

Trinity Academy, Barnsley, Temporary Building

Air Quality Technical Note

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This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS EN ISO 45001:2018)

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1. Introduction

- 1.1. Waterman Infrastructure & Environment Ltd (hereafter '*Waterman*') was appointed by The Department of Education ('the Client') to undertake an air quality assessment in support of the planning application being submitted to Barnsley Metropolitan Borough Council (BMBC) for a temporary new school building and associated playing fields and outdoor space on land adjacent to Keresforth Close, Barnsley S70 (hereafter '*the Site*').

Site Context

- 1.2. The Site is located within Kingstone which forms the south-western suburban extent of Barnsley. Barnsley town centre is situated c. 1.2km north-east of the Site.
- 1.3. The site is bounded by Broadway to the south-west, residential properties to the north, the main Trinity School Building would be constructed to the north-east of the site of the temporary school. A site context plan is shown in Figure 1.

Proposed Development

- 1.4. The Proposed Development consists of the erection of a temporary modular school building with associated access road, parking, external play areas and associated works.

Figure 1: Site Location Plan



Effects of the Temporary School Building

- 1.5. As part of the planning application for the development of the permanent Trinity School Building an air quality assessment was undertaken, the air quality assessment (WIE17125-109-R-1-1-4-AQA, August 2020) is provided in Annex 1 of this technical note.

Construction Phase

- 1.6. The assessment of the proposed construction of the permanent school building considered that the Site was high risk to dust soiling impacts based on the IAQM guidance and appropriate mitigation measures should be implemented to ensure there are no adverse effects. It is considered that the mitigation measures would also be applied to the temporary school and therefore the effects of the construction phase would not be significant.

Operational Phase

- 1.7. Dispersion modelling was undertaken to predict the impact on local air quality associated with the completed and operational of the permanent school. The assessment predicts that the permanent school is predicted to not have a significant effect on NO₂, PM₁₀ and PM_{2.5} concentrations at all existing and future receptors.
- 1.8. The transport consultant has confirmed that the traffic flows associated with the temporary modular school building would be less than those associated with the temporary school building as only a couple of the school years will be using the building. It is therefore considered that the results of the permanent school air quality assessment represent a worst-case assessment and the effect of the temporary school would not be significant.

Annex 1: Trinity School Building Air Quality Assessment (WIE17125-109-R-1-1-4-AQA)



Trinity Academy

Air Quality Assessment

August 2020

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Issue	Date	Prepared by	Checked by	Approved by
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Comments

Comments

Disclaimer

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We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

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Appendices

Appendix A Summary of Relevant Legislation, Planning Policy and Guidance

Appendix B Air Quality Assessment Detailed Methodology

Executive Summary

Planning permission is sought for a development providing approximately 6,450m² of residential space, and a school with associated outdoor sports provision and carparking at Keresforth Close, Barnsley.

The implementation of a range of appropriate management practices to control dust, plant and vehicle emissions would ensure any effects associated with construction activities would be not significant.

The operational Development would generate vehicle trips, which could potentially change local air quality in terms of NO₂ and particulate matter (PM₁₀ and PM_{2.5}) concentrations. However, on completion, the Development is predicted to not have a significant effect on NO₂, PM₁₀ and PM_{2.5} concentrations at existing and future sensitive receptors on and surrounding the Site.

The overall effect of the Development on air quality is not significant.

1. Introduction

- 1.1. Waterman Infrastructure & Environment Ltd (hereafter referred to as 'Waterman') was instructed by the Department for Education (The Applicant) to prepare an air quality assessment to accompany the planning application for re-development of land off Keresforth Close in Barnsley Metropolitan Borough Council (BMBC), hereafter referred to as the 'Site'.
- 1.2. The Site is approximately 7 hectares in area and is located within Kingstone which forms the south-western suburban extent of Barnsley, centred on National Grid Reference SE 33365 05544. The site is bounded by Broadway to the south-west, residential properties and playing fields to the north, Joseph Locke Primary school to the east and a mixture of allotments and two-storey residential properties to the south-east. The Site is currently predominantly disused but comprises of the former Keresforth Centre NHS facility, and a playing field adjacent to the A6133 Broadway.
- 1.3. Current proposals are for the demolition of all structures within the Site boundary to facilitate the construction of 6,450m² of residential space, and a 900-place secondary school with associated outdoor sports provision and carparking, hereafter referred to as the Development.
- 1.4. BMBC has designated six Air Quality Management Areas (AQMAs) for annual mean or hourly mean nitrogen dioxide (NO₂). The Site is not located within an AQMA.
- 1.5. The purpose of this air quality assessment is to provide a review of the existing air quality at and surrounding the Site and assess the potential effect of the Development on local air quality during construction and on completion. Consideration is given to the impact of emissions from construction activities and the completed and operational Development on existing sensitive receptors surrounding the Site as well as on proposed residential and school receptors within the Development. The most significant pollutants associated with road traffic emissions, in relation to human health, are NO₂ and particulate matter (PM₁₀ and PM_{2.5}). The assessment focuses on these pollutants.
- 1.6. Section 2 of this air quality assessment lists the legislation, planning policy and guidance relevant to air quality. Section 3 provides details of the assessment methodology and Section 4 sets out the baseline conditions at and around the Site. The results of the assessments are presented in Section 5 and Section 6. Section 7 describes any required mitigation measures. A summary of the findings and conclusions of the assessment is given in Section 8. The air quality assessment is supported by:
 - Appendix A: Summary of Relevant Legislation, Planning Policy and Guidance; and
 - Appendix B: Air Quality Assessment Detailed Methodology.

2. Air Quality Legislation, Planning Policy and Guidance

2.1. The following legislation, planning policy and guidance are considered relevant to this air quality assessment. A summary of these documents is provided in **Appendix A**:

- Legislation:
 - EU Framework Directive 2008/50/EC, 2008¹;
 - Air Quality Standards Regulations, 2010²;
 - The UK Air Quality Strategy, 2007³;
 - The Environment Act 1995⁴;
- Planning Policy
 - National Planning Policy Framework, 2019⁵;
 - Barnsley Metropolitan Borough Council. Barnsley Local Plan. January 2019⁶;
- Guidance:
 - Department for Environment, Food and Rural Affairs, Clean Air Strategy, 2019⁷;
 - Improving Air Quality in the UK: Tackling Nitrogen Dioxide in our Towns and Cities. UK Air Quality Plan for Tackling Nitrogen Dioxide, 2017⁸;
 - Environmental Protection UK & Institute of Air Quality Management Guidance; Land-Use Planning & Development Control: Planning for Air Quality, 2017⁹
 - Planning Practice Guidance¹⁰;
 - Local Air Quality Management Policy Guidance, 2016¹¹;
 - Institute of Air Quality Management: Guidance on the Assessment of Dust from Demolition and Construction, 2014¹²; and
 - Barnsley Metropolitan Borough Council Barnsley MBC Air Quality Action Plan, April 2017 (updated 2019)¹³

¹ Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.

² Defra, (2010) The Air Quality Standards (England) Regulations.

³ Department of the Environment, Food and Rural Affairs (Defra), (2007). 'The Air Quality Strategy for England, Scotland, Wales & Northern Ireland'

⁴ Office of the Deputy Prime Minister (ODPM), 1995, 'The Environment Act' 1995.

⁵ Department for Communities and Local Government, 2019, 'National Planning Policy Framework'. DCLG, London.

⁶ Barnsley Metropolitan Borough Council. Barnsley Local Plan. January 2019

⁷ Defra (2019) Clean Air Strategy, 2019

⁸ Defra (2017) Improving Air Quality in the UK: Tackling nitrogen dioxide in our towns and cities. Draft UK Air Quality Plan for Tackling Nitrogen Dioxide (Consultation Document)

⁹ Environmental Protection UK & Institute of Air Quality Management (2017), 'Land-Use Planning & Development Control: Planning for Air Quality', EPUK & IAQM, London.

¹⁰ DCLG (2014), 'Planning Practice Guidance: Air Quality (ID 32)' (06 March 2014).

¹¹ Defra (2016), 'Local Air Quality Management (LAQM) Policy guidance 2016 (LAQM.PG (16))', DEFRA, London.

¹² Institute of Air Quality Management, 2014, 'Guidance on the Assessment of dust from demolition and construction.

¹³ Barnsley Metropolitan Borough Council Barnsley MBC Air Quality Action Plan, April 2017 (updated 2019)

3. Assessment Methodology and Significance

Assessment Methodology

- 3.1. This air quality assessment was undertaken using a variety of information and procedures as follows:
- review of BMBC's air quality Review and Assessment statutory reports published as part of the LAQM regime to determine baseline conditions around the Site;
 - review of the local area to identify potentially sensitive receptor locations that could be affected by changes in air quality arising from the construction works and the operation of the Development;
 - identification of air quality sensitive receptors within the Development, to determine air quality conditions that future users would be exposed to;
 - review and use of relevant traffic flow data from the Applicant's transport consultant (Waterman);
 - determination of the likely significant effects of construction works and activities, and consideration of the environmental management controls likely to be employed during the construction phase at the Site;
 - dispersion modelling of pollutant emissions using the ADMS-Roads model¹⁴ to predict the likely pollutant concentrations at the Site and the likely effect of the completed and operational Development on local air quality in terms of traffic emissions. The latest NO₂ from NO_x Calculator available from the LAQM Support website¹⁵ has been applied to derive the road-related NO₂ concentrations from the modelled NO_x concentrations;
 - comparison of the predicted air pollutant concentrations with monitored concentrations at the Barnsley A628 Roadside (CM2) automatic monitor and a diffusion tube located on Dodworth Road (DT14) and adjustment of modelled results where necessary (model verification details are provided in **Appendix B**);
 - comparison of the predicted air pollutant concentrations with the UK AQS objectives;
 - determination of the likely significant effects of the operational phase of the Development on air quality, based on the application of the EPUK/ IAQM guidance significance criteria to the modelled results; and
 - identification of mitigation measures, where appropriate.
- 3.2. Emissions of total NO_x from motor vehicle exhausts comprise nitric oxide (NO) and nitrogen dioxide (NO₂). NO oxidises in the atmosphere to form NO₂.
- 3.3. The most significant pollutants associated with road traffic emissions, in relation to human health, are NO₂ and PM₁₀. This assessment therefore focuses on NO₂ and particulate matter (PM₁₀ and PM_{2.5}).

¹⁴ Cambridge Environmental Research Consultants Ltd, ADMS-Roads, 2018, Version 4.1.1.

¹⁵ AEA, NO_x to NO₂ Calculator, <http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php>, Version 7.1, May 2019.

Construction Phase Assessment Methodology

Dust Emissions

- 3.4. The assessment of the effects from the construction activities in relation to dust has been based on the IAQM's Guidance on the Assessment of Dust from Demolition and Construction, 2014 and the following:
- consideration of planned construction activities and their phasing; and
 - a review of the sensitive uses in the area immediately surrounding the Site.
- 3.5. The IAQM guidance identifies receptors within 350m of the Site boundary, and within 50m of construction routes would be sensitive to emissions and nuisance dust from construction activities. The location of individual sensitive receptors assessed are detailed in **Table 2** of this report. For clarification, **Figure 1** shows the area surrounding the Site, where sensitive receptors could be affected, considering the IAQM guidance.
- 3.6. Following the IAQM guidance, construction activities can be divided into the following four distinct activities:
- demolition – any activity involved in the removal of an existing building;
 - earthworks – the excavation, haulage, tipping and stockpiling of material, but may also involve levelling the site and landscaping;
 - construction – any activity involved with the provision of a new structure; and
 - trackout – the movement of vehicles from unpaved ground on a site, where they can accumulate mud and dirt, onto the public road network where dust might be deposited.
- 3.7. The IAQM guidance considers three separate dust effects, with the proximity of sensitive receptors being taken into consideration for:
- annoyance due to dust soiling;
 - potential effects on human health due to significant increase in exposure to PM₁₀; and
 - harm to ecological receptors.
- 3.8. A summary of the four-step process undertaken for the construction dust assessment, as set out in the IAQM guidance, is presented in **Table 1**.

Table 1: Summary of the IAQM Guidance for Undertaking a Construction Dust Assessment

Step	Description
1	Screen the Need for a Detailed Assessment Simple distance-based criteria are used to determine the requirement for a detailed dust assessment. An assessment will normally be required where there are 'human receptors' within 350m of the boundary of the site and / or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance or 'ecological receptors' within 50m of the boundary of the site and/or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance.
2	Assess the Risk of Dust Effects The risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological effects should be determined using three risk categories: low, medium and high based on the following factors: - the scale and nature of the works, which determines the risk of dust arising (i.e. the magnitude of potential dust emissions) classed as small, medium or large; and - the sensitivity of the area to dust effects, considered separately for ecological and human receptors (i.e. the potential for effects) defined as low, medium or high.
3	Site Specific Mitigation Determine the site-specific measures to be adopted at the site based on the risk categories determined in Step 2 for the four activities. For the cases where the risk is 'insignificant' no mitigation measures beyond those required by legislation are required. Where a local authority has issued guidance on measures to be adopted these should be taken into account.
4	Determine Significant Effects Following Steps 2 and 3, the significance of the potential dust effects should be determined, using professional judgement, taking into account the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks.

Construction Vehicle Exhaust Emissions

- 3.9. The IAQM guidance on assessing construction effects states:
- 3.10. *"Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant effect on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out, then it should be assessed using the same methodology and significance criteria as operational traffic impacts."*
- 3.11. The Site is approximately 7.4 hectares. In accordance with the IAQM guidance, a quantitative assessment of the exhaust emissions from construction traffic is not required, and a qualitative assessment is appropriate.

Construction Plant Emissions

- 3.12. Given the size of the Site and the small contribution of emissions to local air quality, in accordance with the IAQM guidance, is considered that a quantitative assessment of the exhaust emissions from construction plant is not required, and a qualitative assessment is appropriate.

Operational Phase Assessment Methodology

ADMS Model

- 3.13. The likely effect on local air quality from traffic emissions generated from the completed and operational Development has been assessed using the atmospheric dispersion model ADMS-Roads.
- 3.14. The ADMS-Roads dispersion model predicts how emissions from roads and small-scale industrial sources combine with local background pollution levels, taking account of meteorological conditions, to affect local air quality.
- 3.15. Traffic data has been provided by the Applicant's transport consultant (Waterman IE). The model has been run for the year 2019, using background data and vehicle emission rates for 2019 as inputs. The baseline year of 2019 has been assessed to represent a worst-case assessment on the air quality effects of the Development.
- 3.16. The Development does not propose a centralised energy plant such as a centralised gas-fired boiler or Combined Heat and Power Plant (CHP). If a centralised gas-fired boiler or CHP is subsequently proposed, details would be submitted to the BMBC at the appropriate time, secured by way of a planning condition. This air quality assessment does not therefore consider any emissions to air from any centralised heating or energy plant.
- 3.17. Full details of the dispersion modelling study are presented within **Appendix B**.

Model Uncertainty

- 3.18. Analyses of historical monitoring data by Defra¹⁶ identified a disparity between actual measured NO_x and NO₂ concentrations and the expected decline associated with emission forecasts, which form the basis of air quality modelling as described above. In February 2020, Air Quality Consultants published a report on Performance of Defra's Emission Factor Toolkit 2013-2019¹⁷. The report concluded that the analysis of recent NO_x measurements provides evidence that vehicle controls are working, and as a result, the Emission Factor Toolkit (EFT) is now reflecting the rate of observed reductions. Therefore, this air quality assessment has been undertaken using the emission factors published by Defra in the EFT version 9.

Background Pollutant Concentrations

- 3.19. To estimate the total concentrations due to the contribution of any other nearby sources of pollution, background pollutant concentrations need to be added to the modelled concentrations. Full details of the background pollution data used within the air quality assessment are included in **Appendix B**.

Model Verification

- 3.20. Model verification is the process of comparing monitored and modelled pollutant concentrations and, if necessary, adjusting the modelled results to reflect actual measured concentrations, to improve the accuracy of the modelling results. The model has been verified by comparing the predicted annual mean NO₂ concentrations for the baseline 2019, with the results from the Barnsley A628 Roadside (CM2) automatic monitor and a diffusion tube located on Dodworth Road

¹⁶ <http://laqm.defra.gov.uk/faqs/faqs.html>.

¹⁷ Air Quality Consultants. 2020. Performance of Defra's Emission Factor Toolkit 2013 – 2019. February 2020

(DT14) . Modelled concentrations have then been adjusted accordingly. The verification and adjustment process are described in detail in **Appendix B**.

Potentially Sensitive Receptors

- 3.21. The UK AQS approach is to focus on locations at, and close to, ground level where members of the public (in a non-workplace area) are likely to be exposed over the averaging time of the objective in question (i.e. over 1-hour, 24-hour or annual periods). Objective exceedances principally relate to annual mean NO₂ and PM₁₀, and 24-hour mean PM₁₀ concentrations. Potentially sensitive locations relate mainly to residential properties and other sensitive locations (such as hospitals and schools) where the public may be exposed for prolonged periods.
- 3.22. **Table 2** presents existing sensitive receptors selected due to their proximity to the road network likely to be affected by the Development. **Table 2** also presents future sensitive receptor locations which are representative of sensitive uses proposed within the Development itself. The future sensitive receptor locations are located at ground level, representing areas of the Development closest to road traffic and exposed to the worst-case air quality conditions. The location of the selected existing and future receptors assessed are presented in **Figure 2**.

Table 2: Selected Receptor Locations

ID	Receptor Location	Receptor Type	Grid Reference		Height Above Ground (m)
1	Keresforth Court	Residential	433227	405554	0
2	Scholars Walk	Residential	433193	405525	0
3	63 Keresforth Hill Road	Residential	433441	405380	0
4	134 Park Road	Residential	433756	405389	0
5	Broadway Drive	Residential	433117	405594	0
6	Broadway Court	Residential	432682	406116	0
7	188 Dodworth Road	Residential	432794	406206	0
8	213 Dodworth Road	Residential	433187	406346	0
9	259 Dodworth Road	Residential	432610	406139	0
10	2 Broadway	Residential	432705	406148	0
11	Proposed: Residential 1	Residential	433365	405652	0
12	Proposed: Residential 2	Residential	433417	405687	0
13	Proposed: School 1	Residential	433476	405689	0
14	Proposed: School 2	Residential	433461	405643	0

Limitations and Assumptions

- 3.23. For the purposes of the dust nuisance assessment during demolition and construction works, it was assumed activities would be carried out at the Site boundary to provide a worst-case assessment.
- 3.24. 2019 baseline traffic data was not available for Keresforth Close. The Keresforth Close 'With Development' scenario comprises vehicle movements associated with the Development only.

- 3.25. Currently there is no methodology to assess and determine the impact of a development against the EU Limit Values. In addition, compliance with the EU Limit Values is a UK Government responsibility as national measures, such as vehicle scrappage schemes and increased diesel fuel prices, would be required to meet compliance. The effect of the Development has been assessed against the UK AQS objectives rather than the EU Limit Values.
- 3.26. There is no standard or recognised methodology to predict the reduction in pollutant concentrations from all air quality mitigation measures or measures likely to have a positive impact of local air quality (such as cycle spaces, electric charging points, sustainable transport options or green infrastructure etc.) as these measures are either based on holistic behavioural changes and/or there is a lack of real-world quantifiable data (in $\mu\text{g}/\text{m}^3$).

Determining Significance of Effects

Construction

Dust Emissions

- 3.27. The potential effects of construction activities on local air quality were based on professional judgement and with reference to the criteria set out in IAQM's construction dust guidance. Appropriate mitigation that would be implemented to minimise any adverse effects on air quality were also considered. Details of the assessor's experience and competence to undertake the dust assessment is provided in **Appendix B**.
- 3.28. The Site currently comprises of two surface-level car parks and building demolition activities would not be undertaken. Demolition has therefore not been considered further.
- 3.29. The assessment of the risk of dust effects arising from the likely construction activities, as identified by the IAQM's construction dust guidance, is based on the magnitude of potential dust emissions and the sensitivity of the area. The risk category matrix for construction activity types, taken from the IAQM guidance, is presented in **Table 3** to **Table 6**.

Table 3: Risk Category from Demolition Activities

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

Table 4: Risk Category from Earthworks Activities

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

Table 5: Risk Category from Construction Activities

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

Table 6: Risk Category from Trackout Activities

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

- 3.30. The risk category determined for each construction activity type was used to define the appropriate mitigation measures that should be applied. The IAQM's construction dust guidance recommends significance is only assigned to the effect after considering mitigation and assumes all actions to avoid or reduce the effects are inherent within the design of the development. In the case of construction mitigation, this would be secured through planning conditions, legal requirements or required by regulations. Therefore, in this assessment no significance is identified for the pre-mitigation effects of the construction activities.

Construction Vehicle Exhaust Emissions

- 3.31. The significance of the effects of construction vehicle exhaust emissions on air quality is based on professional judgement.

Construction Plant Emissions

- 3.32. The significance of the effects of construction plant emissions on air quality is also based on professional judgement.

Completed Development

- 3.33. The EPUK / IAQM guidance provides an approach to assigning the magnitude of changes as a result of a development as a proportion of a relevant assessment level. Followed by examining this change in the context of the new total concentration and its relationship with the assessment criterion to provide a description of the impact at selected receptor locations.
- 3.34. **Table 7** presents the IAQM framework for describing the impacts (the change in concentration of an air pollutant) at individual receptors. The term Air Quality Assessment Level (AQAL) is used to include air quality objectives or limit values, where these exist.

Table 7: Impact Descriptors for Individual Receptors

Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 - 94% of AQAL	Negligible	Slight	Moderate	Moderate

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

Note: AQAL may be an air quality objective, EU limit value, or an Environment Agency 'Environmental Assessment Level (EAL)'
 The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers.
 Changes of 0% (i.e. less than 0.5%) are described as Negligible
 The table is only to be used with annual mean concentrations

- 3.35. The approach set out in the EPUK / IAQM guidance provides a method for describing the impact magnitude at individual receptors only. The guidance outlines that this change may have an effect on the receptor depending on the severity of the impact and other factors that may need to be taken into account. The assessment framework for describing impacts can be used as a starting point to make a judgement on the significance of the effect. However, whilst there may be 'slight', 'moderate' or 'substantial' impacts described at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.
- 3.36. Following the approach to assessing significance outlined in the EPUK / IAQM guidance, the significance of likely residual effects of the completed Development on air quality was established through professional judgement and consideration of the following factors:
- the geographical extent of effects (local, district or regional);
 - their duration (temporary or long term);
 - their reversibility (reversible or permanent);
 - the magnitude of changes in pollutant concentrations;
 - the exceedance of standards (e.g. AQS objectives); and
 - changes in pollutant exposure.

4. Baseline Conditions

Barnsley Metropolitan Borough Council's Review and Assessment Process

- 4.1. BMBC has completed all earlier stages of the quality review and assessment as required under the LAQM regime. As a result, between 2005 and 2012, BMBC declared eight AQMA's for exceedences of the NO₂ AQS objectives. Two AQMA's have since been revoked.
- 4.2. The six remaining AQMAs are:
- Barnsley AQMA No.1 - declared for annual mean NO₂ and covers an area along the M1 between Junction 35a and Junction 38, including Haigh, Darton, Cawthorne Dike, Higham, Dodworth, Gilroyd, Rockley, Birdwell, and Tankersley. The area extends 100m either side of the central reservation;
 - Barnsley AQMA No.2A - declared for annual mean NO₂ and encompasses the A628 from junction 37 of the M1 to Town End roundabout, including part of Summer Lane from Town End roundabout to Wharnccliffe Street;
 - Barnsley AQMA No.4 - declared for annual mean NO₂ and encompasses the southbound carriageway of the A61 Harborough Hill Road from the PC World gyratory to the southbound slip road of the A61 near to its junction with Queens Road;
 - Barnsley AQMA No.5 - declared for annual mean NO₂ and encompasses the junction of Rotherham Road and Burton Road;
 - Barnsley AQMA No.6 - declared for annual mean and hourly mean NO₂ and incorporates the A616 road through Langsett; and
 - Barnsley AQMA No.7 - declared for annual mean NO₂ and incorporates the southbound carriageway of the A61 Sheffield Road adjacent to the junction with the A6133 Cemetery Road.
- 4.3. AQMA No.2 and AQMA No.6 are located approximately 500m north and 680m west of the Site respectively. The Site is not located within an AQMA.

Barnsley Metropolitan Borough Council's Local Monitoring

- 4.4. BMBC currently undertakes monitoring of NO₂ and PM₁₀ at three automatic monitors within BMBC. The automatic monitors are:
- The Barnsley A628 Roadside (CM2) roadside monitor; monitoring NO₂ and located approximately 0.9km north-west of the Site;
 - The Barnsley Gawber (CM3) urban background monitor; monitoring NO₂ and located approximately 2.1km north-west of the Site; and
 - Barnsley A635 Roadside (CM1) roadside monitor; monitoring PM₁₀ and located approximately 2.9km north-west of the Site.
- 4.5. NO₂ concentrations from the Barnsley A628 (CM2) and PM₁₀ concentrations from the Barnsley A635 (CM1) roadside automatic monitors are presented in **Table 8** below.

Table 8: Measured Concentrations at the CM1 and CM2 BMBC Roadside Monitors

Monitor	Pollutant	Averaging Period	AQS Objective	2015	2016	2017	2018	2019
CM2	NO ₂	Annual Mean (µg/m ³)	40µg/m ³	39	36	35	32	32
		1-Hour Mean (No. of Hours)	200µg/m ³ not to be exceeded more than 18 times a year	2	2	4	0	0
CM1	PM ₁₀	Annual Mean (µg/m ³)	40µg/m ³	22	22	17	18	20
		24-Hour Mean (No. of Days)	50µg/m ³ not to be exceeded more than 35 times a year	9	11	5	5	11

Source: Data obtained from BMBC 2020 Air Quality Annual Status Report

- 4.6. The monitoring results in **Table 8** indicate the respective NO₂ and PM₁₀ AQS objectives were met in all years at the Barnsley A628 Roadside (CM2) and Barnsley A635 Roadside (CM1) monitors.
- 4.7. BMBC also measures NO₂ at 67 locations using diffusion tubes. The latest available results for the 14 NO₂ roadside diffusion tube within 1.2km from the centre of the Site are presented in **Table 9**.

Table 9: NO₂ Concentrations at the BMBC diffusion tubes within 1.2km to the Site

Site ID	Location	Distance to Site (km)	Annual Mean NO ₂ Concentration (µg/m ³)				
			2015	2016	2017	2018	2019
DT13	Traffic Lights Dodworth Road	0.8	48.1	45.1	43.9	39.0	43.3
DT12	Dodworth Road	0.9	48.5	45.5	41.8	38.9	38.9
DT14	Dodworth Road	0.9	49.8	49.2	44.4	39.4	40.5
DT11	Dodworth Road	0.9	43.9	43.2	38.5	35.0	39.1
DT15	Pogmoor Crossroads	0.9	41.2	38.3	34.5	34.5	31.5
DT16	Pogmoor Crossroads	0.9	38.6	36.3	34.3	32.8	32.7
DT17	Pogmoor Crossroads	0.9	40.8	37.8	32.6	33.6	31.9
DT18	Traffic Lights Pogmoor Road	1.0	44.4	36.9	34.1	27.6	30.3
DT20	Dodworth Road– Pogmoor	1.0	44.7	43.4	40.9	37.0	39.6
DT33	Westway	1.1	30.8	31.8	30.9	29.0	31.2
DT19	Crown Hill Rd	1.1	30.9	28.1	28.7	25.7	27.2
DT21	Dodworth Rd, Pogmoor	1.1	58.1	51.1	49.1	45.8	46.2
DT22	Dodworth Rd, Pogmoor	1.1	53.2	52.7	50	44.2	48.1
DT23	Dodworth Rd, Pogmoor	1.2	49.8	50	52	43.4	47.0

Notes: Data obtained from BMBC 2020 Air Quality Annual Status Report
Exceedances of the AQS Objectives shown in **bold** text.

- 4.8. **Table 9** indicates the annual mean NO₂ objective of 40µg/m³ was exceeded at five of the 14 diffusion tube monitoring locations within 1.2km of the Site in 2019. Exceedences were recorded at a total of 11 diffusion tube locations between 2015 and 2019. The five diffusion tubes that recorded an exceedence of the NO₂ objective of 40µg/m³ in 2019 are all located within Barnsley AQMA No.2A.

5. Construction Phase Effects

- 5.1. Construction activities in relation to the Development have the potential to affect local air quality through Demolition, Earthworks, Construction and Trackout activities, as described above.

Construction Phase Effects

- 5.2. The nearest high sensitivity human receptors are located at Joseph Locke Primary School, adjacent to the north eastern boundary and residential properties within 20m on the opposite side of Keresforth Close. Greenacre School is located within 50m of the Site boundary on the other side of the A6133 Broadway. There are no ecological receptors within 50m of the Site boundary or the routes used by construction vehicles, therefore ecological effects have not been considered further. The location of the Site and Construction Phase Assessment Bands are presented in **Figure 1**.
- 5.3. As there are existing receptors within 350m of the boundary of the Site and within 50m of the routes that would be used by construction vehicles on the public highway, it is considered a detailed assessment is required to determine the likely dust effects, as recommended by the IAQM guidance on construction dust. Results of this assessment are provided for each main activity (Demolition, Earthworks, Construction and Trackout) below.

Dust Emissions

Demolition

- 5.4. In the absence of the total volume of buildings to be demolished, it was estimated that the total volume of buildings to be demolished could exceed 50,000m³. Based on the size and considering the other criteria in Step 2A of the IAQM Guidance, the potential dust emissions during demolition would be of a **large** magnitude.

Earthworks

- 5.5. The area of the Site is approximately 7.4 ha, or 74,000m². Based on the size and considering the other criteria in Step 2A of the IAQM guidance, the potential dust emissions during earthworks activities would be of **large** magnitude.

Construction

- 5.6. The estimate for the total volume of buildings to be constructed could exceed 100,000m³. Based on the size and considering the other criteria in Step 2A of the IAQM guidance, the potential dust emissions during construction activities would be of **large** magnitude.

Trackout

- 5.7. It was estimated that the number of construction heavy duty vehicle (HDV) trips would be between 10 and 50 outward HDV trips per day (Monday to Saturday). Based on this and considering the criteria in Step 2A of the IAQM guidance, the potential for dust emissions due to trackout activities would be of **medium** magnitude.

Sensitivity of the area

- 5.8. The sensitivity of the area to each main activity has been assessed based on the number and distance of the nearest sensitive receptors to the activity, and the sensitivity of these receptors to dust soiling and human health.

Sensitivities of People to Dust Soiling Effects

- 5.9. There were estimated to be between 10 and 100 high sensitive receptors within 20m of the Site. On this basis (as set out in Table 2 of the IAQM guidance) the sensitivity of the area to dust soiling is considered to be **high**.

Sensitivities of People to the Health Effects of PM₁₀

- 5.10. The Defra background PM₁₀ concentration for the Site was 10.7µg/m³ for 2019. On this basis (as set out in Table 3 of the IAQM guidance) the sensitivity of the area to human health is considered to be **low**.

Dust Risk Summary

- 5.11. The dust risk categories, based on the potential magnitude of dust emissions and the sensitivity of the area to dust, are presented in **Table 10**.

Table 10: Summary of Risk

Potential Effect	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High Risk	High Risk	High Risk	Medium Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk

- 5.12. The Site is considered **high risk** to dust soiling impacts. Consequently, mitigation would be required to ensure that adverse impacts be minimised, reduced and, where possible, eliminated.

Construction Vehicle Emissions

- 5.13. Construction related vehicles entering and egressing the Site from / to the local road network would have the potential to increase local air pollutant concentrations, particularly in respect of NO₂ and particulate matter (both PM₁₀ and PM_{2.5}).
- 5.14. At this stage, the number of HDVs associated with the development is not known. However, based on the size of the Site, it is estimated the number of HDVs would be between 10 and 50 outward HDV trips per day. However, emissions from construction traffic would be relatively small compared to existing road traffic emissions on A6133 Broadway (10,547 daily vehicles including 2.7% HDV's in 2019). Further details on existing traffic flows is contained within **Appendix B**.
- 5.15. Considering the current traffic movements and background pollutant concentrations around the Site, the likely effect of construction vehicles entering and egressing the Site on air quality would be **not significant** during the construction period.

Construction Plant Emissions

- 5.16. Emissions from plant operating on the Site would be small in comparison to existing background concentrations. It is therefore considered that even in the absence of mitigation, the likely effect on local air quality would be **not significant**.

6. Operational Phase Effects

- 6.1. Effects on local air quality associated with the completed and operational Development would likely result from changes to the associated traffic flows. **Table 11** and **Table 12** present the predicted concentrations at relevant existing and proposed receptors nearest to road traffic emissions.

Nitrogen Dioxide (NO₂)

Table 11: Results of the ADMS Modelling at Sensitive Receptors (NO₂)

ID	Receptor Location	NO ₂ Annual Mean (µg/m ³)		
		2019 Baseline	2019 With Development	2019 Change
1	Keresforth Court	21.4	22.3	0.9
2	Scholars Walk	19.2	19.4	0.2
3	63 Keresforth Hill Road	20.1	20.4	0.3
4	134 Park Road	21.3	21.6	0.3
5	Broadway Drive	18.8	18.9	0.1
6	Broadway Court	25.9	26.2	0.3
7	188 Dodworth Road	23.1	23.2	0.1
8	213 Dodworth Road	21.3	21.4	0.1
9	259 Dodworth Road	27.0	27.1	0.1
10	2 Broadway	29.4	29.8	0.4
11	Proposed: Residential 1	-	19.4	-
12	Proposed: Residential 2	-	19.2	-
13	Proposed: School 1	-	18.5	-
14	Proposed: School 2	-	18.5	-

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS models rather than the rounded numbers.

- 6.2. The results in **Table 11** indicate the 2019 baseline NO₂ annual mean concentrations are not predicted to exceed the NO₂ objective at any of the existing sensitive receptors modelled.
- 6.3. As discussed in **Appendix B**, the 1-hour mean NO₂ AQS objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60µg/m³. As shown in **Table 11**, the predicted 2019 baseline NO₂ annual mean concentrations were below 60µg/m³ at all the existing locations and as such it is likely that the 1-hour mean objective is met at these locations.
- 6.4. **Table 11** shows that in the 'with' Development scenario, all existing receptors are predicted to be below the NO₂ annual mean objective in 2019. Therefore, the 1-hour mean objective is also predicted to be met at all existing receptor locations.

- 6.5. The highest concentration ($29.8\mu\text{g}/\text{m}^3$) is predicted at Receptor 10 in the 'with' Development scenario.
- 6.6. Using the impact descriptors outlined in **Table 7**, the Development is predicted to result in a 'negligible' impact on annual mean NO_2 concentrations at all 10 existing receptors. Using professional judgement and based on the reduction in annual mean NO_2 concentrations and the concentrations predicted at the sensitive receptors, it is considered the effect of the Development on NO_2 concentrations would be **not significant**.

Particulate Matter (PM_{10} and $\text{PM}_{2.5}$)

Table 12: Results of the ADMS Modelling at Sensitive Receptors (PM_{10} and $\text{PM}_{2.5}$)

ID	Receptor Location	PM_{10} Annual Mean ($\mu\text{g}/\text{m}^3$)			PM_{10} - Number of Days $>50\mu\text{g}/\text{m}^3$			$\text{PM}_{2.5}$ Annual Mean ($\mu\text{g}/\text{m}^3$)		
		2019 Baseline	2019 With Development	2019 Change	2019 Baseline	2019 With Development	2019 Change	2019 Baseline	2019 With Development	2019 Change
1	Keresforth Court	11.3	11.4	0.1	1	1	0	7.1	7.2	0.1
2	Scholars Walk	11.0	11.0	0.0	2	2	0	6.9	6.9	0.0
3	63 Keresforth Hill Road	11.2	11.3	0.1	1	1	0	7.1	7.1	0.0
4	134 Park Road	11.5	11.5	0.0	1	1	0	7.2	7.2	0.0
5	Broadway Drive	10.9	11.0	0.1	2	2	0	6.9	6.9	0.0
6	Broadway Court	11.7	11.7	0.0	1	1	0	7.5	7.5	0.0
7	188 Dodworth Road	11.6	11.6	0.0	1	1	0	7.4	7.4	0.0
8	213 Dodworth Road	11.4	11.4	0.0	1	1	0	7.4	7.4	0.0
9	259 Dodworth Road	11.9	11.9	0.0	1	1	0	7.6	7.7	0.1
10	2 Broadway	12.0	12.1	0.1	1	1	0	7.7	7.8	0.0
11	Proposed: Residential 1	-	11.0	-	-	2	-	-	6.9	-
12	Proposed: Residential 2	-	10.9	-	-	2	-	-	6.9	-
13	Proposed: School 1	-	10.8	-	-	2	-	-	6.8	-
14	Proposed: School 2	-	10.9	-	-	2	-	-	6.8	-

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers.

- 6.7. As shown in **Table 12**, the annual mean concentrations of PM_{10} are predicted to be below the objective of $40\mu\text{g}/\text{m}^3$ in 2019 both the baseline and 'with' the Development scenarios at all receptor locations considered. The maximum predicted concentration in all scenarios assessed is $12.1\mu\text{g}/\text{m}^3$ at Receptor 10 in the 2019 'with Development' scenario.
- 6.8. Using the impact descriptors outlined in **Table 7**, the Development is predicted to result in a 'negligible' impact on annual mean PM_{10} concentrations at all existing receptors.
- 6.9. The results in **Table 12** indicate that in 2019 both the baseline and 'with' the Development scenarios, all receptor locations are predicted to be below the 24-hour mean PM_{10} objective value of no more than 35 days exceeding $50\mu\text{g}/\text{m}^3$.

- 6.10. The results in **Table 12** indicate that in 2019 both the baseline and 'with' the Development scenarios, all receptor locations are predicted to be below the annual mean PM_{2.5} objective value of 25µg/m³. The maximum predicted concentration in all scenarios assessed is 7.8µg/m³ at Receptor 10 in the 2019 'with Development' scenario. Using the impact descriptors outlined in **Table 7**, the Development is predicted to result in a 'negligible' impact on annual mean PM_{2.5} concentrations at all existing receptors.
- 6.11. Using professional judgement, based on the severity of the impact and the concentrations predicted at the sensitive receptors, it is considered the effect of the Development on PM₁₀ and PM_{2.5} concentrations would be **not significant**.

Conditions within the Development

- 6.12. As shown by the results in **Table 11 and Table 12**, the predicted NO₂, PM₁₀ and PM_{2.5} concentrations for locations within the Development itself are below the relevant objectives in 2019 for residential and school uses. As such, it is considered the effect of introducing residential and educational uses to the Site is **not significant**.

7. Mitigation Measures and Residual Effects

Construction

Dust Emissions

- 7.1. The Site is a high-risk site in relation to nuisance dust emissions (referred to earlier in this report). Consequently, a range of environmental management controls would be developed with reference to the IAQM guidance for high-risk sites. The mitigation measures would be included within a Construction Environmental Management Plan and implemented to prevent the release of dust entering the atmosphere and / or being deposited on nearby receptors.
- 7.2. Mitigation measures are routinely and successfully applied to construction projects throughout the UK and are proven to significantly reduce the potential for adverse nuisance dust effects associated with the various stages of the construction work. Therefore, it is considered that residual effects due to fugitive emissions would be **not significant**.

Construction Vehicle Exhaust Emissions

- 7.3. All construction traffic logistics would be agreed with BMBC. Consideration would also be given to the avoidance, or limited use of, traffic routes in proximity to sensitive routes (i.e. residential roads etc.) and the avoidance (or limited) use of roads during peak hours, where practicable. Based on professional judgement, considering the current traffic movements surrounding the Site; the existing background concentrations in the local area; and that construction phase would be short-term and temporary, the overall effect would be **not significant**.

Construction Vehicle Exhaust Emissions

- 7.4. Even in the absence of mitigation, the likely effect of any emissions from plant operation on the Site would be **not significant**. This would therefore remain the likely residual effect.

Operational Development

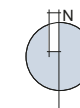
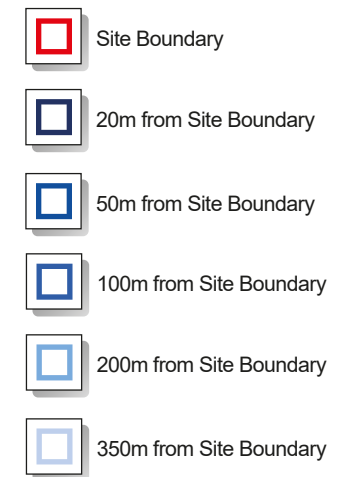
- 7.5. As identified earlier in this report, even in the absence of mitigation, the Development is predicted to have a **not significant** effect on local air quality. Accordingly, mitigation measures would not be required so residual effects would be **not significant**.

8. Summary and Conclusions

- 8.1. A qualitative assessment of dust effects during the construction phase has been carried out using the IAQM guidance. The implementation of a range of appropriate site management practices to control dust emissions would significantly reduce the potential for adverse nuisance dust effects associated with the various stages of the works. It is considered that likely residual effects due to fugitive emissions would be **not significant**.
- 8.2. It is anticipated that after management measures have been implemented, the effect of construction vehicles entering and egressing the Site during the construction phase would be **not significant**.
- 8.3. Following completion of the Development is predicted to have a **not significant** effect on NO₂, PM₁₀ and PM_{2.5} concentrations, at all existing and future receptors considered. As such, the overall effect of the Development on air quality is **not significant**.

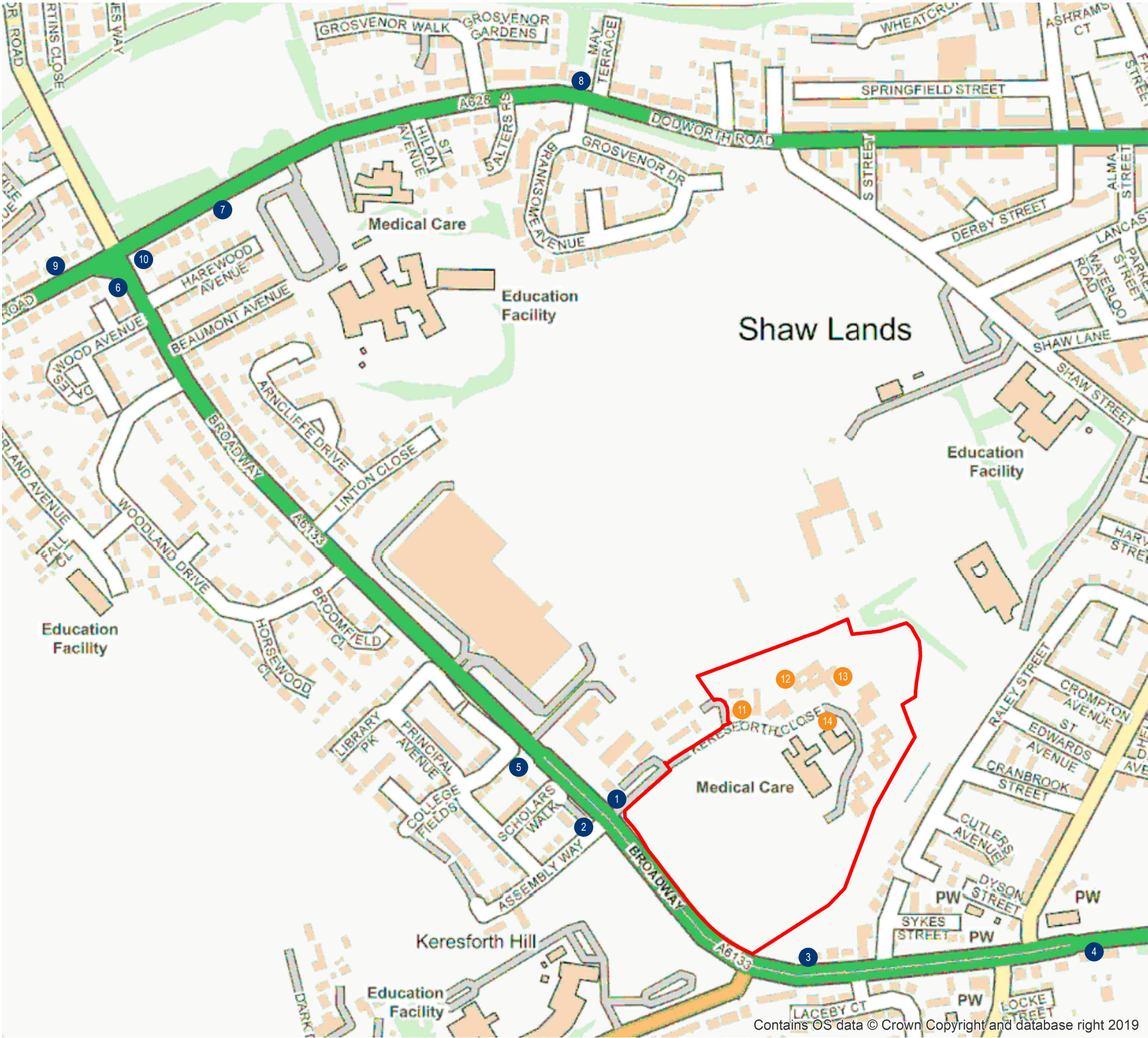
FIGURES

Figure 1: Construction Phase Assessment Bands

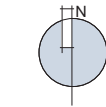


Project Details	WIE17125-109: Trinity Academy
Figure Title	Figure 1: Construction Phase Assessment Bands
Figure Ref	WIE17125-109_GR_AQA_1A
Date	August 2020
File Location	\\s-incs\wiel\projects\wie17125\100\graphics\aqal\issued figures

Figure 2: Site Plan and Receptor Locations



- Site Boundary
- Proposed Receptor Locations
- Existing Receptor Locations



Project Details	WIE17125-109: Trinity Academy
Figure Title	Figure 2: Site Plan and Receptor Locations
Figure Ref	WIE17125-109_GR_AQA_2A
Date	August 2020
File Location	\\s-inc\wiel\projects\wie17125\100\graphics\laq\issued figures

APPENDICES

Appendix A	Summary of Relevant Legislation, Planning Policy and
Guidance	

Appendix A: Summary of Relevant Legislation, Planning Policy and Guidance

Legislation

EU Framework Directive 2008/50/EC, 2008

Air pollutants at high concentrations can have adverse effects on the health of humans and ecosystems. European Union (EU) legislation on air quality forms the basis for UK legislation and policy on air quality.

The EU Framework Directive 2008/50/EC on ambient air quality assessment and management came into force in May 2008 and was implemented by Member States, including the UK, by June 2010. The Directive aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

Air Quality Standards Regulations, 2010

The Air Quality Standards Regulations implement Limit Values prescribed by the EU Framework Directive 2008/50/EC. The Limit Values are legally binding and the Secretary of State, on behalf of the UK Government, is responsible for their implementation.

The UK Air Quality Strategy, 2007

The current UK Air Quality Strategy (UK AQS) was published in July 2007 sets out the objectives for Local Planning Authorities (LPA) in undertaking their Local Air Quality Management (LAQM) duties. The 2007 UK AQS introduced a national level policy framework for exposure reduction for fine particulate matter. Objectives in the UK AQS are in some cases more onerous than the Limit Values set out within the relevant EU Directives and the Air Quality Standards Regulations 2010. In addition, objectives have been established for a wider range of pollutants.

The UK AQS objectives of air pollutants relevant to this assessment are summarised in Table A1.

Table A1: Summary of Relevant UK AQS Objectives

Pollutant	Objective		Date by which Objective to be Met
	Concentration	Measured as	
Nitrogen Dioxide (NO ₂)	200µg/m ³	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40µg/m ³	Annual Mean	31/12/2005
Particulate Matter (PM ₁₀) ^(a)	50µg/m ³	24 hour mean not to be exceeded more than 35 times per year	31/12/2004
	40µg/m ³	Annual Mean	31/12/2004
Particulate Matter (PM _{2.5}) ^(b)	Target of 15% reduction in concentrations at urban background locations	Annual Mean	Between 2010 and 2020
	25µg/m ³	Annual Mean	01/01/2020

Note: (a) Particulate matter with a mean aerodynamic diameter less than 10 microns (or micrometres – µm)
(b) Particulate matter with a mean aerodynamic diameter less than 2.5 microns

The Environment Act, 1995

In a parallel process, the Environment Act 1995 required the preparation of a national air quality strategy setting health-based air quality objectives for specified pollutants and outlining measures to be taken by LPAs in relation to meeting these objectives (the LAQM system).

Part IV of the Environment Act 1995 provides a system of LAQM under which LPAs are required to review and assess the future quality of the air in their area by way of a staged process. Should this process suggest that any of the AQS objectives will not be met by the target dates, the LPA must consider the declaration of an Air Quality Management Area (AQMA) and the subsequent preparation of an Air Quality Action Plan (AQAP) to improve the air quality in that area in pursuit of the AQS objectives.

Planning Policy

National Planning Policy

National Planning Policy Framework, 2019

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied.

Paragraph 103 states *"The planning system should actively manage patterns of growth in support of these objectives. 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. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making"*

Paragraph 170 states: *"Planning policies and decisions should contribute to and enhance the natural and local environment by: ... preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans..."*

Paragraph 180 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."*

Furthermore, Paragraph 181 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".*

Local Planning Policy

Barnsley Metropolitan Borough Council. Barnsley Local Plan. January 2019

The Local Plan was adopted in January 2019. The Local Plan sets out the key elements of the planning framework for Barnsleyt were designed to help shape the future of the Borough and determine individual planning applications.

Policy T5 'Reducing the Impact of Road Trave' states BMBC '*will reduce the impact of road travel by: Developing and implementing robust, evidence-based air quality action plans to improve air quality;*

Policy AQ1 'Development in Air Quality Management Areas' states: '*Development which impacts on areas sensitive to air pollution in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), taking into account any suitable and proportionate mitigation required for the development. We will only allow residential development which impacts on areas sensitive to air pollution, where the developer provides an assessment that shows living conditions will be acceptable for future residents, subject to any required mitigation. We will only allow development which impacts on areas sensitive to air pollution which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality, subject to any required mitigation. Furthermore, development which impacts on areas sensitive to air pollution due to traffic emissions will be expected to demonstrate suitable and proportionate mitigation relative to the increased traffic emissions generated by the development*'.

Guidance

Department for Environment, Food and Rural Affairs, Clean Air Strategy, 2019

Published in January 2019 the Clean Air Strategy sets out a coherent framework and national action to improve air quality throughout the UK.

The Strategy is underpinned by new national powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to act in areas with an air pollution problem. The Strategy also supports the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

Improving Air Quality in the UK: Tackling Nitrogen Dioxide in our Towns and Cities. UK Air Quality Plan for Tackling Nitrogen Dioxide, 2017

The UK Government was required by the High Court to release an Air Quality Plan to meet the NO₂ Limit Value in the shortest timescale as possible. This document was adopted on 26th July 2017.

The plan focuses on reducing concentrations of NO_x and NO₂ around road vehicle emissions within the shortest possible time. With the principal aims to:

- a. reduce emissions of NO_x from the current road vehicle fleet in problem locations now; and*
- b. accelerate road vehicle fleet turnover to cleaner vehicles to ensure that the problem remains addressed and does not move to other locations.*

The other aims include reducing background concentrations of NO_x from:

- Other forms of transport such as rail, aviation and shipping;
- Industry and non-road mobile machinery; and
- Buildings, both commercial and domestic, and other stationary sources.

The Plan provides measures to reduce NO_x and NO₂ concentrations in the UK, such measures include:

- Mandate local authorities to implement Clean Air Zones within the shortest possible time;
- Consultation on proposal for a Clean Air Zone Framework for Wales;
- Consultation on a draft National Low Emission Framework for Scotland;
- Commitment to establishing a Low Emission Zone for Scotland by 2018;
- Tackling air pollution on the English Road network;
- New real driving emissions requirement to address real world NO_x emissions;
- Additional funding to accelerate uptake of hydrogen vehicles and infrastructure;
- Additional funding to accelerate the uptake of electric taxis;
- Further investment in retrofitting alongside additional support of low emission buses and taxis;
- Regulatory changes to support the take up of alternatively fuelled light commercial vehicles;
- Exploring the appropriate tax treatment for diesel vehicles;
- Call for evidence on updating the existing HGV Road User Levy;
- Call for evidence on use of red diesel;
- Ensure wider environmental performance is apparent to consumers when purchasing cars;
- Updating Government procurement policy;
- New emissions standards for non-road mobile machinery;
- New measures to tackle NO_x emissions from Medium Combustion Plants; and
- New measures to tackle NO_x emissions from generators.

The above measures do not provide any actions which are relevant to the operation or design of the Development.

A High Court ruling¹ on 21st February 2018, stated the UK Governments air quality improvement plan adopted on 31st July 2017 was unlawful as *'it does not contain measures sufficient to ensure substantive compliance with the 2008 Directive and the English Regulations'*. The UK Government *'must ensure steps are taken to achieve compliance as soon as possible, by the quickest route possible and by a means that makes that outcome likely'*.

The judgement stated that the UK Government must produce a supplementary plan, setting out requirements for feasibility studies to be undertaken in the 33 Local Authority Areas. Greater London including LBS is not considered within this judgement.

In May 2018, it was announced the European Union (EU) was going to take the UK to the European Commission over failure to meet the Limit Values for NO₂.

¹ <https://www.judiciary.gov.uk/judgments/the-queen-on-the-application-of-clientearth-no-3-claimant-v-secretary-of-state-for-environment-food-and-rural-affairs-and-others/>

Environmental Protection UK & Institute of Air Quality Management Guidance; Land-Use Planning & Development Control: Planning for Air Quality, 2017

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) provide guidance for air quality considerations within the local development control processes, promoting a consistent approach to the treatment of air quality issues.

The EPUK and IAQM guidance explains how development proposals can adopt good design principles to reduce emissions and contribute to better air quality. The guidance also provides a method for screening the need for an air quality assessment and a consistent approach for describing the impacts at individual receptors. The EPUK and IAQM Guidance, advises that:

"In arriving at a decision about a specific proposed development the local planning authority is required to achieve a balance between economic, social and environmental considerations. For this reason, appropriate consideration of issues such as air quality, noise and visual amenity is necessary. In terms of air quality, particular attention should be paid to:

- *Compliance with national air quality objectives and of EU Limit Values;*
- *Whether the development will materially affect any air quality action plan or strategy;*
- *The overall degradation (or improvement) in local air quality; or*
- *Whether the development will introduce new public exposure into an area of existing poor air quality".*

Planning Practice Guidance

The Government's online Planning Practice Guidance (PPG) states that air quality concerns are more likely to arise where development is proposed within an area of existing poor air quality, or where it would adversely impact upon the implementation of air quality strategies and / or action plans. The PPG notes that when deciding whether air quality is relevant to a planning application, considerations would include whether the development would lead to:

- Significant effects on traffic, such as volume, congestion, vehicle speed, or composition;
- The introduction of new point sources of air pollution, such as furnaces, centralised boilers and Combined Heat and Power (CHP) plant; and
- Exposing occupants of any new developments to existing sources of air pollutants and areas with poor air quality.

Institute of Air Quality Management: Guidance on the Assessment of Dust from Demolition and Construction, 2014

The IAQM Construction Dust Guidance provides guidance to consultants and Environmental Health Officers (EHOs) on how to assess air quality impacts from construction related activities. The guidance provides a risk based approach based on the potential dust emission magnitude of the site (small, medium or large) and the sensitivity of the area to dust impacts. The importance of professional judgement is noted throughout the guidance. The guidance recommends that once the risk class of the site has been identified, the appropriate level of mitigation measures are implemented to ensure that the construction activities have no significant impacts.

Barnsley Metropolitan Borough Council Barnsley MBC Air Quality Action Plan, April 2017 (updated 2019)

The Air Quality Action Plan outlines the action BMBC will take to improve air quality in Barnsley between 2017 and 2021 and contains a number of actions designed to improve air quality in our air quality management areas, and in the Borough as a whole.

This action plan replaces the previous action plan for the period 2012 to 2016. The following is a list of actions BMBC wishes to pursue, subject to securing appropriate funding, and securing stakeholder approval.

- Congestion management
- Barnsley Voluntary Bus Agreement High
- Encourage uptake of lower emission vehicles and alternative fuels (EVs, CNG, H2)
- Langsett
- Planning applications – air quality assessment and mitigation
- Speed restrictions on gradient Feasibility Study
- Procurement
- Control over emissions from Part B and A2 processes, and act as consultees for Part A1 processes
- Enforcement of the Clean Air with regards to industrial smoke
- Enforcement of the Clean Air with regards to domestic smoke control
- Investigation of nuisance complaints, including appropriate action to resolve the problem
- BMBC fleet improvement
- Priority parking for LEVs
- Freight and Delivery Management
- ECO Stars HDV Recognition Scheme
- ECO Stars Taxi Recognition Scheme
- ECO Driving
- Consolidation Centre
- Barnsley Intelligent Transport System (MOVA / SCOOT)
- Encourage cycling and walking (developing infrastructure and campaigns)
- Care4Air
- Assessment of air quality impact of major traffic schemes
- Smoky diesel hotline
- Car and Lift sharing programmes
- Promoting Travel Alternatives (Workplace travel planning; encourage / facilitate home-working; personalised travel planning; school travel plans)
- Anti-idling enforcement



Appendix B Air Quality Assessment Detailed Methodology

Appendix B: Air Quality Assessment Detailed Methodology

- 1.1 This appendix presents the technical information and data upon which the completed Development air quality assessment was based.

Model

- 1.2 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; which requires a range of input data, which can include pollutant emissions rates, meteorological data and local topographical information.
- 1.3 The effect of the Development on local air quality was assessed using the advanced atmospheric dispersion model ADMS-Roads, considering the contribution of emissions from forecast road-traffic on the local road network by the opening year of the Development.

ADMS-Roads

- 1.4 The ADMS-Roads model is a comprehensive tool for investigating air pollution in relation to road networks. On review of the Site, and its surroundings, ADMS-Roads was considered appropriate for the assessment of the long and short-term effects of the proposals on air quality. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations. It can predict long-term and short-term concentrations, including percentile concentrations.
- 1.5 ADMS-Roads model is a formally validated model, developed in the United Kingdom (UK) by CERC (Cambridge Environmental Research Consultants). This includes comparisons with data from the UK's air quality Automatic Urban and Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC web site at www.cerc.co.uk.

Model Scenarios

- 1.6 To assess the effects of the Development on local air quality, the 2019 baseline year has been considered for a robust assessment.
- 1.7 The year 2019 was modelled, as it is the latest full year of air quality monitoring data available. Traffic data for 2019 and meteorological data for 2019 were also used to be consistent with the verification year (discussed further below).

Traffic Data

- 1.8 Traffic flow data comprising Annual Average Daily Traffic (AADT) flows, traffic composition (% Heavy-Duty Vehicles (HDVs)) used in the model were provided by Waterman IE and used in the model for the surrounding road network.
- 1.9 The methodology for calculating the expected change in vehicle trips because of the Development, once completed and operational, is set out in detail within the Transport Assessment. The assessment covers all traffic generated by the Development, including

servicing and delivery trips. **Table A1** presents the traffic data used within the Air Quality Assessment.

Table A1: 24-hour AADT Data Used within the Assessment

ID	Link Name	Speed (kph)	Base 2019		With 2019	
			AADT	%HDV	AADT	%HDV
1	A6133 Broadway	48	10547	2.7	11383	2.6
2	A628 Dodworth Road East	64	15547	3.0	1193	3.0
3	A628 Doworth Road West	64	27027	3.7	12797	3.6
4	Keresforth Close	10	No traffic data available		1143	1.9

Note: 2019 traffic data was not available for Keresforth Close. The Keresforth Close 'With Development' scenario comprises vehicle movements associated with the Development only.

Vehicle Speeds

- 1.10 To take into account the presence of slow-moving traffic near junctions and at roundabouts, the speed on each junction was reduced to 20kph. To account for congestion, the speeds at the junction of Pogmoor Road, Dodworth Road and A6133 Broadway were reduced to 10kph. The speeds were reduced using the following criteria recommended within LAQM.TG(16)¹:
- Traffic approaching the lights when green, e.g. 20-50 kph; and
 - Traffic on the carriageway approaching the lights when red, e.g. 5-20 kph, depending on the time of day and how congested the junction is.

Diurnal Profile

- 1.11 The ADMS-Roads model uses an hourly traffic flow based on the daily (AADT) flows. Traffic flows follow a diurnal variation throughout the day and week. Therefore, a diurnal profile was used in the model to replicate how the average hourly traffic flow would vary throughout the day and the week. This was based on data collated by Waterman from the Department for Transport (DfT) statistics Table TRA0307: 'Traffic Distribution by Time of Day on all roads in Great Britain', 2018² (the latest data available at the time of undertaking the air quality assessment). **Figure A1** presents the diurnal variation in traffic flows which has been used within the model.

¹ Defra, 2016, Local Air Quality Management Technical Guidance LAQM.TG(16)

² Department for Transport (DfT) Statistics, www.dft.gov.uk/statistics/series/traffic

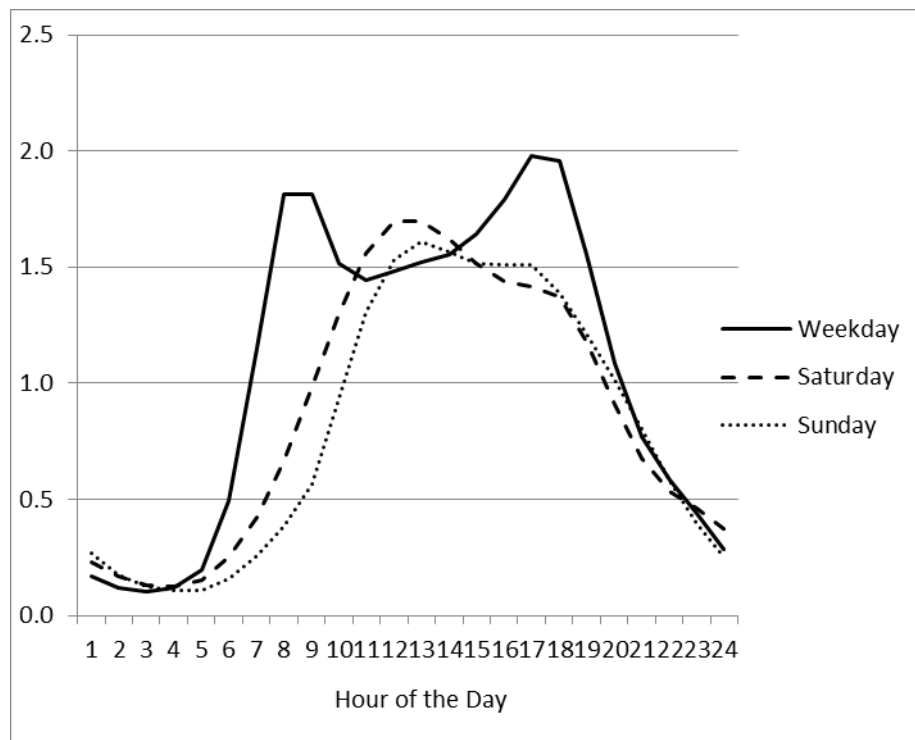


Figure A1: Department for Transport 2018 Diurnal Traffic Variation

Street Canyon Effect

- 1.12 Narrow streets with tall buildings on either side have the potential to create a confined space, which can interfere with the dispersion of traffic pollutants and may result in pollutant emissions accumulating in these streets. In an air quality model, these narrow streets are described as street canyons.
- 1.13 ADMS-Roads includes a street canyon model to take account of the additional turbulent flow patterns occurring inside such a narrow street with relatively tall buildings on both sides. LAQM.TG(16) identifies a street canyon “as narrow streets where the height of buildings on both sides of the road is greater than the road width.”
- 1.14 Following a review of the road network to be included within the model, it was considered that modelled roads are relatively wide and the majority of existing buildings along these roads are not considered to be tall. The proposed buildings within the Site would not cause any canyons to be created. Therefore, no street canyons were included within the model for any of the scenarios considered.

Proposed Car Park

- 1.15 The Development would include a surface level car park. The car park was scoped out of the air quality assessment as the car park would not be underground and would be naturally ventilated. This is in line with the indicative criteria for requiring an air quality assessment set out in ‘Land-Use Planning & Development Control: Planning for Air Quality’³.

³ Environmental Protection UK & Institute of Air Quality Management (2017), ‘Land-Use Planning & Development Control: Planning for Air Quality’, EPUK & IAQM, London

Road Traffic Emission Factors

- 1.16 The atmospheric dispersion model ADMS-Roads was used for the assessment. The model includes the latest vehicle emission factors published by Defra in the Emission Factors Toolkit (v9.0 published in May 2019) and is based on the latest COPERT database published by the European Environment Agency.
- 1.17 The model uses several parameters (traffic flow, percentage of HDV, speed and road type) to calculate road traffic emissions for the selected pollutants.

Background Pollutant Concentrations

- 1.18 Background pollutant concentration data (i.e. concentrations due to the contribution of pollution sources not directly considered in the dispersion modelling) have been added to contributions from the modelled pollution sources, for each year of assessment.
- 1.19 In 2019, automatic background pollution monitoring was undertaken within BMBC using the Barnsley Gawber (CM3) monitor, located approximately 2.1km north-west of the Site. **Table A2** shows the latest concentrations measured at the Barnsley Gawber (CM3) automatic monitor.

Table A2: Annual Mean Concentrations at BMBC's Barnsley Gawber (CM3) Automatic Monitor

Pollutant	Averaging Period	AQS Objective	2015	2016	2017	2018	2019
NO ₂	Annual Mean (µg/m ³)	40µg/m ³	19	19	16	16	17
	Hourly Mean (No. of hours)	200µg/m ³ not to be exceeded more than 18 times a year.	0	0	0	0	0

Source: Data obtained from BMBC 2020 Air Quality Annual Status Report

- 1.20 The monitoring results in Table A2 shows the AQS NO₂ objectives were met at the BMBC Barnsley Gawber (CM3) urban background monitor from 2015 to 2019.
- 1.21 Urban background NO₂ monitoring is also undertaken within GBC at two diffusion tubes. The latest available results for the two NO₂ diffusion tubes are presented in **Table A3**.

Table A3: NO₂ Concentrations at the two BMBC urban background diffusion tubes

Site ID	Location	Distance to Site (km)	Annual Mean NO ₂ Concentration (µg/m ³)				
			2015	2016	2017	2018	2019
DT10	Lansdowne Crescent, Darton	4.7	29.6	29.1	26.9	22.2	24.4
DT29	Moor Lane, Birdwell	5.4	32.7	31.3	32.1	27.6	28.3

Source: Data obtained from BMBC 2020 Air Quality Annual Status Report

- 1.22 The monitoring results in **Table A3** shows the annual mean NO₂ objectives were met at both BMBC urban background diffusion tubes between 2015 and 2019.
- 1.23 In addition to the monitoring data, background concentrations of NO₂, PM₁₀ and PM_{2.5} are available from the Defra LAQM Support website⁴ for 1x1km grid squares for assessment years between 2017 and 2030. **Table A4** presents the Defra mapped NO₂ background concentrations for the grid square the Site is located within (433500, 405500) for 2019.

⁴ <http://laqm.defra.gov.uk/>

Table A4: Defra Background Maps in 2019 for the Grid Square at the Site

Pollutant	2019 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)
NO _x	16.0
NO ₂	11.8
PM ₁₀	10.7
PM _{2.5}	6.7

- 1.24 **Tables A2, A2 and A4** illustrate the NO₂ annual mean concentration at the CM3 automatic monitor is below the concentrations recorded at the two diffusion tubes, but higher than the Defra maps NO₂ concentration. The CM2 automatic monitor is the closest monitor to the Site and considered a conservative representation of air quality conditions at the Site and so was used in the assessment.
- 1.25 Defra background map concentrations for PM₁₀ and PM_{2.5} were used. **Table A5** presents the concentrations used in the assessment.

Table A5: Background Concentrations used in the Assessment

Pollutant	2019 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)
Grid Square 433500, 405500; Verification CM3 & DT14, Receptors 1,2,3,4,5,11,12,13 &14	
NO ₂	17.0
PM ₁₀	10.7
PM _{2.5}	6.7
Grid Square 432500, 406500; Receptors 6,7, 9 and 10	
NO ₂	17.0
PM ₁₀	10.5
PM _{2.5}	6.8
Grid Square 433500, 406500; Receptor 8	
NO ₂	17.0
PM ₁₀	10.5
PM _{2.5}	6.9

Meteorological Data

- 1.26 Local meteorological conditions strongly influence the dispersal of pollutants. Key meteorological data for dispersion modelling include hourly sequential data for wind direction, wind speed, temperature, precipitation and the extent of cloud cover for each hour of a given year. As a minimum ADMS-Roads requires wind speed, wind direction, and cloud cover.
- 1.27 Meteorological data to input into the model were obtained from the Emley Moor Meteorological Station, which is the closest to the Site and considered to be the most representative. The 2019 data were used to be consistent with the base traffic year and model verification year.
- 1.28 Most dispersion models do not use meteorological data if they relate to calm wind conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads treats calm wind conditions by setting the minimum wind speed to 0.75 m/s. It is recommended in Technical Guidance LAQM.TG(16) that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when

considering predictions of high percentiles and the number of exceedences. Technical Guidance LAQM.TG(16) recommends that meteorological data should only be used if the percentage of usable hours is greater than 85%. 2019 meteorological data from Emley Moor includes 8,613 usable hours, which equates to 99.3%. The London City Airport meteorological data is above the 85% threshold and therefore adequate for the dispersion modelling. **Figure A2** presents the wind-rose for the meteorological data.

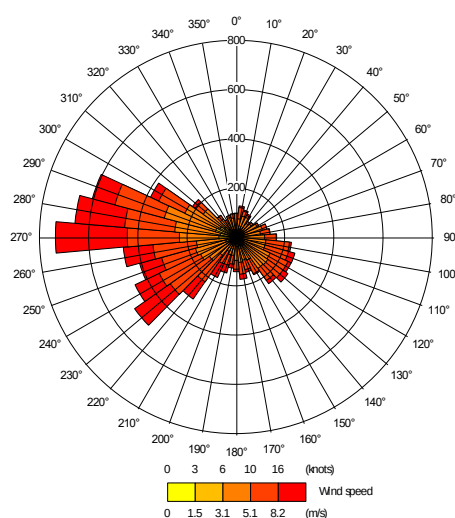


Figure A2: 2019 Wind Rose for the Emley Moor Meteorological Site

- 1.29 A value of 0.2 was used for the Emley Moor Meteorological Station, which is representative of agricultural areas and is considered appropriate following a review of the local area.

Model Data Processing

- 1.30 The modelling results were processed to calculate the averaging periods required for comparison with the Air Quality Strategy Objectives.
- 1.31 NO_x emissions from combustion sources (including vehicle exhausts) comprise principally nitric oxide (NO) and NO₂. The emitted NO reacts with oxidants in the air (mainly ozone) to form more NO₂. Since only NO₂ is associated with impacts on human health, the air quality standards for the protection of human health are based on NO₂ and not total NO_x or NO.
- 1.32 The ADMS-Roads model was run without the Chemistry Reaction option to allow verification (see below). Therefore, a suitable NO_x:NO₂ conversion was applied to the modelled NO_x concentrations. There are a variety of different approaches to dealing with NO_x:NO₂ relationships, a number of which are widely recognised as being acceptable. However, the current approach was developed for roadside sites, and is detailed within the Technical Guidance LLAQM.TG(16).
- 1.33 The LAQM Support website provides a spreadsheet calculator⁵ to allow the calculation of NO₂ from NO_x concentrations, accounting for the difference between primary emissions of NO_x and background NO_x, the concentration of O₃, and the different proportions of primary NO₂ emissions, in different years. This approach is only applicable to annual mean concentrations.

⁵ AEA, NO_x to NO₂ Calculator, <http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php>
Version 7.1, April 2019

- 1.34 Research⁶ undertaken on behalf of Defra has indicated that the hourly mean limit value and objective for NO₂ is unlikely to be exceeded at a roadside location where the annual-mean NO₂ concentration is less than 60µg/m³, LLAQM.TG(16) confirms that this assumption is still valid. The hourly objective is, therefore, not considered further within this assessment where the annual-mean NO₂ concentration is predicted to be less than 60µg/m³.
- 1.35 To calculate the number of daily exceedances of 50µg/m³ PM₁₀, the relationship between the number of 24-hour exceedances of 50µg/m³ and the annual mean PM₁₀ concentration from LLAQM.TG (16) was applied as follows:

$$\text{Number of Exceedances} = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

Other Model Parameters

- 1.36 There are other parameters used within the ADMS-Roads model which are described for completeness and transparency:
- The model requires a surface roughness value to be inputted.
 - A value of 1.0 was used for the Site, which is representative of cities and woodland; and
 - A value of 0.2 was used for the Emley Moor Meteorological Station, which is representative of agricultural areas (min).
 - The model requires the Monin-Obukhov length (a measure of the stability of the atmosphere) to be inputted. A value of 30m (representative of cities and large towns) was used for the modelling; and
 - The model requires the Road Type to be inputted. 'England [Urban]' was selected and used for the modelling of the road links.

Model Verification

- 1.37 Model verification is the process of comparing monitored and modelled pollutant concentrations for the same year, at the same locations, and adjusting modelled concentrations if necessary to be consistent with monitoring data. This increases the robustness of modelling results.
- 1.38 Discrepancies between modelled and measured concentrations can arise for a number of reasons, for example:
- Traffic data uncertainties;
 - Background concentration estimates;
 - Meteorological data uncertainties;
 - Sources not explicitly included within the model (e.g. car parks and bus stops);
 - Overall model limitations (e.g. treatment of roughness and meteorological data, treatment of speeds); and
 - Uncertainty in monitoring data, particularly diffusion tubes.
- 1.39 Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of all of these aspects.
- 1.40 Box 7.15 of LAQM.TG(16) provides guidance on approaching model verification and adjustment. This requires the roadside NO_x contribution to be calculated. In addition,

⁶ Defra (2016), 'Local Air Quality Management Policy guidance PG(16)', DEFRA, London

monitored NO_x concentrations are required, which have been calculated from the annual mean NO₂ concentration at monitoring sites using the NO_x to NO₂ spreadsheet calculator as described above. The verification process applied here, has been based on Box 7.15.

Nitrogen Dioxide

- 1.41 The dispersion model was run to predict annual mean NO_x concentrations using the Barnsley A628 Roadside (CM2) automatic monitor and a diffusion tube located on Dodworth Road (DT14). The monitors are roadside and considered appropriate for model verification. The DT13 diffusion tube located at traffic lights on Dodworth Rd was not used within the model verification as the diffusion tube is exposed to very localised source of pollution from vehicles idling at the traffic lights.
- 1.42 The 2019 background data presented in **Table A5** were used in the verification. The following tables present the adjusted model results using these input values.

Table A6: 2019 Annual Mean NO₂ Modelled and Monitored Concentrations

Site ID	Monitored Annual Mean NO ₂ (µg/m ³)	Modelled Total Annual Mean NO ₂ (µg/m ³)	% Difference (modelled – monitored)
DT14	24.6	40.5	-39.3
CM2	26.4	32.0	-17.4

- 1.43 **Table A6** indicates the model under predicts at both monitors. Technical Guidance LAQM.TG(16) suggests that where there is a disparity of more than 10% between modelled and monitored results, adjustment of the modelling results is necessary. The steps involved in the adjustment process are presented in **Table A7** and **Table A8**.

Table A7: Model Verification Results for Unadjusted NO_x Emissions

Site ID	Monitored NO ₂ (µg/m ³)	Monitored Road NO _x (µg/m ³)	Modelled Road NO _x (µg/m ³)	Ratio of Monitored Road Contribution NO _x /Modelled Road Contribution NO _x
DT14	40.5	49.6	14.8	3.4
CM2	32.0	30.3	18.6	1.6

- 1.44 **Figure A3** shows the mathematical relationship between modelled and monitored roadside NO_x (i.e. total NO_x minus background NO_x) in a scatter graph (data taken from **Table A7**), with a trendline passing through zero and its derived equation.

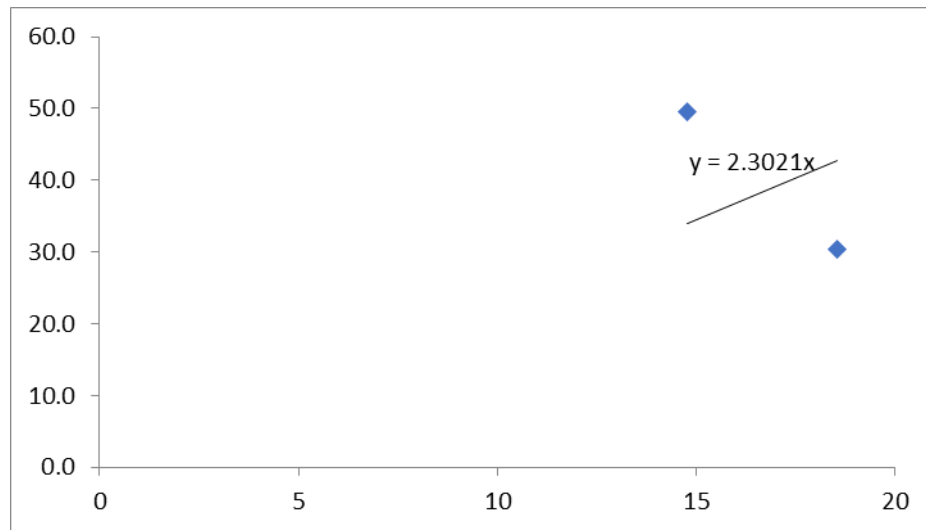


Figure A3: Unadjusted Modelled versus Monitored Annual Mean Roadside NO_x at Monitoring Sites

- 1.45 In **Table A8** the adjustment factor (2.3021) obtained from **Figure A3** was applied to the relevant modelled NO_x Roadside concentrations before being converted to annual mean NO₂ using the NO_x:NO₂ spreadsheet calculator.

Table A8: Model Verification Result for Adjustment NO_x Emissions

Site ID	Adjusted Modelled Road NO _x (µg/m³)	Modelled Total NO ₂ (µg/m³)	Monitored Total NO ₂ (µg/m³)	% Difference
DT14	34.0	33.7	40.5	-16.8
CM2	42.7	37.6	32.0	17.3

- 1.46 The data in **Table A8** indicates a more conservative agreement between monitored and modelled annual mean NO₂ results compared to the unadjusted model in **Table A6**. The NO_x adjustment process was therefore applied to the roadside NO_x modelling for 2019 'without' and 'with' the Development.

Particulate Matter (PM₁₀ and PM_{2.5})

- 1.47 PM₁₀ and PM_{2.5} monitoring data is not available for the Site and local area. Therefore, the roadside modelled NO_x adjustment factor of 2.3021 was subsequently applied to all the roadside PM₁₀ and PM_{2.5} modelling results.

Verification Summary

- 1.48 Any atmospheric dispersion model study will always have a degree of inaccuracy due to a variety of factors. These include uncertainties in traffic emissions data, the differences between available meteorological data and the specific microclimate at each receptor location, and simplifications made in the model algorithms that describe the atmospheric dispersion and chemical processes. There will also be uncertainty in the comparison of predicted concentrations with monitored data, given the potential for errors and uncertainty in sampling methodology (technique, location, handling, and analysis) as well as processing of any monitoring data.

- 1.49 Whilst systematic under or over prediction can be taken into account through the model verification / adjustment process, random errors will inevitably occur and a level of uncertainty will still exist in corrected / adjusted data.
- 1.50 Model uncertainties arise because of limited scientific knowledge, limited ability to assess the uncertainty of model inputs, for example, emissions from vehicles, poor understanding of the interaction between model and / or emissions inventory parameters, sampling and measurement error associated with monitoring sites and whether the model itself completely describes all the necessary atmospheric processes.
- 1.51 Overall, it is concluded that with the adjustment factors applied to the ADMS-Roads model, it is performing well and modelled results are considered to be suitable to determine the potential effects of the Development on local air quality.

Assessor Experience

Name: Andy Fowler

Years of Experience: 10

Qualifications:

- CEnv
- BSc (Hons)
- Member of the IAQM
- AIEMA (Associate Member of the Institute of Environmental Management and Assessment)
- Full Member of the Institution of Environmental Sciences (IES)

Andy has been responsible for the technical delivery of a wide range of air quality projects for a variety of clients in both the public and private sector. These projects include consideration of emissions from both transportation and industrial sources, through both monitoring and modelling, and therefore he has an in depth understanding of the regulatory requirements for these sources and the published technical guidance for their assessment.

UK and Ireland Office Locations

