons was instructed. Nothing contained in this Report shall be construed to give any rights or benefits to anyone other than the Client and Delta-Simons, and all duties and responsibilities undertaken are for the sole and exclusive benefit of the Client and not for the benefit of any other party. In particular, Delta-Simons does not intend, without its written consent, for this Report to be disseminated to anyone other than the Client or to be used or relied upon by anyone other than the Client. Use of the Report by any other person is unauthorised and such use is at the sole risk of the user. Anyone using or relying upon this Report, other than the Client, agrees by virtue of its use to indemnify and hold harmless Delta-Simons from and against all claims, losses and damages (of whatsoever nature and howsoever or whensoever arising), arising out of or resulting from the performance of the work by the Consultant.

Appendix B - Glossary

Glossary

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
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 subgroups (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.
AQMA	Air Quality Management Area.
AQO	Air Quality Objective.
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of Defra.
BMBC	Barnsley Metropolitan Borough Council
Conservative	Tending to over-predict the impact rather than under-predict.
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
Defra	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport.
EFT	Emissions Factor Toolkit.
Emission rate	The quantity of a pollutant released from a source over a given period of time.
EPUK	Environmental Protection (UK).
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
IAQM	Institute of Air Quality Management.
LAQM	Local Air Quality Management.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
$\mu g/m^3$ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

Term	Definition
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.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix C - Relevant UK Air Quality Strategy Objectives

Relevant UK Air Quality Strategy Objectives

National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health						
Pollutant	**Applies To**	**Objective**	**Measured As**	**Date to be achieved by and maintained thereafter**	**European Obligations**	**Date to be achieved by and maintained thereafter**
Nitrogen dioxide (NO_2)	UK	40µg/m^3	annual mean	31.12.2005	40µg/m^3	01.01.2010
	UK	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005	200µg/m^3 not to be exceeded more than 18 times a year	01.01.2010
Particulate Matter (PM_{10}) (gravimetric)[A]	UK (except Scotland)	40µg/m^3	annual mean	31.12.2005	40µg/m^3	01.01.2010
	UK (except Scotland)	50µg/m^3 not to be exceeded more than 35 times a year	24-hour mean	31.12.2004	50µg/m^3 not to be exceeded more than 35 times a year	01.01.2005
Particulate Matter ($PM_{2.5}$)	UK (except Scotland)	25µg/m^3	annual mean	2020	Target value 25µg/m^3	2010

[A] Measured using the European gravimetric transfer sampler or equivalent

µg/m^3 = microgram per cubic metre

Appendix D - IAQM Construction Assessment Methodology

IAQM Construction Assessment Methodology

Step 1 - Screening the Need for a Detailed Assessment

An assessment will normally be required where there are:

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

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

Step 2a - Define the Potential Dust Emission Magnitude

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment.

Table D1 - Examples of Potential Dust Emission Magnitude

Magnitude	Activity	Criteria
Large	Demolition	>50,000m^3 building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks	Total site area greater than 10,000m^2 Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) More than 10 heavy earth moving vehicles active at any one time Formation of bunds greater than 8m in height More than 100,000 tonnes of material moved
	Construction	Total building volume greater than 100,000m^3 On-site concrete batching Sandblasting
	Trackout	More than 50 Heavy Duty Vehicle (HDV) trips per day Potentially dusty surface material (e.g. high clay content) Unpaved road length greater than 100m
Medium	Demolition	20,000 - 50,000m^3 building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks	Total site area 2,500m^2 to 10,000m^2; Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one times Formation of bunds 4m to 8m in height Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	Total building volume 25,000m^3 to 100,000m^3 Potentially dusty construction material (e.g. concrete) On-site concrete batching
	Trackout	10 to 50 HDV trips per day Moderately dusty surface material (e.g. high clay content) Unpaved road length 50m to 100m
Small	Demolition	<20,000m^3 building demolished, non-dusty material (e.g metal cladding), <10m above ground level, work during wetter months

Magnitude	Activity	Criteria
Small	Earthworks	Total site area less than 2,500m^2; Soil type with large grain size (e.g. sand) Less than 5 heavy earth moving vehicles active at any one time Formation of bunds less than 4m in height Total material moved less than 20,000 tonnes Earthworks during wetter months
	Construction	Total building volume less than 25,000m^3 Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	Less than 10 HDV trips per day Surface material with low potential for dust release Unpaved road length less than 50m

Step 2b - Define the Sensitivity of the Area

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table D2- Sensitivity of the Area to Dust Soiling Effects

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 D3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentrations ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
Medium	>32	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table D4 - 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

Step 2c - Define the Risk of Impacts

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table D5 - Risk of Dust Impacts

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks and Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3 - Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

Step 4 - Determine Significant Effects

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

Appendix E - Dispersion Model Details

Model Input Parameters

Traffic Flow Data

2019 is the most recent year for which monitoring data and meteorological data are available to enable verification of the model results, and so this year has been used as the baseline year for this assessment. 2023 is the anticipated opening year of the Proposed Development.

Baseline traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as HDV proportion, were obtained from the PTC and Department for Transport (DfT)[18]. The DfT web tool enables the user to view and download available traffic flows on every link of the 'A' road and motorway network, as well as selected minor roads, in Great Britain for the years 1999 to 2020. It should be noted that the DfT web tool is referenced in Defra's LAQM.TG16 guidance as being a suitable source of data for air quality assessments and it is therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the Site.

The 2019 traffic data obtained from DfT were converted to the anticipated operational year utilising a factor obtained from TEMPro (version 7.2c). This software package has been developed by the DfT to calculate future traffic growth throughout the UK.

Table E1 - 2019 Verification Traffic Data

Road Link	Name	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_x Emission Factor (g/km/s)
1	Site Access	-	-	-	-
2	Wood Walk	8,245	10.00	45	0.041097
3	Wood Walk, roundabout approach	8,245	10.00	45	0.041097
4	Wood Walk, roundabout approach (junction)	8,245	10.00	20	0.065660
5	Wood Walk, towards Wombwell Road	8,245	10.00	45	0.041097
6	Wombwell Road	7,067	3.00	40	0.029621
7	Wombwell Road (junction)	7,067	3.00	20	0.040162
8	Hawshaw Lane (n. junction)	7,067	3.00	20	0.040162
9	Hawshaw Lane	7,067	3.00	40	0.029621
10	Hawshaw Lane (s. junction)	7,067	3.00	20	0.040162
11	Hoyland Road (n. junction)	7,067	3.00	20	0.040162
12	Hoyland Road	7,067	3.00	40	0.029621
13	Hoyland Road (s. junction)	7,067	3.00	20	0.040162
14	A6135 Sheffield Road south-east (junction)	9,385	2.49	20	0.051776
15	A6135 Sheffield Road south-east	9,385	2.49	40	0.038559
16	A6135 Sheffield Road north-west (junction)	17,416	3.74	20	0.103174
17	A6135 Sheffield Road north-west	17,416	3.74	40	0.075093
18	A6135 Sheffield Road north-west (roundabout)	17,416	3.74	15	0.117226
19	Woodhead Lane (junction)	648	1.08	20	0.003277
20	Woodhead Lane	648	1.08	60	0.002204
21	A6195 Dearne Valley Parkway (a), north-east roundabout approach (junction)	26,309	4.96	30	0.136650
22	A6195 Dearne Valley Parkway (a)	26,309	4.96	60	0.099981
23	A6195 Dearne Valley Parkway (a), south-west roundabout approach (junction)	26,309	4.96	30	0.136650

Road Link	Name	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_x Emission Factor (g/km/s)
24	A6195 Dearne Valley Parkway (b), east roundabout approach (junction)	26,309	4.96	30	0.136650
25	A6195 Dearne Valley Parkway (b)	26,309	4.96	60	0.099981
26	A6195 Dearne Valley Parkway (b), west roundabout approach (junction)	26,309	4.96	30	0.136650
27	A6195 Dearne Valley Parkway (c), north-east roundabout approach (junction)	26,309	4.96	30	0.136650
28	A6195 Dearne Valley Parkway (c)	26,309	4.96	60	0.099981
29	A6195 Dearne Valley Parkway (c), south-west roundabout approach (junction)	26,309	4.96	30	0.136650
30	A6195 Dearne Valley Parkway (d), west roundabout approach (junction)	19,818	4.93	30	0.102805
31	A6195 Dearne Valley Parkway (d)	19,818	4.93	60	0.075252
32	Barnsley Road (junction)	4,347	1.93	20	0.023189
33	Barnsley Road	4,347	1.93	40	0.017464
34	Sheffield Road, roundabout approach (n. junction)	2,134	2.34	15	0.013097
35	Sheffield Road	2,134	2.34	25	0.010645
36	Sheffield Road, roundabout approach (s. junction)	2,134	2.34	15	0.013097
37	A6195 Dearne Valley Parkway (e), Rockingham roundabout approach (junction)	28,031	5.38	20	0.181036
38	A6195 Dearne Valley Parkway (e)	28,031	5.38	30	0.148180
39	A6195 Dearne Valley Parkway (e), Birdwell roundabout approach (junction)	28,031	5.38	20	0.181036
40	Roundabout Link (Sheffield Road)	15,489	3.66	20	0.091355
41	A61 Sheffield Road, roundabout approach (junction)	17,627	4.77	20	0.110340
42	A61 Sheffield Road	17,627	4.77	40	0.078953
43	A6195 Dearne Valley Parkway Roundabout (a)	15,141	6.01	20	0.100895
44	A6195 Dearne Valley Parkway Roundabout (b)	26,309	4.96	20	0.166315
45	A6195 Dearne Valley Parkway Roundabout (c)	26,309	4.96	20	0.166315
46	A6195 Rockingham Roundabout	14,532	5.27	20	0.093333
47	A6135 Sheffield Road Roundabout	9,210	3.66	15	0.061680
48	Birdwell Roundabout	26,173	4.10	20	0.158122
49	A61 off ramp (junction)	20,046	2.43	20	0.110196
50	A61 off ramp	20,046	2.43	20	0.110196
51	A61 on ramp (junction)	20,046	2.43	20	0.110196
52	A61 on ramp	20,046	2.43	20	0.110196
53	A61 roundabout (elevated)	23,146	2.62	20	0.128674
54	M1 Southbound off ramp (junction)	10,630	0.90	15	0.058752
55	M1 Southbound off ramp	10,630	0.90	30	0.045733
56	M1 Southbound on ramp (junction)	8,142	5.20	15	0.059843
57	M1 Southbound on ramp	8,142	5.20	30	0.042719
58	M1 Southbound	39,744	10.00	80	0.162344

Road Link	Name	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)
59	M1 Northbound	38,789	12.10	80	0.164354
60	M1 Northbound off ramp	8,447	4.40	30	0.042835
61	M1 Northbound off ramp (junction)	8,447	4.40	15	0.059220
62	M1 Northbound on ramp (junction)	10,553	0.50	15	0.056537
63	M1 Northbound on ramp	10,553	0.50	30	0.044475

Table E2 - 2023 Without Development Traffic Data

Road Link	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
1	-	-	-	-	-	-
2	8,519	10.00	45	0.042462	0.004269	0.002480
3	8,519	10.00	45	0.042462	0.004269	0.002480
4	8,519	10.00	20	0.067842	0.004533	0.002744
5	8,519	10.00	45	0.042462	0.004269	0.002480
6	7,302	3.00	40	0.030606	0.003064	0.001784
7	7,302	3.00	20	0.041497	0.003195	0.001915
8	7,302	3.00	20	0.041497	0.003195	0.001915
9	7,302	3.00	40	0.030606	0.003064	0.001784
10	7,302	3.00	20	0.041497	0.003195	0.001915
11	7,302	3.00	20	0.041497	0.003195	0.001915
12	7,302	3.00	40	0.030606	0.003064	0.001784
13	7,302	3.00	20	0.041497	0.003195	0.001915
14	9,697	2.49	20	0.053497	0.004176	0.002500
15	9,697	2.49	40	0.039841	0.004009	0.002333
16	17,994	3.74	20	0.106598	0.008054	0.004833
17	17,994	3.74	40	0.077585	0.007712	0.004491
18	17,994	3.74	15	0.121117	0.008217	0.004996
19	670	1.08	20	0.003389	0.000276	0.000165
20	670	1.08	60	0.002279	0.000261	0.000150
21	27,182	4.96	30	0.141184	0.012267	0.007237
22	27,182	4.96	60	0.103298	0.011835	0.006806
23	27,182	4.96	30	0.141184	0.012267	0.007237
24	27,182	4.96	30	0.141184	0.012267	0.007237
25	27,182	4.96	60	0.103298	0.011835	0.006806
26	27,182	4.96	30	0.141184	0.012267	0.007237
27	27,182	4.96	30	0.141184	0.012267	0.007237
28	27,182	4.96	60	0.103298	0.011835	0.006806
29	27,182	4.96	30	0.141184	0.012267	0.007237
30	20,476	4.93	30	0.106218	0.009233	0.005447
31	20,476	4.93	60	0.077751	0.008908	0.005123
32	4,491	1.93	20	0.023957	0.001900	0.001137

Road Link	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
33	4,491	1.93	40	0.018043	0.001826	0.001062
34	2,205	2.34	15	0.013533	0.000963	0.000583
35	2,205	2.34	25	0.010999	0.000932	0.000553
36	2,205	2.34	15	0.013533	0.000963	0.000583
37	28,962	5.38	20	0.187049	0.013604	0.008185
38	28,962	5.38	30	0.153101	0.013223	0.007804
39	28,962	5.38	20	0.187049	0.013604	0.008185
40	16,003	3.66	20	0.094386	0.007145	0.004287
41	18,212	4.77	20	0.114001	0.008404	0.005052
42	18,212	4.77	40	0.081574	0.008034	0.004681
43	15,644	6.01	20	0.104247	0.007481	0.004505
44	27,182	4.96	20	0.171833	0.012614	0.007584
45	27,182	4.96	20	0.171833	0.012614	0.007584
46	15,014	5.27	20	0.096429	0.007030	0.004229
47	9,516	3.66	15	0.063729	0.004335	0.002635
48	27,042	4.10	20	0.163372	0.012235	0.007346
49	20,711	2.43	20	0.113855	0.008903	0.005330
50	20,711	2.43	20	0.113855	0.008903	0.005330
51	20,711	2.43	20	0.113855	0.008903	0.005330
52	20,711	2.43	20	0.113855	0.008903	0.005330
53	23,914	2.62	20	0.132943	0.010342	0.006193
54	10,983	0.90	15	0.060703	0.004568	0.002756
55	10,983	0.90	30	0.047252	0.004394	0.002582
56	8,412	5.20	15	0.061827	0.004018	0.002451
57	8,412	5.20	30	0.044136	0.003822	0.002255
58	41,064	10.00	80	0.167736	0.020286	0.011665
59	40,077	12.10	80	0.169811	0.020766	0.011938
60	8,727	4.40	30	0.044255	0.003877	0.002286
61	8,727	4.40	15	0.061183	0.004068	0.002477
62	10,903	0.50	15	0.058412	0.004472	0.002695
63	10,903	0.50	30	0.045950	0.004307	0.002530

Table E3 - 2023 With Development Traffic Data

Road Link	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
1	550	2.00	15	0.003296	0.000237	0.000144
2	9,069	9.51	45	0.044569	0.004491	0.002609
3	8,849	9.71	45	0.043741	0.004403	0.002558
4	8,849	9.71	20	0.069634	0.004674	0.002829
5	8,739	9.79	45	0.043297	0.004357	0.002532
6	7,467	2.99	40	0.031285	0.003132	0.001823
7	7,467	2.99	20	0.042411	0.003266	0.001957

Road Link	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
8	7,467	2.99	20	0.042411	0.003266	0.001957
9	7,467	2.99	40	0.031285	0.003132	0.001823
10	7,467	2.99	20	0.042411	0.003266	0.001957
11	7,467	2.99	20	0.042411	0.003266	0.001957
12	7,467	2.99	40	0.031285	0.003132	0.001823
13	7,467	2.99	20	0.042411	0.003266	0.001957
14	9,813	2.50	20	0.054169	0.004228	0.002531
15	9,813	2.50	40	0.040333	0.004058	0.002362
16	18,110	3.74	20	0.107286	0.008106	0.004864
17	18,110	3.74	40	0.078085	0.007762	0.004520
18	18,110	3.74	15	0.121898	0.008270	0.005028
19	769	1.20	20	0.003919	0.000318	0.000190
20	769	1.20	60	0.002625	0.000301	0.000173
21	27,281	4.95	30	0.141638	0.012308	0.007261
22	27,281	4.95	60	0.103646	0.011875	0.006829
23	27,281	4.95	30	0.141638	0.012308	0.007261
24	27,281	4.95	30	0.141638	0.012308	0.007261
25	27,281	4.95	60	0.103646	0.011875	0.006829
26	27,281	4.95	30	0.141638	0.012308	0.007261
27	27,281	4.95	30	0.141638	0.012308	0.007261
28	27,281	4.95	60	0.103646	0.011875	0.006829
29	27,281	4.95	30	0.141638	0.012308	0.007261
30	20,575	4.92	30	0.106686	0.009275	0.005472
31	20,575	4.92	60	0.078105	0.008949	0.005146
32	4,590	1.93	20	0.024485	0.001942	0.001162
33	4,590	1.93	40	0.018441	0.001866	0.001086
34	2,304	2.33	15	0.014131	0.001006	0.000609
35	2,304	2.33	25	0.011486	0.000974	0.000577
36	2,304	2.33	15	0.014131	0.001006	0.000609
37	29,061	5.37	20	0.187594	0.013646	0.008210
38	29,061	5.37	30	0.153561	0.013265	0.007829
39	29,061	5.37	20	0.187594	0.013646	0.008210
40	16,119	3.66	20	0.095071	0.007197	0.004318
41	18,328	4.76	20	0.114668	0.008455	0.005082
42	18,328	4.76	40	0.082063	0.008083	0.004709
43	15,743	5.98	20	0.104752	0.007522	0.004530
44	27,281	4.95	20	0.172370	0.012656	0.007609
45	27,281	4.95	20	0.172370	0.012656	0.007609
46	15,113	5.25	20	0.096966	0.007072	0.004254
47	9,615	3.64	15	0.064311	0.004377	0.002661
48	27,042	4.10	20	0.163372	0.012235	0.007346

Road Link	AADT (Total vehicles)	%HDV	Speed (km/h)	NO_X Emission Factor (g/km/s)	PM_{10} Emission Factor (g/km/s)	$PM_{2.5}$ Emission Factor (g/km/s)
49	20,711	2.43	20	0.113855	0.008903	0.005330
50	20,711	2.43	20	0.113855	0.008903	0.005330
51	20,711	2.43	20	0.113855	0.008903	0.005330
52	20,711	2.43	20	0.113855	0.008903	0.005330
53	23,914	2.62	20	0.132943	0.010342	0.006193
54	10,983	0.90	15	0.060703	0.004568	0.002756
55	10,983	0.90	30	0.047252	0.004394	0.002582
56	8,412	5.20	15	0.061827	0.004018	0.002451
57	8,412	5.20	30	0.044136	0.003822	0.002255
58	41,064	10.00	80	0.167736	0.020286	0.011665
59	40,077	12.10	80	0.169811	0.020766	0.011938
60	8,727	4.40	30	0.044255	0.003877	0.002286
61	8,727	4.40	15	0.061183	0.004068	0.002477
62	10,903	0.50	15	0.058412	0.004472	0.002695
63	10,903	0.50	30	0.045950	0.004307	0.002530

Roughness Length

The roughness length (z_0) is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents and 0.3m for the meteorological station site. These values of z_0 are considered appropriate for the morphology of both areas and are suggested within ADMS-Roads as being suitable for 'parkland, open suburbia' and 'agricultural areas (max)' respectively.

Monin-Obukhov Length

The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 10m was used to describe both the modelling extents and the meteorological station site. This value is considered appropriate for the nature of both areas and is suggested within ADMS-Roads as being suitable for 'small towns <50,000'.

Model Verification

Introduction

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters, such as 'roughness length'; and
- Overall limitations of the dispersion model.

Nitrogen Dioxide

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides (NO_x = NO + NO_2), in line with the guidance provided within LAQM.TG16.

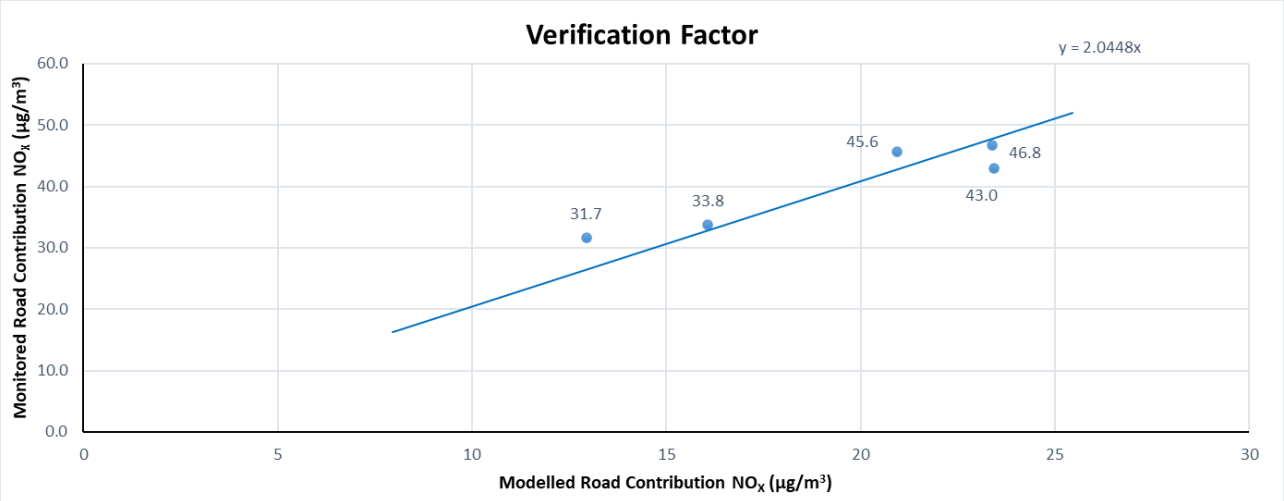
The model has been run to predict the 2019 annual mean road-NO_x contribution at one kerbside and four roadside diffusion tubes within the modelled road network at the verification locations with suitable monitoring data and traffic data. The model outputs of road-NO_x have been compared with the 'measured' road-NO_x, which was determined from the NO_2 concentration measured using the diffusion tubes at the monitoring locations, utilising the NO_x to NO_2 Calculator provided by Defra and the NO_2 background concentration (from the Defra background map). As discussed in the methodology section, the most recent suitable data available for model verification purposes is 2019 data.

Table E4 - Model Verification

Site ID	2019 Monitored Total NO_2 ($\mu g/m^3$)	2019 Background NO_2 ($\mu g/m^3$)	2019 Monitored Road Contribution NO_x ($\mu g/m^3$)	2019 Modelled Road Contribution NO_x ($\mu g/m^3$)	Ratio
DT24	30.3	13.0	33.8	16.1	2.104
DT25	38.6	17.4	43.0	23.4	1.832
DT26	40.3	17.4	46.8	23.4	1.999
DT27	39.8	17.4	45.6	20.9	2.180
DT31	29.7	13.4	31.7	12.9	2.446

The road-NO_x adjustment factor was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (**Figure E1**). This resulted in a factor of **2.04**, indicating that the model was under-predicting. This road-NO_x adjustment factor was applied to the modelled road-NO_x concentration for the monitoring site to provide adjusted modelled road-NO_x concentrations. The total nitrogen dioxide concentration was then determined by inputting the adjusted modelled road-NO_x concentration and the background NO_2 concentration into the NO_x to NO_2 calculator.

Figure E1 - Comparison of Measured Road-NO_x with Unadjusted Modelled Road-NO_x



PM_{10} and $PM_{2.5}$

There are no local PM_{10} or $PM_{2.5}$ monitoring data against which the model could be verified. Consequently, the verification factor determined above for adjusting the road-NO_x contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG16.

Model Uncertainty

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG16 identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include:

a) Root mean square error (RMSE);

b) Fractional bias (FB); and

c) Correlation coefficient (CC).

These parameters estimate how the model results agree or diverge from the observations. These calculations can be carried out prior to, and after adjustment, or based on different options for adjustment, and can provide useful information on model improvement. Further details can be found in Box 7.17 of LAQM.TG16.

Table E5 - Methods for Describing Model Uncertainty

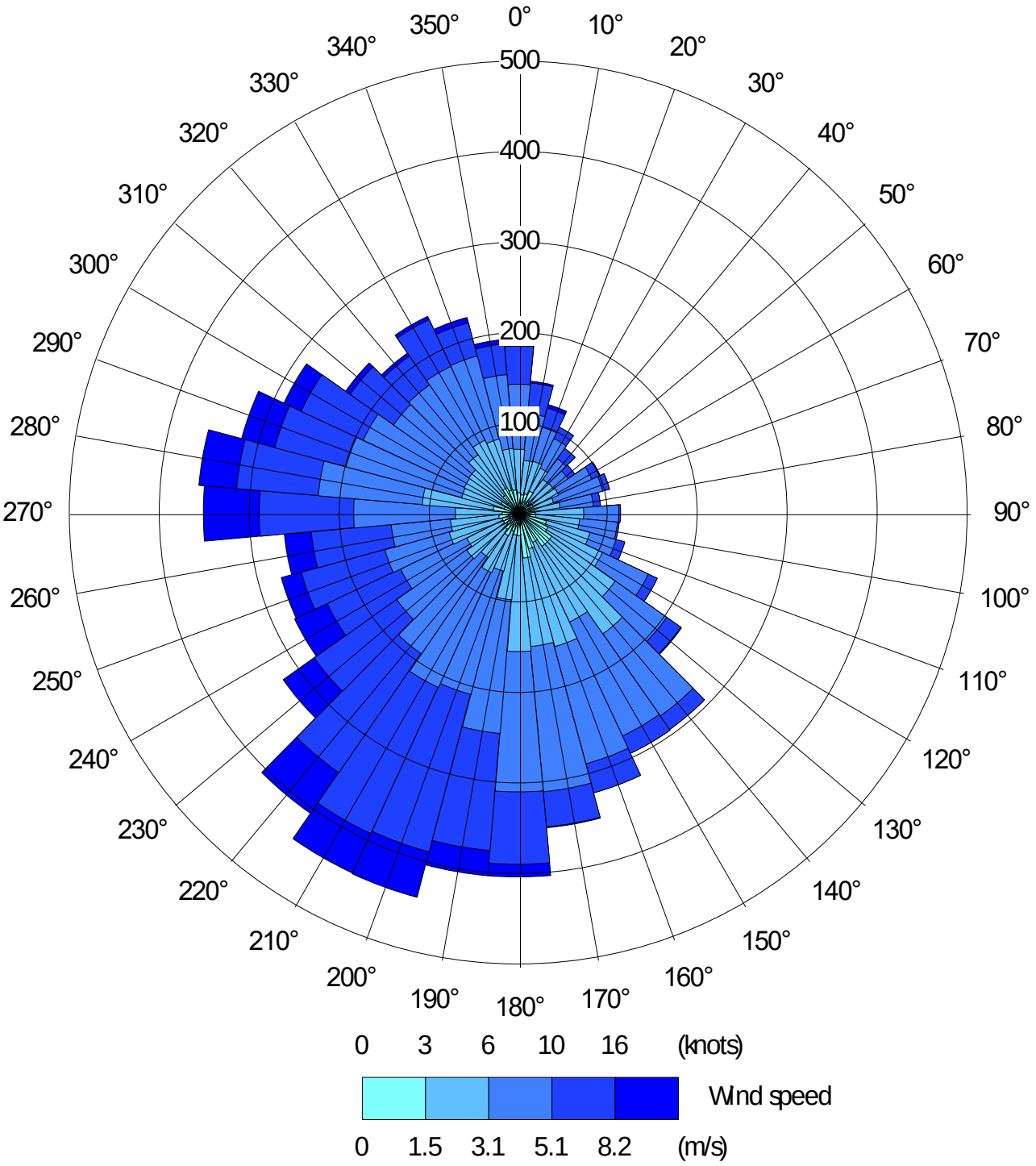
Statistical Parameter	**Comments**
RMSE	RMSE is used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared. If the RMSE values are higher than 25% of the objective being assessed, it is recommended that the model inputs and verification should be revisited in order to make improvements. For example, if the model predictions are for the annual mean NO_2 objective of 40 µg/m^3, if an RMSE of 10µg/m^3 or above is determined for a model it is advised to revisit the model parameters and model verification. Ideally an RMSE within 10% of the air quality objective would be derived, which equates to 4µg/m^3 for the annual mean NO_2 objective.
Fractional Bias	It is used to identify if the model shows a systematic tendency to over or under predict. FB values vary between +2 and -2 and has an ideal value of zero. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.
Correlation Coefficient	It is used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship. This statistic can be particularly useful when comparing a large number of model and observed data points.

To assess the uncertainty of a model, the RMSE is the simplest parameter to calculate providing an estimate of the average error of the model in the same units as the modelled predictions. It is also often easier to interpret the RMSE than the other statistical parameters and therefore it has been calculated in this assessment to understand the model uncertainty.

The overall weighted RMSE value calculated after verification was below 10% and therefore the final predictions are considered to be acceptable.

Appendix F - Wind Rose for Doncaster Sheffield Airport (2019)

Wind Rose for Doncaster Sheffield Airport (2019)



Appendix G - Dispersion Modelling Results

Table G1 - Annual Mean NO_2 Concentration

Receptor	Future Without Dev.(µg/m^3)	Future With Dev. (µg/m^3)	% of AQAL	Change (µg/m^3)	% of AQO	Impact
R1	17.4	17.5	43.7	0.1	<0.5	Negligible
R2	22.2 (22.23)	22.5 (22.45)	56.1	0.2 (0.22)	<1.0	Negligible
R3	22.0 (22.04)	22.3 (22.27)	55.7	0.2 (0.23)	<1.0	Negligible
R4	24.0	24.2	60.4	0.2	<0.5	Negligible
R5	18.9 (18.92)	19.1 (19.05)	47.6	0.1 (0.13)	<0.5	Negligible
R6	21.1	21.2	53.0	0.1	<0.5	Negligible
R7	24.5	24.6	61.5	0.1	<0.5	Negligible
R8	17.3	17.4	43.4	0.1	<0.5	Negligible
R9	18.9	19.0	47.5	0.1	<0.5	Negligible
R10	16.8	16.8	42.1	<0.1	<0.5	Negligible
R11	18.7	18.8	47.0	0.1	<0.5	Negligible
R12	18.9	19.0	47.5	0.1	<0.5	Negligible
R13	38.2	38.4	96.1	0.2	<1.0	Slight
R14	33.7 (33.65)	33.9 (33.90)	84.8	0.3 (0.25)	<1.0	Negligible
PR1	-	21.6	53.9	-	-	-
PR2	-	19.0	47.6	-	-	-
PR3	-	24.2	60.4	-	-	-
PR4	-	19.4	48.6	-	-	-
PR5	-	21.2	53.0	-	-	-
PR6	-	19.9	49.8	-	-	-
PR7	-	20.2	50.5	-	-	-

* Results are rounded to 0.1µg/m^3

Table G2 - Annual Mean PM_{10} Concentration

Receptor	Future Without Dev.(µg/m^3)	Future With Dev. (µg/m^3)	% of AQAL	Change (µg/m^3)	% of AQO	Impact
R1	12.0	12.0	30.0	<0.1	<0.5	Negligible
R2	13.0	13.0	32.5	<0.1	<0.5	Negligible
R3	12.9	13.0	32.5	0.1	<0.5	Negligible
R4	13.2 (13.24)	13.3 (13.29)	33.2	<0.1	<0.5	Negligible
R5	12.3	12.3	30.8	<0.1	<0.5	Negligible
R6	12.8 (12.83)	12.9 (12.85)	32.1	<0.1	<0.5	Negligible
R7	13.8	13.9	34.8	0.1	<0.5	Negligible
R8	12.2	12.2	30.5	<0.1	<0.5	Negligible
R9	12.6	12.6	31.5	<0.1	<0.5	Negligible
R10	12.0	12.0	30.0	<0.1	<0.5	Negligible
R11	12.1	12.2	30.5	0.1	<0.5	Negligible
R12	12.2	12.2	30.5	<0.1	<0.5	Negligible

Receptor	Future Without Dev.(µg/m^3)	Future With Dev. (µg/m^3)	% of AQAL	Change (µg/m^3)	% of AQO	Impact
R13	15.8	15.8	39.5	<0.1	<0.5	Negligible
R14	15.0	15.1	37.8	0.1	<0.5	Negligible
PR1	-	12.8	32.0	-	-	-
PR2	-	12.3	30.8	-	-	-
PR3	-	13.3	33.3	-	-	-
PR4	-	12.4	31.0	-	-	-
PR5	-	12.7	31.8	-	-	-
PR6	-	12.6	31.5	-	-	-
PR7	-	12.6	31.5	-	-	-

* Results are rounded to 0.1µg/m^3

Table G3 - Annual Mean $PM_{2.5}$ Concentration

Receptor	Future Without Dev.(µg/m^3)	Future With Dev. (µg/m^3)	% of AQAL	Change (µg/m^3)	% of AQO	Impact
R1	7.7	7.7	30.8	<0.1	<0.5	Negligible
R2	8.3	8.3	33.2	<0.1	<0.5	Negligible
R3	8.3	8.3	33.2	<0.1	<0.5	Negligible
R4	8.5	8.5	34.0	<0.1	<0.5	Negligible
R5	7.9	7.9	31.6	<0.1	<0.5	Negligible
R6	8.2	8.2	32.8	<0.1	<0.5	Negligible
R7	8.6	8.6	34.4	<0.1	<0.5	Negligible
R8	7.6	7.7	30.8	0.1	<0.5	Negligible
R9	7.9	7.9	31.6	<0.1	<0.5	Negligible
R10	7.7	7.7	30.8	<0.1	<0.5	Negligible
R11	7.8	7.8	31.2	<0.1	<0.5	Negligible
R12	7.8	7.9	31.6	0.1	<0.5	Negligible
R13	9.9	9.9	39.6	<0.1	<0.5	Negligible
R14	9.4	9.5	38.0	0.1	<0.5	Negligible
PR1	-	8.2	32.8	-	-	-
PR2	-	7.9	31.6	-	-	-
PR3	-	8.5	34.0	-	-	-
PR4	-	8.0	32.0	-	-	-
PR5	-	8.1	32.4	-	-	-
PR6	-	8.1	32.4	-	-	-
PR7	-	8.1	32.4	-	-	-

* Results are rounded to 0.1µg/m^3