



Air Quality Assessment

Land to the West of New Street

Russell Homes Limited

MAN.1969.002.AQ.R.002



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Air Quality Assessment

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Non-Technical Summary

- i. This report provides a consideration of potential impacts relating to a proposed residential development located at land to the West of New Street, Littleborough.
- ii. Due to the nature and scale of the proposals there is the potential for impacts to occur at nearby sensitive receptors during the construction and operational phases. Adverse impacts could arise following fugitive dust emissions generated by construction phase activities, as well as road vehicle exhaust emissions associated with vehicle movements generated during operation. There is also potential for site users to be exposed to unacceptable pollution at the development as a result of road vehicle exhaust emissions from the local road network
- iii. To determine overall impact significance, a qualitative risk assessment and detailed dispersion modelling has been produced to quantify impacts from fugitive dust emissions and road vehicle exhaust emissions, respectively.
- iv. Construction phase impacts were assessed in accordance with the Institute of Air Quality Management methodology and assuming the implementation of good practice dust control measures air quality impacts relating to fugitive dust emissions are predicted to be not significant.
- v. Operational road vehicle exhaust emissions impacts were modelled and assessed against the significance criteria provided by the Environmental Protection UK and Institute of Air Quality Management methodology. These were assessed in combination with consented Phases 1 and 2.
- vi. On-site pollutant exposure impacts were modelled and compared against national standards to determine site suitability.
- vii. The dispersion modelling indicated that predicted impacts as a result of operational phase emissions in combination with those from the consented phases, were predicted to be not significant at all sensitive locations in the vicinity of the site. Pollutant concentrations across the development site indicated compliance with the relevant air quality standards.
- viii. In summary and considering all the above, it is predicted with confidence that both development impacts and onsite pollutant exposure are deemed not significant and should not form a constraint to planning consent.

1.0 Introduction

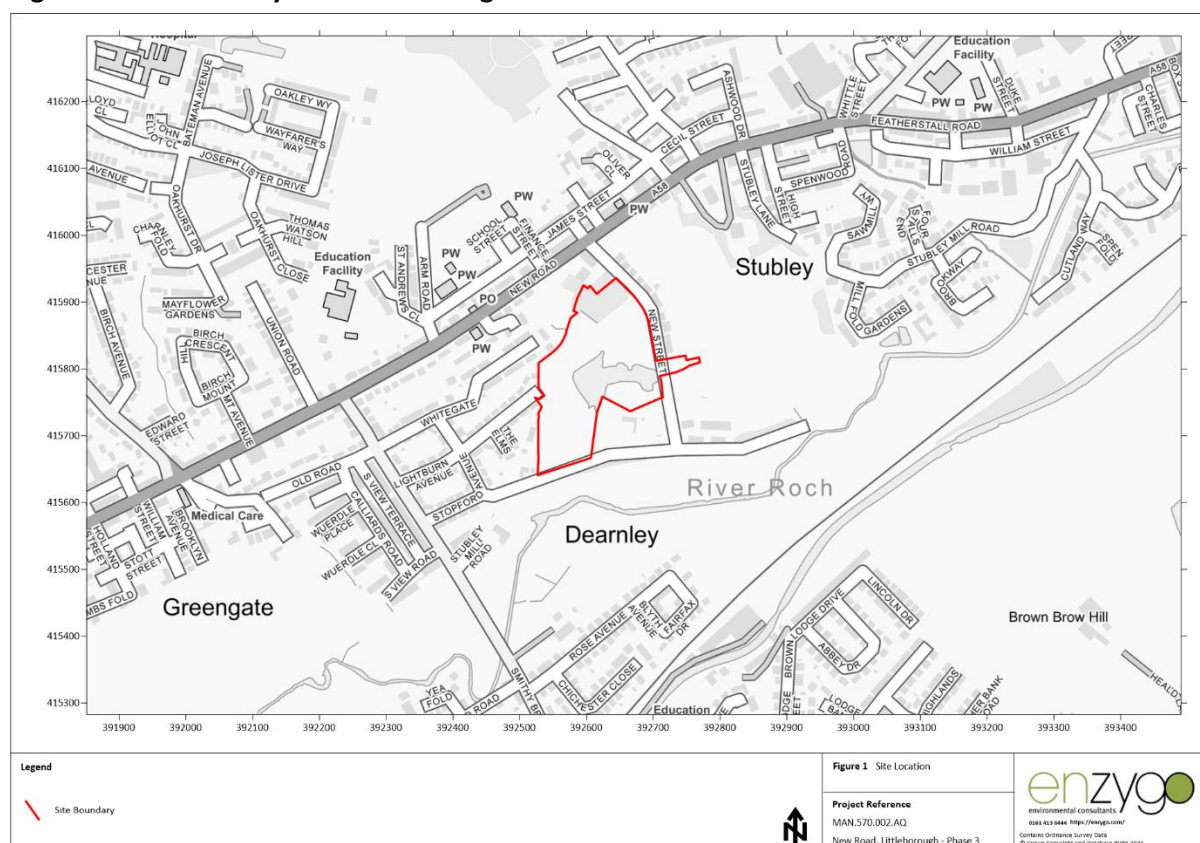
1.1 Background

- 1.1.1 Enzygo Limited was commissioned by Russell Homes UK Limited to produce an Air Quality Assessment in support of a planning application for a residential development at land to the West of New Street, referred to as the 'Proposed Development'.
- 1.1.2 Enzygo understands that the Proposed Development comprises the erection of 62 dwellings including access and associated works.
- 1.1.3 An Air Quality Assessment is required to assess the significance of impacts relating to the development and the potential for on-site exposure to unacceptable levels of pollution. The assessment will be undertaken in line with the requirements of the National Planning Policy Framework (NPPF).
- 1.1.4 Details of the assessment methodology, assessment inputs, results and conclusions are presented within this report.

1.2 Site Location and Context

- 1.2.1 The Proposed Development is located on land to the west of New Street, Littleborough at approximate National Grid Reference (NGR): 392620, 415815.
- 1.2.2 The site is adjacent to a well-established residential area to the north and west and open fields to the south. The A58 New Road runs approximately 45 m to the north of the site. To the east of the development site, previous phases of the wider development are under completion and access to the proposed development will be via this area. The Greater Manchester Air Quality Management Area (AQMA) is located 2 km west of the site along the A58 (Halifax Road). Figure 1 below provides a view of the site boundary and location.

Figure 1 Site Boundary and Surrounding Context



2.0 Legislation Guidance and Policy

The following legislation, guidance and policy will be considered during the preparation of the Air Quality Assessment:

- European Union (EU) Directive 2008/50/EC;
- The National Planning Policy Framework (NPPF), updated on 20th July 2021;
- The National Planning Practice Guidance (NPPG), relevant chapters produced on 1st November 2019;
- Section 82 of the Environment Act (1995) (Part IV);
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs (DEFRA), 2007¹;
- The Air Quality Standards (Amendment) Regulations (2016);
- Local Air Quality Management Technical Guidance 2016, DEFRA, April 2021;²
- Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management (IAQM), v1.1, June 2016³; and
- Land-Use Planning and Development Control: Planning for Air Quality, Environmental Protection UK and IAQM, January 2017⁴.

2.1 UK Legislation and National Strategy

- 2.1.1 Government policy requires the Secretary of State to publish a national Air Quality Strategy (AQS). The national AQS¹ produced by the Department for Environment, Food and Rural Affairs (DEFRA) sets out the framework to reducing adverse impacts of air pollution upon human health, vegetation, and ecosystems. To achieve this the AQS defines air quality objectives (AQOs) for 10 key pollutant species, including nitrogen dioxide (NO₂), fine particulate matter (PM₁₀ and PM_{2.5}), carbon monoxide (CO), sulphur dioxide (SO₂), benzene (C₆H₆), lead (Pb), Ozone (O₃), polycyclic aromatic hydrocarbons (PAHs) and 1,3 - butadiene.
- 2.1.2 In accordance with the Environment Act (1995), Local Authorities (LAs) have an obligation to periodically review and assess air quality within their administration to determine if specified pollutants are exceeding relevant objectives. This review involves the assessment of present and likely future air quality and is termed Local Air Quality Management (LAQM).
- 2.1.3 Should the LAQM process identify areas which are predicted to or currently exceeding relevant AQOs the LA is required to designate an Air Quality Management Area (AQMA). The AQMA is then accompanied by an Air Quality Action Plan (AQAP) which sets various measures and polices to improve air quality with the goal of restoring compliance with the AQOs. The process of LAQM is informed by DEFRA's Technical Guidance LAQM (TG16)².
- 2.1.4 European Directive 2008/50/EC also sets out a similar approach to the AQS and defines limit values for the protection of human health and ecosystems. The Environmental Permitting

¹ The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, DEFRA, 2007

² Local Air Quality Management Technical Guidance 2016 LAQM.(TG16), DEFRA, April 2021.

³ Guidance on the Assessment of Dust from Demolition and Construction, Institute of Air Quality Management, 2016.

⁴ Land-Use Planning and Development Control: Planning for Air Quality, EPUK and IAQM, January 2017.

(England and Wales) (Amendment) (EU Exit) Regulations 2019 ensures that the Environmental Permitting (EP) regime can continue following the UK's exit from the European Union (EU).

2.1.5 The regulations state also that exceedances of the objectives should be assessed in relation to air quality 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".

2.1.6 The limits values, objectives and target values which are applicable to this assessment are summarised in Table 1 with relation to human health receptors.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objectives	
	Concentration ($\mu\text{g}/\text{m}^3$)	Averaging Periods
NO ₂	40	Annual mean
	200	1-hour mean; not to be exceeded more than 18 times a year
PM ₁₀	40	Annual mean
	50	24-hour mean; not to be exceeded more than 35 times a year
PM _{2.5}	25	Annual mean

2.1.7 LAQM (TG16)² specifies locations where the AQOs should be applied as detailed in Table 2.

Table 2 Where Air Quality Objectives Apply

Averaging Period	Objectives Should Apply At	Objectives Should Not Apply At
Annual mean	All locations where members of the public might be regularly exposed Building façades of residential properties, schools, hospitals, care homes etc.	Building facades of offices and places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean	As above together with hotels, and gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	As above, and kerbside sites (for example, pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more Any outdoor locations where members of the public might reasonably be expected to spend one hour or longer	Kerbside sites where the public would not be expected to have regular access

2.1.8 Based on the residential land use the Proposed Development would be sensitive to all averaging periods detailed in Table 2.

2.2 Local Planning Policy

Rochdale Local Plan

2.2.1 Rochdale Metropolitan Borough Council (RMBC) Local Plan consists of a series of planning documents, of which the Core Strategy sets the spatial vision and strategy for the district. The Core Strategy was adopted in October 2016 and provides a series of key policies that will guide the scale, location and type of development in the area until 2028. As such, the policies contained within the Core Strategy provides the current basis for the determination of planning applications within RMBC's area of administration. A review of the Core Strategy indicated the following policies are relevant to this assessment.

C6 - Improving health and well being

"We will achieve this through:

[...]

i. Identifying and implementing measures to reduce traffic movements and congestion to reduce air and noise pollution"

G9 - Reducing the impact of pollution, contamination and land instability

"We will reduce all forms of pollution, contamination, and land instability in the borough, by:

a. Focusing on measures that reduce air pollution in Air Quality Management Areas, and other areas where pollution levels are unacceptable, particularly around motorways and main roads;

b. Requiring that development does not have impacts that lead to an unacceptable increase in air, water, noise, light or other pollution;

c. Ensuring sensitive new developments such as housing, schools and hospitals are not adversely affected by existing sources of pollution such as roads and certain types of industry;

d. Requiring a Low Emissions Strategy (LES) where development requires a Transport Assessment, and in other circumstances as appropriate;

g. Using planning conditions or obligations to control pollution from new development, or the impact of pollution on new development."

2.2.2 Reference has been made to these policies during the undertaking of this Air Quality Assessment by assessing the impacts of road vehicle exhaust emissions on nearby existing and proposed sensitive locations.

3.0 Methodology

Emissions generated by the Proposed Development during construction and operation have potential to cause impacts at sensitive locations. These have been assessed in accordance with the following methodology which consists of three assessment steps:

- Construction Phase Dust Risk Assessment
- Onsite Pollutant Exposure Assessment; and
- Offsite Operational Phase Impact Assessment.

3.1 Construction Phase Impacts

3.1.1 There is potential for fugitive dust impacts to occur at sensitive locations as a result of earthworks, construction and trackout activities during the construction phase of the Proposed Development. A qualitative assessment was undertaken in accordance with the methodology outlined within the IAQM³.

3.1.2 The methodology identifies specific control measures to be implemented on site which aim to reduce residual fugitive dust impacts. Appendix C details the IAQM assessment methodology.

3.2 Operational Phase Site Exposure

3.2.1 The suitability of the site with regards to future pollutant exposure has been determined by detailed dispersion modelling and comparison with the AQOs detailed in Table 1. Dispersion modelling using the ADMS-Roads model (version 5.0) was carried out for model verification against local air quality monitoring results for the baseline year 2019 and future year on-site predictions for the anticipated completion year of 2025.

3.2.2 ADMS is developed by Cambridge Environmental Research Consultants (CERC) and routinely used throughout the UK for the prediction of pollutant dispersion from road sources. The model requires various inputs including traffic flow data, emission factor inventories, and meteorological data which are detailed further in Appendix A.

3.2.3 It should be noted that air quality is predicted to improve in the future and in order to provide a realistic assessment, emission factors for 2025 have been used within the future modelling. The use of future year emission accords with predictions provided by DEFRA⁵ which reflect a cleaner vehicle fleet driven by future advancements to low and zero emission technologies.

3.3 Operational Phase Impacts

3.3.1 Potential operational impacts associated with vehicles travelling to and from the site was defined by predicting pollutant concentrations at sensitive locations with and without the Proposed Development in place. The following assessment scenarios were modelled:

- 2019 as baseline year for verification against latest ratified data;
- Opening year do-minimum (DM) – Traffic flows for 2025 should the proposals not proceed without consented Phase 1 and 2 scheme flows; and
- Opening year do-something (DS) – Traffic flows for 2025 should the proposals be completed, in combination with the consented Phase 1 and 2 scheme development flows.

⁵ <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>

3.3.2 The combined impacts of Phase 3 with previous phases to the east of the proposed development site were considered cumulatively to ensure a robust assessment has been carried out.

3.4 Emission Factors

3.4.1 It should be noted that air quality is predicted to improve in the future. Given the 6-year period between the 2019 baseline year and the anticipated opening year of 2025 it would be unreasonable not to assume a reduction in emission factors as a direct result of cleaner, modern vehicle fleets and future advancements to low emission technologies.

3.4.2 In order to provide a realistic assessment, emission factors for 2025 were utilised within the dispersion model.

3.5 EPUK and IAQM Impact Significance Criteria

3.5.1 Receptors potentially sensitive to changes in pollutant concentrations were identified within the assessment extents. LAQM (TG16)² provides the following examples of where annual mean AQOs should apply:

- Residential properties;
- Schools;
- Hospitals; and
- Care homes.

3.5.2 The sensitivity impact significance of each receptor was defined in accordance with the criteria shown in Table 3. These are based upon the guidance provided within the EPUK and IAQM guidance⁴.

Table 3 EPUK and IAQM Assessment Significance Criteria

Long Term Average Concentration	% Change in Concentration Relative to AQO			
	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

3.5.3 The criteria shown in Table 3 is adapted from the EPUK and IAQM guidance⁴ with sensitivity descriptors included to allow comparisons of various air quality impacts. It should be noted that changes of 0%, i.e. less than 0.5%, will be described as negligible in accordance with the EPUK and IAQM guidance⁴.

3.5.4 Following the prediction of impacts at discrete receptor locations utilising the criteria in Table 3 the EPUK and IAQM guidance⁴ states that this framework is to be used as a starting point to make a judgement on significance of effect but other influences might need to be accounted for. Whilst impacts might be determined as 'slight', 'moderate' or 'substantial' at individual receptors, overall effect might not necessarily be deemed as significant in some circumstances. The following factors may provide some assistance in determining the overall significance of a development:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;

- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective will be relevant;
- The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors;
- Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease; and
- The extent to which an objective is exceeded e.g. an annual mean NO₂ concentration of 41 µg/m³ should attract less significance than an annual mean of 51 µg/m³.

3.5.5 These factors were considered, and an overall significance determined for the impact of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts.

Full details of data used for the modelling assessment are presented in Appendix A of this report.

4.0 Baseline Conditions

Available air quality data and the surrounding context was reviewed to provide a baseline for assessment. These are detailed in the following sections.

4.1 Emission Sources

4.1.1 The main sources pollutant emissions within the vicinity of the Proposed Development site are road emissions associated with the A58. The site boundary is located approximately 40 m south of the A58 New Road at the nearest point. Therefore, the site can be considered as being close to significant emissions sources.

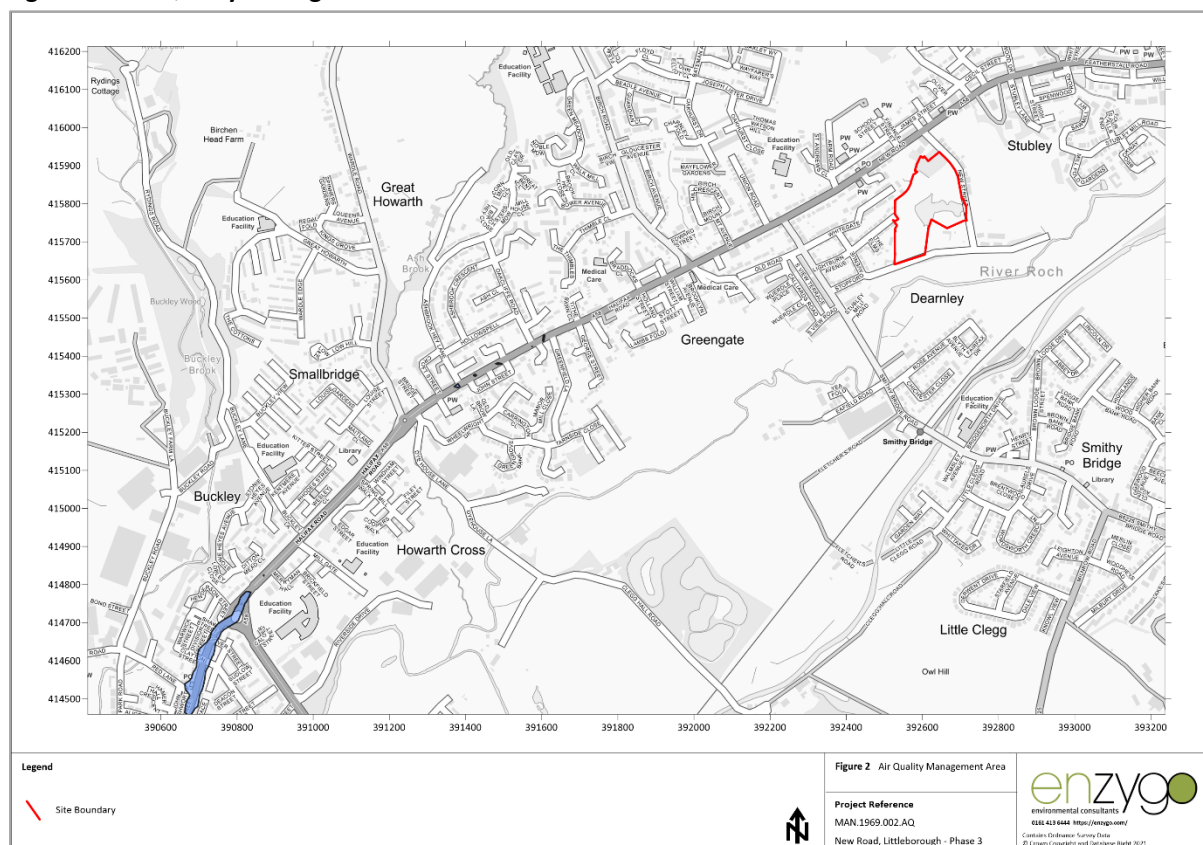
4.2 Air Quality Management Areas

4.2.1 Following a review of DEFRA's AQMA database⁶ one AQMA was identified within 2 km of the Proposed Development as detailed below:

- *Greater Manchester Combined Authority AQMA (Rochdale Metropolitan Borough Council) - This is the part of the Greater Manchester Combined Authority AQMA located within the Rochdale Council area.*

4.2.2 The Greater Manchester AQMA is located 2 km west of the Proposed Development and has been designated for annual mean NO₂ exceedances. Due to the distances from the Proposed Development, it is unlikely the emissions associated with the AQMA would affect onsite NO₂ concentrations and similarly the Proposed Development is unlikely to influence receptors in this area. Reference should be made to Figure 2 for a graphical representation of the AQMA.

Figure 2 – Air Quality Management Areas



⁶ https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=123

4.3 Air Quality Monitoring

4.3.1 To provide further context to existing air quality within the vicinity of the site the last Air Quality monitoring provided by RMBC⁷ was reviewed. The review indicated the closest automatic station is the Oldham Crompton Way located 6.7 km south of the Proposed Development (NGR: 393887, 409191). This location does not provide a similar environment to the assessment extents, and this source of baseline data will not be considered further.

4.3.2 A review of RMBC passive diffusion tube network indicated 3 sites within the assessment area. Data from 2017 to 2019 at these locations is presented in Table 4. Exceedances of the annual mean AQO are highlighted in **bold**.

Table 4 Roadside Diffusion Tube Monitoring Results

ID	Site Name	Type	NGR (m)		Distance to Site (m)	Annual Mean Concentration (µg/m³)		
			X	Y		2017	2018	2019
RO12ANO	Halifax Road Wardle	Roadside	392072	415687	562	40.1	31.4	39.4
RO13ANO	725 Halifax Road Wardle	Urban Background	392042	415707	588	18.3	13.7	17.2
RO28ANO	Smithy Bridge Road	Urban Background	392871	415127	721			29.5

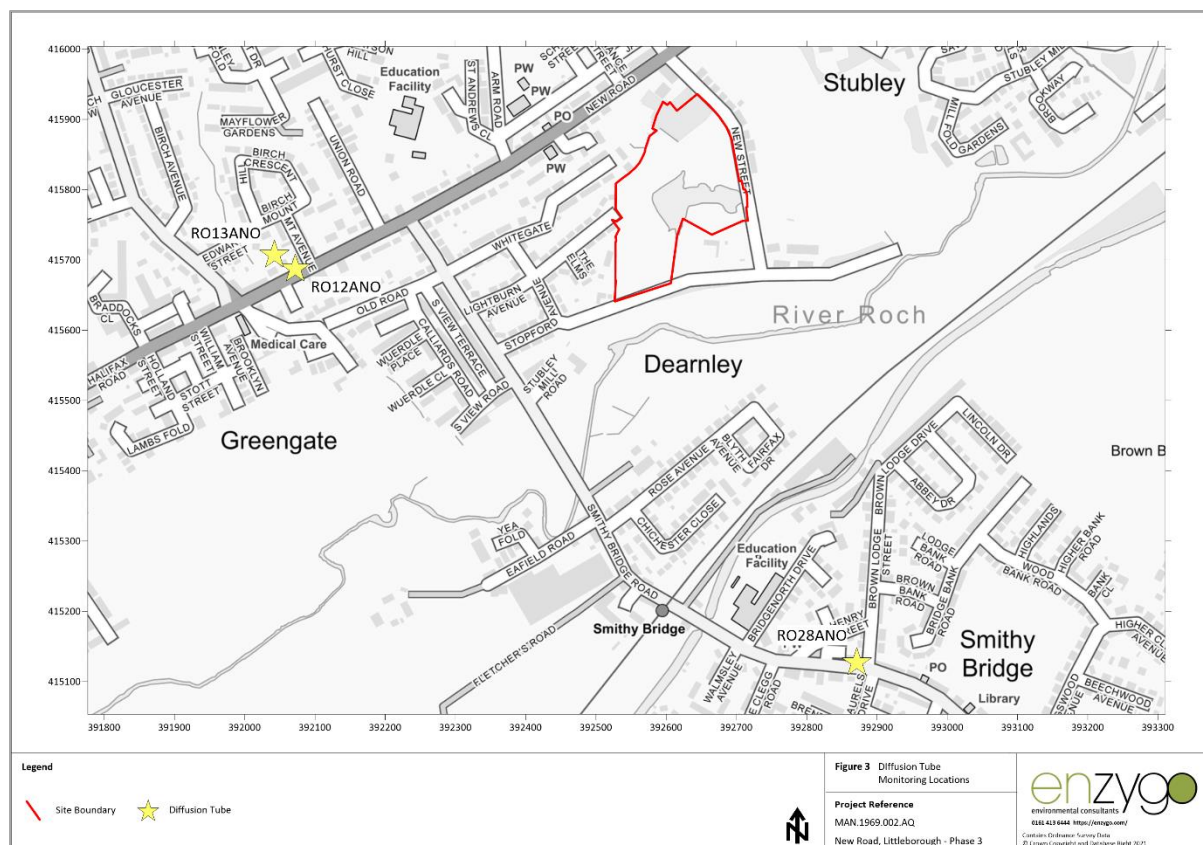
4.3.3 NO₂ diffusion tube monitoring data from 2017 to 2019 indicates one exceedance of the annual mean AQO at location 12 (Halifax Road), which is marginally above the 40 µg/m³ objective. The historical data presents no overall improvement to annual mean NO₂ concentrations with the majority of the results increasing from 2018.

4.3.4 The closest locations to the site (RO12) indicate that A58 roadside concentrations are close to the annual mean AQO for NO₂.

4.3.5 It should be noted that results from 2020 would be significantly affected by the COVID pandemic and therefore 2020 data has not been reviewed during the baseline assessment. Figure 3 provides a graphical representation of the passive monitoring locations.

⁷ 2020 Air Quality Annual Status Report, Greater Manchester Combined Authority, June 2021

Figure 3 – Diffusion Tube Monitoring Locations



4.4 DEFRA Background Concentrations

4.4.1 To assist LA their air quality Review and Assessments, DEFRA have produced background concentration maps for NO₂, PM₁₀ and PM_{2.5}. Predictions are based on a 1 km by 1 km grid basis across the entire UK. The Proposed Development is located across the NGR: 392500, 415500.

4.4.2 Data for this location was downloaded for the most reliable baseline year (2019) and the predicted development opening year (2025). Table 5 presents the data.

Table 5 DEFRA Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m ³)		Percentage of Annual Mean AQO (%)	
	2019	2025	2019	2025
NO ₂	12.48	9.88	31	25
PM ₁₀	10.75	10.04	27	25
PM _{2.5}	7.24	6.72	30	27

4.4.3 Based on DEFRA background predictions concentrations of NO₂ and PM do not exceed the relevant AQOs during the baseline or predicted opening year. Background concentrations are well below the AQOs.

4.4.4 The data also indicates the concentrations are predicted to decrease further in future years and suggest an improvement to local air quality.

4.5 Sensitive Receptors

4.5.1 A sensitive receptor is defined as any location which may be affected by changes in air quality as a result of a development. These have been defined for construction dust impacts in the following Sections.

Construction Phase Sensitive Receptors

- 4.5.2 No national or European ecological designations are located within 50m of the Site boundary, or within 50 m from a route used by construction vehicles on the public highway (up to 500 m from the Site entrance). Therefore, the risk of dust effects at a nationally or European designated ecological receptor site from construction impacts is not considered further in this assessment.
- 4.5.3 Human receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350 m from the development boundary. These are summarised in Section 5.1.
- 4.5.4 Reference should be made to Figure 5 and Figure 6 within Appendix A for a graphical representation of construction phase dust buffer zones.

Operational Phase Sensitive Receptors

- 4.5.5 A desk-top study was undertaken to identify any sensitive receptor locations in the vicinity of the site that require specific consideration during the assessment and are summarised Table 6.

Table 6 Existing Sensitive Human Receptors

Receptor Name		NGR (m)		Distance to Site (m)	Height (m)
		X	Y		
R1	5 New Road	392690.8	416042.5	249	1.5
R2	8 New Road	392710.4	416082.1	292	1.5
R3	26 New Road	392627.7	416023.3	220	1.5
R4	111 New Road	392457.5	415878.0	181	1.5
R5	703 Halifax Road	391996.0	415650.7	644	1.5
R6	622 Halifax Road	391930.3	415594.4	723	4.5
R7	748 Halifax Road	392230.8	415745.4	396	1.5
R8	161 Featherstall Road	392821.5	416118.1	372	1.5
R9	St Mary's RC Primary School	393130.8	416212.5	653	1.5
R10	Tinkerbelle Nursery	393044.6	416147.2	545	1.5
R11	2 Duke Street	393248.2	416182.4	732	1.5
R12	105 Church Street	393536.5	416269.2	1,026	1.5
R13	136 New Road	392323.2	415820.6	299	1.5
R14	763 Halifax Road	392098.3	415706.4	533	1.5

- 4.5.6 Receptors modelled at 1.5m to represent the average UK “breathing height” above ground level. Reference should be made to Figure 4 for a graphical representation of operational phase emission sensitive human receptor locations.

Figure 4 –Existing Sensitive Receptor Locations



5.0 Assessment

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

5.1 Construction Phase Impact Assessment

5.1.1 A desk top screening assessment (Step 1) identified sensitive receptors within 350m of the site boundary, and within 50m of the anticipated trackout. These are summarised in Table 7.

5.1.2 There are no designated ecological receptors within 50m of the Site boundary, or within 50m of anticipated trackout routes. Therefore, construction impacts on ecological designations have been screened out of the assessment.

Table 7 Sensitive Receptor Counts

Distance from Site or Trackout Routes (m)	Approximate Number of Receptors
Earthworks and Construction	
Less than 20	10 - 100
20 – 50	10 - 100
50 – 100	More than 100
100 – 350	More than 100
Trackout	
Less than 20	More than 100
20 – 50	More than 100

5.1.3 Figure 5 and Figure 6 provide a map of the construction and trackout buffer distances.

Figure 5 – Demolition, Earthworks and Construction Buffer Distances

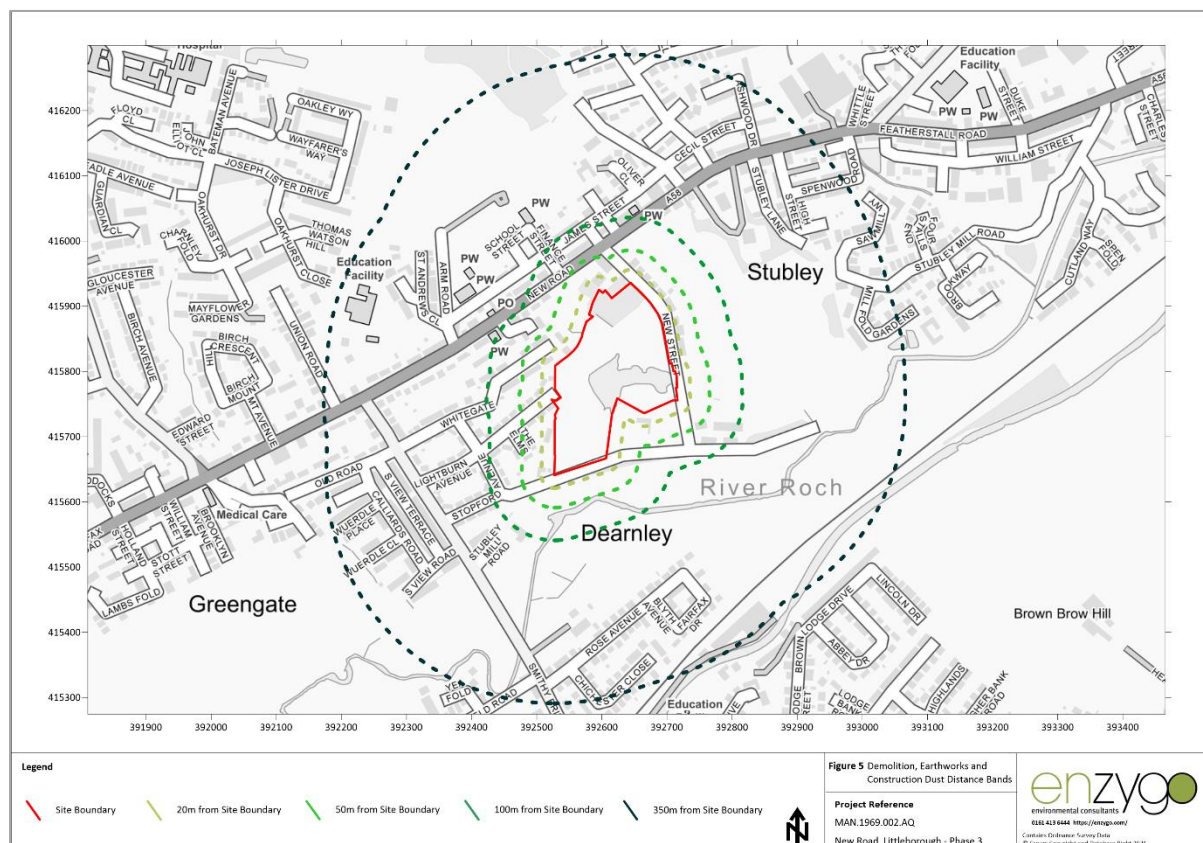
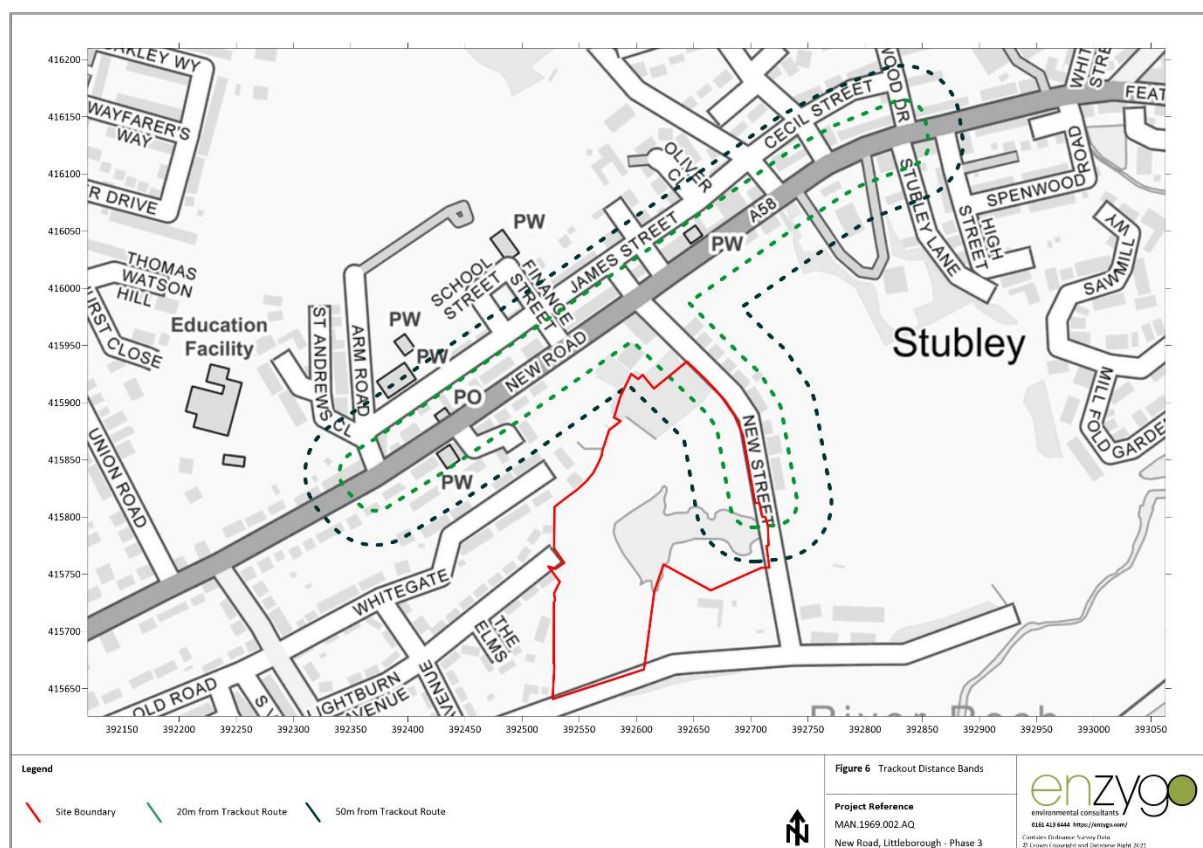


Figure 6 – Trackout Buffer Distances



5.1.4 A detailed assessment of potential dust impacts is therefore required. This is detailed in the following sections as informed by the IAQM guidance³.

Magnitude

5.1.5 The scale and nature of the works has been determined to assess the magnitude (Step 2A) of fugitive dust emissions arising from each construction phase activity. The determination of magnitude was based upon the criteria detailed in Appendix B.

Demolition

5.1.6 The site is currently agricultural land with limited existing building structures which will require demolition. Based on the anticipated of existing building the magnitude of potential dust emissions related to demolition activities is considered **small**.

Earthworks

5.1.7 The Proposed Development may require significant imports and exports of material to prepare for construction. Based on the estimated site area of 33,000 m² combined with anticipated material movements the magnitude of potential dust emissions related to earthwork activities is considered **large**.

Construction

5.1.8 The proposed development comprises the construction of 62 dwellings. Based on the IAQM criteria the magnitude of potential dust emissions related to construction activities is considered **large**.

Trackout

5.1.9 Information on the number of HDV trips generated during the construction phase was not available at the time of assessment. Similarly, the surface material and unpaved road length was not known. Based on the site area, it is anticipated that the unpaved road length is likely to be greater than 100m. Based on the IAQM criteria the magnitude of potential dust emissions related to construction activities is considered **large**.

5.1.10 A summary of the construction phase magnitudes is detailed in Table 8.

Table 8 Dust Emission Magnitude

Earthworks	Earthworks	Construction	Trackout
Small	Large	Medium	Large

Sensitivity

5.1.11 The next step (Step 2B) was to determine the sensitivity of the surrounding area, based on general principles such as amenity and aesthetics, as well as human exposure sensitivity.

Dust Soiling

5.1.12 Residential dwellings are located directly adjacent to the western and southern boundaries which provides a **high** receptor sensitivity with regards to dust soiling.

Human Health

5.1.13 Predicted annual mean background concentrations of PM₁₀ within the vicinity of the proposed site, as predicted by DEFRA, are 10.28 µg/m³ (Table 5). Based on the receptor counts provided in Table 7, the area is of **low** sensitivity from demolition, earthworks and construction activities and **medium** sensitivity for trackout activities.

Risk

5.1.14 The next stage of the assessment (Step 2C) combined the dust magnitude and receptor sensitivity defined above to determine the overall risk with no mitigation applied. This is summarised in Table 9.

Table 9 Summary of Unmitigated Dust Risk

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

5.1.15 Following the determination of risk for each activity, the final step (Step 3) was to detail necessary mitigation measures to reduce impacts during the construction phase.

5.1.16 These measures have been adapted for the Proposed Development and summarised in Table 13 within Section 6.1.

5.2 Operation Phase Impact Assessment

On-site Exposure

Long Term Objectives

5.2.1 Opening year pollutant concentrations were modelled across the Proposed Development during the future opening year of 2025. Maximum results across the development site are presented in Table 10.

Table 10 Predicted Annual Mean Concentrations Across the Site

Predicted Modelled Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)		
NO_2 (AQO: $40\mu\text{g}/\text{m}^3$)	PM_{10} (AQO: $40\mu\text{g}/\text{m}^3$)	$\text{PM}_{2.5}$ (AQO: $25\mu\text{g}/\text{m}^3$)
10.25 – 11.23	10.13 – 10.44	6.77 – 6.93

5.2.2 Predicted annual mean concentrations presented in Table 10 indicate compliance with national AQOs detailed in Table 1.

5.2.3 Based on these results, on-site exposure to annual mean pollutant concentrations is considered not significant and the site is considered suitable for residential use without the requirement of protective mitigation measures.

5.2.4 Predictions at heights above ground level have not been assessed further, as it is considered that pollutant concentrations would reduce with increased height from emission sources, i.e., the local road network.

5.2.5 Pollutant contour plots in Figure 7, Figure 8 and Figure 9 provide a graphical representation of pollutant concentrations across the site.

Figure 7 – Annual Mean NO_2 Contours

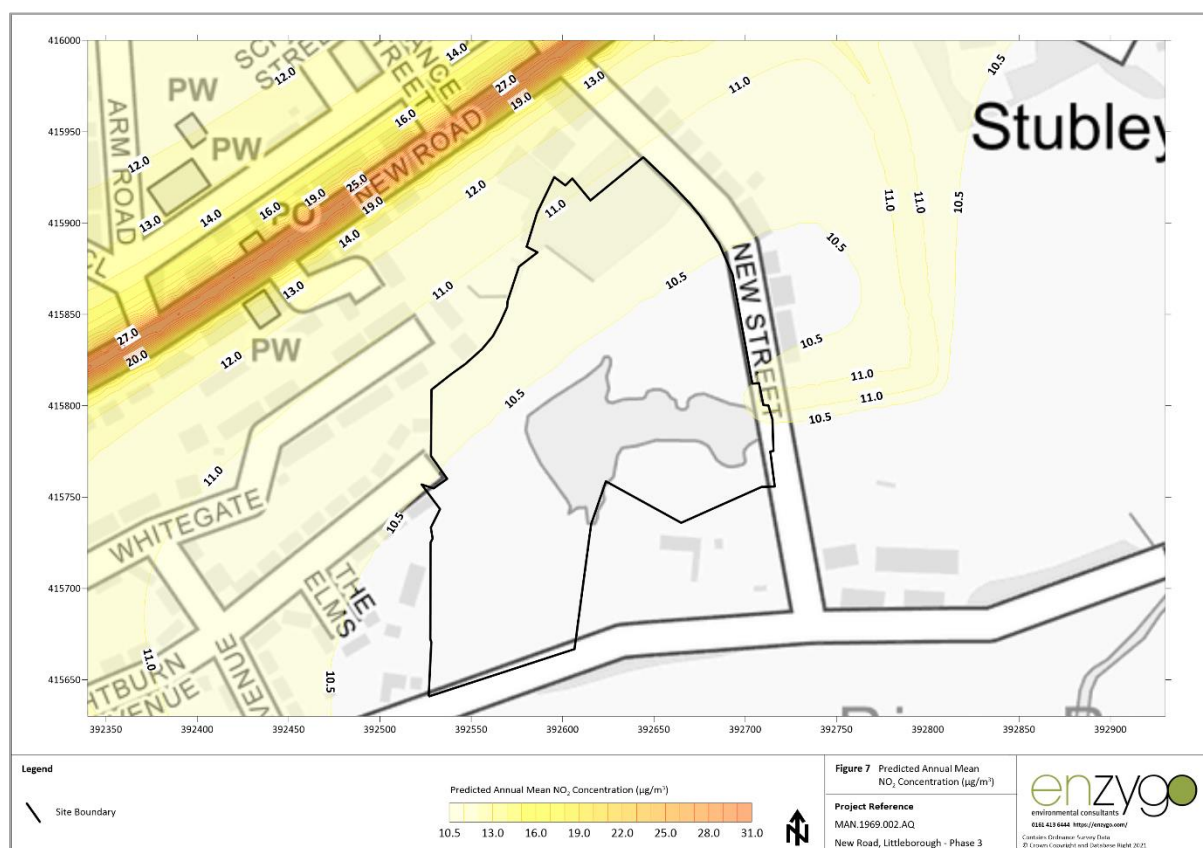


Figure 8 - Annual Mean PM₁₀ Contours

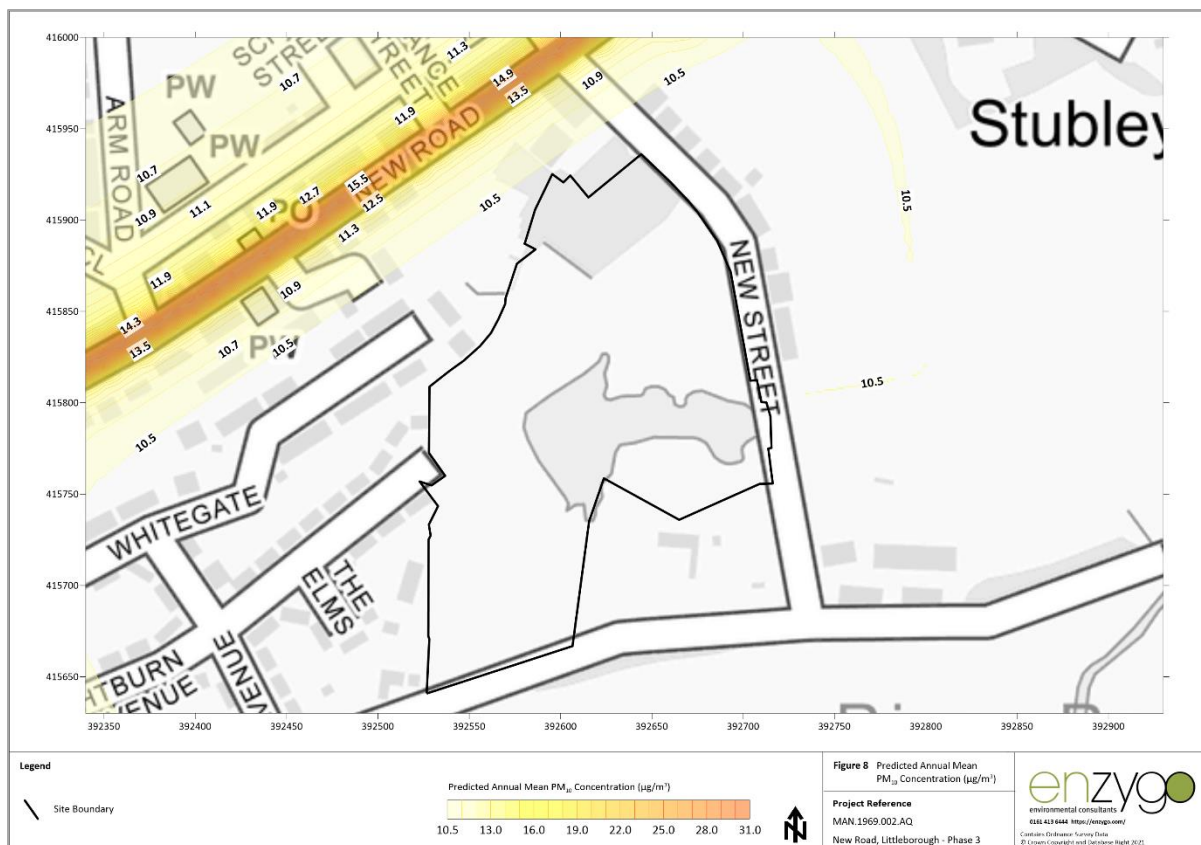
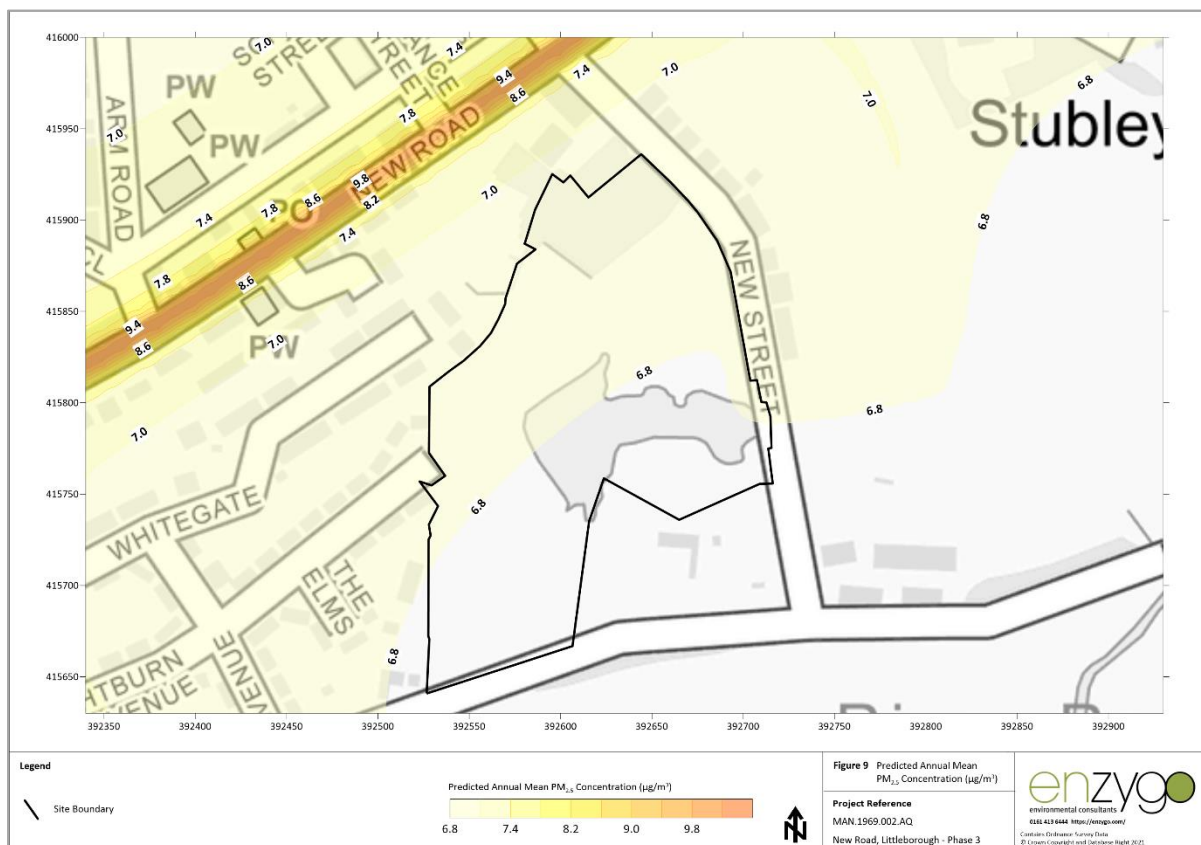


Figure 9 - Annual Mean PM_{2.5} Contours



Short Term Objectives

- 5.2.6 Predictions of short-term concentrations such as 1-hour NO₂ or 24-hour mean concentrations were not produced as part of the dispersion modelling assessment. LAQM(TG16)² states if annual mean NO₂ concentrations are below 60 µg/m³ it is unlikely that the 1-hour AQO will be exceeded. The maximum predicted modelled NO₂ concentration across the site is 11.23 µg/m³ and therefore exceedances of the 1-hour mean AQO are not expected.
- 5.2.7 The EPUK and IAQM guidance⁴, suggests that annual mean PM₁₀ concentrations above 32 µg/m³ equate to likely exceedances of the 24-hour mean AQO. The maximum predicted modelled PM₁₀ concentrations is 10.44 µg/m³ and exceedances of the 24-hour mean AQO are not expected.
- 5.2.8 Based on the modelling results it is predicted that short term concentrations will not exceed the AQOs across the site and the overall significance of potential exposure impacts is not significant.

Road Traffic Exhaust Impacts

- 5.2.9 The Proposed Development has the potential to cause impacts at nearby sensitive locations. This was assessed through dispersion modelling, with the results presented in the following Sections.
- 5.2.10 Based on data from Focus Transport Planning, it is expected that there will be a maximum of 510 AADT trips generated by the Phase 3 development. Based on the anticipated AADT trip generation a dispersion modelling assessment was undertaken to quantify potential changes in pollutant concentrations at sensitive locations in the vicinity of the site.
- 5.2.11 Predicted impact significance at individual receptors on annual mean NO₂, PM₁₀ and PM_{2.5} concentrations based on the criteria given in Table 3 are summarised in Table 11.

Table 11 Summary of Impacts at Sensitive Receptors

Pollutant and Period	Receptors	Significance of Impact
Annual Mean NO ₂	All Receptors	Negligible
Annual Mean PM ₁₀	All Receptors	Negligible
Annual Mean PM _{2.5}	All Receptors	Negligible

- 5.2.12 As shown in Table 11 the significance of impacts was predicted to be negligible at all sensitive receptors.
- 5.2.13 The overall significance of potential impacts was determined to be not significant in accordance with the EPUK and IAQM guidance⁴. The use of robust assumptions, in the form of worse-case road vehicle emission factors, was considered to provide sufficient results confidence for an assessment of this nature.
- 5.2.14 Full assessment results and commentary can be found in Appendix B.

Impact Significance

- 5.2.15 The overall significance of operational phase road traffic emission impacts for 2025 was determined as not significant. This was based on the predicted impacts at discrete receptor locations and the considerations outlined in Section 5.2. This is a worst case assessment of a combination of proposed Phase 3 impacts in combination with the consented Phases 1 and 2 schemes. Further justifications are provided in Table 12.

Table 12 Overall Road Emissions Impact Significance

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance	Impacts on NO ₂ , PM ₁₀ and PM _{2.5} concentrations were predicted to be negligible at all sensitive receptors. These represent worst-case locations and therefore it is unlikely that any other receptors would be significantly affected by the proposed development
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant	The proposed development will not result in any new sensitive exposure to pollutant concentrations above the AQOs at sensitive locations
The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors	The maximum changes in annual mean NO₂ and PM₁₀ concentrations relative to their respective AQOs were predicted to range from: • 0.15% to 0.80% for NO₂, • 0.05% to 0.25% for PM₁₀; and • <0.01% to 0.24% for PM_{2.5}. As such, resultant impacts were negligible at all receptor locations for each pollutant species
Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease	There were no exceedances of the annual mean AQO for NO ₂ , PM ₁₀ and PM _{2.5} at sensitive locations within the modelling extents.
The extent to which an objective is exceeded e.g. an annual mean NO ₂ concentration of 41 µg/m ³ should attract less significance than an annual mean of 51 µg/m ³	There were no exceedances of the annual mean AQO for NO ₂ , PM ₁₀ and PM _{2.5} at sensitive locations within the modelling extents.

5.2.16As such, the overall significance of operational phase road traffic emission impacts on annual mean NO₂ and PM concentrations was determined **not significant**.

6.0 Mitigation

6.1 Construction Phase

6.1.1 The IAQM guidance³ provides several control measures to reduce fugitive dust impacts during the construction phase. These measures have been adapted based on professional judgment for the Proposed Development site and summarised in Table 13.

Table 13 Fugitive Dust Mitigation Measures

Impact	Control Measure and Requirement		
Communications	1	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	H
	2	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	H
	3	Display the head or regional office contact information	H
	4	Develop and implement a Dust Management Plan, which may include measures to control other emissions, approved by the Local Authority.	H
Site Management	5	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	H
	6	Make the complaints log available to the local authority when asked	H
	7	Record any exceptional incidents that cause dust and/or air emissions, either on- or off- site, and the action taken to resolve the situation in the logbook.	H
	8	Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.	H
Monitoring	9	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.	H
	10	Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results, and make an inspection log available to the local authority when asked	H
	11	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	H
	12	Agree dust monitoring locations with the Local Authority	H
Preparing & Maintaining Site	13	Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	H
	14	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	H
	15	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive time period	H
	16	Avoid site runoff of water or mud	H
	17	Keep site fencing, barriers and scaffolding clean using wet methods	H

Impact	Control Measure and Requirement		
	18	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	H
	19	Cover, seed or fence stockpiles to prevent wind whipping	H
Operating Vehicle/Machinery & Sustainable Travel	21	Ensure all vehicles switch off engines when stationary - no idling vehicles	H
	22	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	H
	23	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate)	H
	24	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials	H
	25	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)	H
Operations	26	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.	H
	27	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	H
	28	Use enclosed chutes and conveyors and covered skips.	H
	29	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	H
	30	Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	H
Waste Management	31	Avoid bonfires and burning of waste materials	H
Demolition	32	Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust)	D
	33	Ensure effective water suppression is used during demolition operations. Handheld sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground	H
	34	Avoid explosive blasting, using appropriate manual or mechanical alternative	H
	35	Bag and remove any biological debris or damp down such material before demolition	H
Earthworks & Construction	36	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	H
	37	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable	H
	38	Only remove the cover in small areas during work and not all at once	H
	39	Avoid scabbling (roughening of concrete surfaces) if possible	D

Impact	Control Measure and Requirement		
	40	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.	H
	41	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.	D
	42	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.	D
Trackout	43	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.	H
	44	Avoid dry sweeping of large areas.	H
	45	Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	H
	46	Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.	H
	47	Record all inspections of haul routes and any subsequent action in a site logbook.	H
	48	Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.	H
	49	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	H
	50	Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.	H
	51	Access gates to be located at least 10 m from receptors where possible	H

*D – desired

*H – highly recommended

6.1.2 Assuming the relevant mitigation measures outlined in Table 13 are implemented, the residual effect from all dust generating activities (Step 4) is predicted to be negligible and therefore **not significant** in accordance with the IAQM guidance³.

6.2 Operational Phase

6.2.1 The results of operational phase assessment (in combination with consented Phases 1 and 2) concluded that associated development impacts are predicted as not significant, as a result of negligible impacts at all locations. Additionally, no exceedances of the AQO were predicted at any location identified in the assessment.

6.2.2 The implementation of mitigation measures during the operational phase is not required.

7.0 Conclusions

- 7.1.1 This air quality assessment has considered operational and construction related impacts from the proposed development as well as on-site pollutant exposure for future site users.
- 7.1.2 A qualitative dust risk assessment was undertaken in accordance with the IAQM methodology to define a mitigation strategy. Assuming good practice and the implementation of suggested dust control measures, detailed in Table 13, residual impacts are predicted to be not significant.
- 7.1.3 Dispersion modelling was undertaken to quantify annual mean NO₂ and PM concentrations across the Proposed Development site to assess suitability for residential use. Potential development impacts were also modelled to quantify the significance of operational phase impacts. Modelling results were subsequently verified using RMBC local monitoring locations.
- 7.1.4 The results of the site exposure modelling predicted that onsite annual and hourly mean concentrations comply with the national AQOs at all proposed sensitive locations. Further mitigation to protect future occupiers is therefore not required and operational phase exposure impact were predicted to be not significant.
- 7.1.5 Predicted impacts on NO₂, PM₁₀ and PM_{2.5} concentrations during the operational phase were predicted to be negligible at all sensitive receptor locations within the vicinity of the site. The assessment has considered a worst case assessment of the proposed development impacts in combination with consented Phases 1 and 2. The overall significance of potential impacts was determined to be not significant, in accordance with the EPUK and IAQM guidance.
- 7.1.6 Based on the assessment results, all air quality impacts were considered as not significant and should not be considered a constraint to planning consent and the Proposed Development complies with the NPPF and RMBC planning policies.

8.0 Abbreviations

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
ADMS	Atmospheric Dispersion Modelling Software
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
ASR	Annual Status Report
C ₆ H ₆	Benzene
CERC	Cambridge Environmental Research Consultants
CO	Carbon Monoxide
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DM	Do Minimum
DS	Do Something
EA	Environment Agency
EPUK	Environmental Protection UK
EU	European Union
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
NGR	National Grid Reference
NO ₂	Nitrogen Dioxide
NO _x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
O ₃	Ozone
PAHs	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PM ₁₀	Particulate Matter with an aerodynamic diameter less than 10µm
PM _{2.5}	Particulate Matter with an aerodynamic diameter less than 2.5µm
RMBC	Rochdale Metropolitan Borough Council
RMSE	Route Mean Square Error
SO ₂	Sulphur Dioxide
z ₀	Roughness Length

9.0 Appendix A – Assessment Inputs

ASSESSMENT INPUTS

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0) which is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the UK for the prediction of pollutant dispersion from road sources.

Modelling predictions from this software package are widely accepted by the Environment Agency and DEFRA. The following sections detail the input parameters:

Assessment Area

Ambient concentrations were predicted at distinct receptor locations chosen to represent the most sensitive receptors near to roads affected by the development. Receptor locations are shown in Figure 4.

Gridded outputs over the region NGR: 392340, 415630 to 392930, 196450, were processed and combined with DEFRA background concentrations detailed in Table 5 to provide pollutant contours across the site. Contours are shown in Figure 7, Figure 8 and Figure 9.

Traffic Flow Data

Baseline traffic data for the 2019 scenario were obtained from the following sources:

- Department for Transport Road Traffic Statistics⁸;
- Approved Air Quality Assessment⁹ - Land off New Road, Littleborough; and
- Focus Transport Planning Data.

Vehicle speeds were estimated based on the free flow potential of each link and local speed limits. Assumptions account for speed reductions at junctions and peak hour congestion in line with Section 7.260 of LAQM (TG16)². Road widths were estimated from aerial photography.

A summary of the traffic data used in the verification scenario is provided in Table A1.

Table A1: 2019 Verification Traffic Data

Road Link		Road Width (m)	24 Hour AADT Flow	HDV (%)	Speed (km/hr)	Data Source
L1	A58 (Halifax Road) – West of Smith Bridge Road	11.0	30,726	2.8	30	DfT 46596
L2	A58 (Halifax Road)- Smithy Bridge Road Junction	10.8	30,726	2.8	15	DfT 46596
L3	A58 (New Road) - Westbound	9.9	22,069	4.1	30	AQ106120
L4	A58 (New Road) Westbound - Smithy Bridge Junction Slow Down	11.5	22,069	4.1	15	AQ106120
L5	A58 (Halifax Road) – Birch Road Junction	10.4	30,726	2.8	15	DfT 46596
L6	A58 (New Road) East of Site Access	8.6	22,069	4.1	50	AQ106120

⁸ <https://roadtraffic.dft.gov.uk/#6/55.254/-6.053/basemap-regions-countpoints>

⁹ <https://pa.watford.gov.uk/publicaccess/applicationDetails.do?activeTab=documents&keyVal=QTECYRQWFYQ00>

Road Link		Road Width (m)	24 Hour AADT Flow	HDV (%)	Speed (km/hr)	Data Source
L7	A58 (Featherstall Road) – East of Whitelees Road	8.4	22,069	4.1	50	AQ106120
L8	Site Access	5.8	0	0.0	20	Focus
L9	A58 (Halifax Road) – West of Birch Road	11.5	30,726	2.8	50	DfT 46596
L10	Smithy Bridge Road	7.2	6,871	2.8	30	DfT 807063

Future development traffic flows for the DM and DS scenarios were produced by Focus Transport Planning, the appointed traffic consultant. These were based on peak flow predictions which were factored to 24 hour flows by using national average traffic diurnal profiles.

The DS scenarios included the Phase 1 and 2 operational flows combined with Phase 3 operational flows.

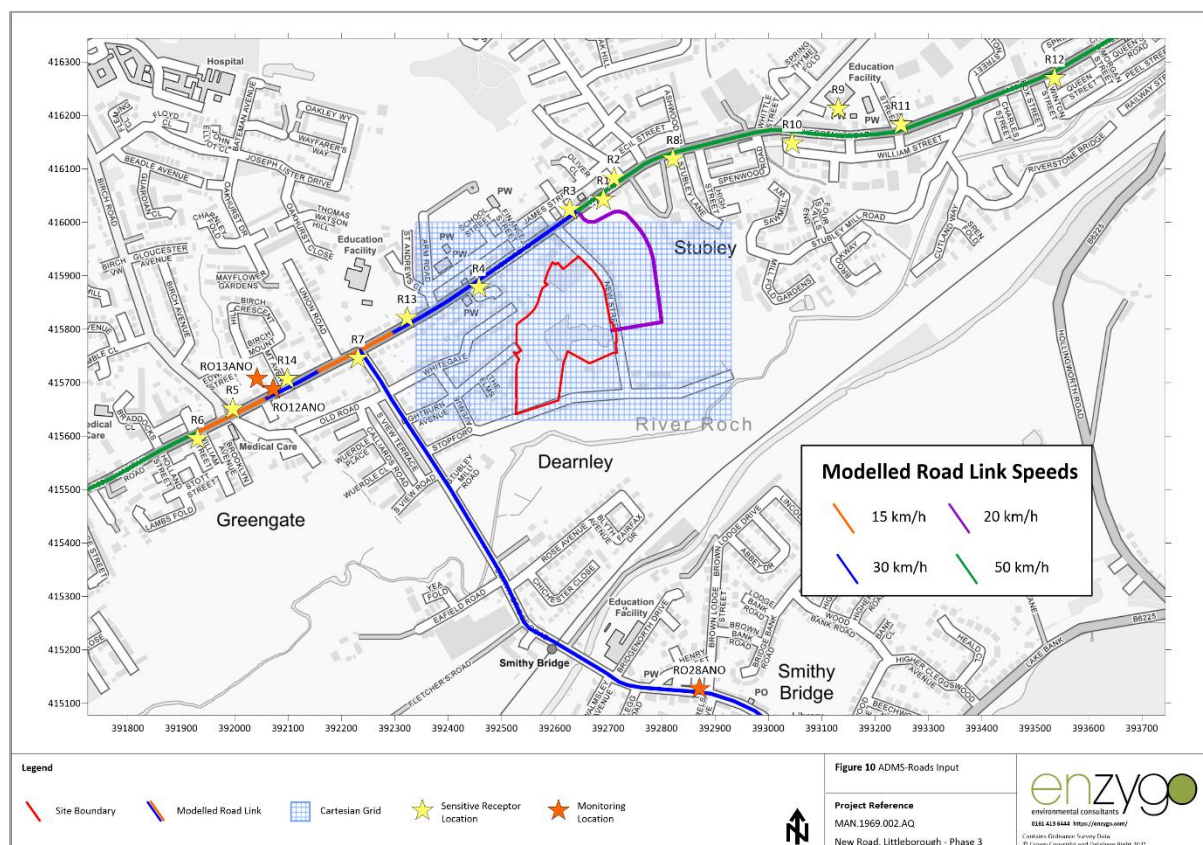
The road width and mean vehicle speed shown in Table A1 remained the same for the 2025 scenarios. A summary of the 2025 traffic data is shown in Table A2.

Table A2: 2025 Traffic Data

Road Link		DM Scenario		DS Scenario		Additional Flow (AADT)	
		24 Hr AADT Flow	HDV (%)	24 Hr AADT Flow	HDV (%)	Phase 1+2	Phase 3
L1	A58 (Halifax Road) – West of Smith Bridge Road	31,466	2.8	32,169	2.7	443	259
L2	A58 (Halifax Road)- Smithy Bridge Road Junction	31,466	2.8	32,169	2.7	443	259
L3	A58 (New Road) - Westbound	22,601	4.1	23,304	4.0	443	259
L4	A58 (New Road) Westbound - Smithy Bridge Junction Slow Down	22,601	4.1	23,304	4.0	443	259
L5	A58 (Halifax Road) – Birch Road Junction	31,466	2.8	32,169	2.7	443	259
L6	A58 (New Road) East of Site Access	22,601	4.1	23,288	4.0	436	251
L7	A58 (Featherstall Road) – East of Whitelees Road	22,601	4.1	23,288	4.0	436	251
L8	Site Access	828	0.0	1,338	0.0	828	510
L9	A58 (Halifax Road) – West of Birch Road	31,466	2.8	32,169	2.7	443	259
L10	Smithy Bridge Road	7,037	1.7	7,037	1.7	0	0

Reference should be made to Figure 10 for a graphical representation of the road link locations used within the operation phase assessment.

Figure 10 - ADMS Roads Inputs



Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 10.1) released in August 2020, which incorporates updated COPERT 5.3 vehicle emissions factors for NO_x and PM and EURO 6 vehicle fleet sub-categories.

The 2025 DM and DS scenarios assume a reduction to future year emission factors guided by increasing EV fleets and future advancements to low emission technologies as provided by DEFRA's EFT v11.

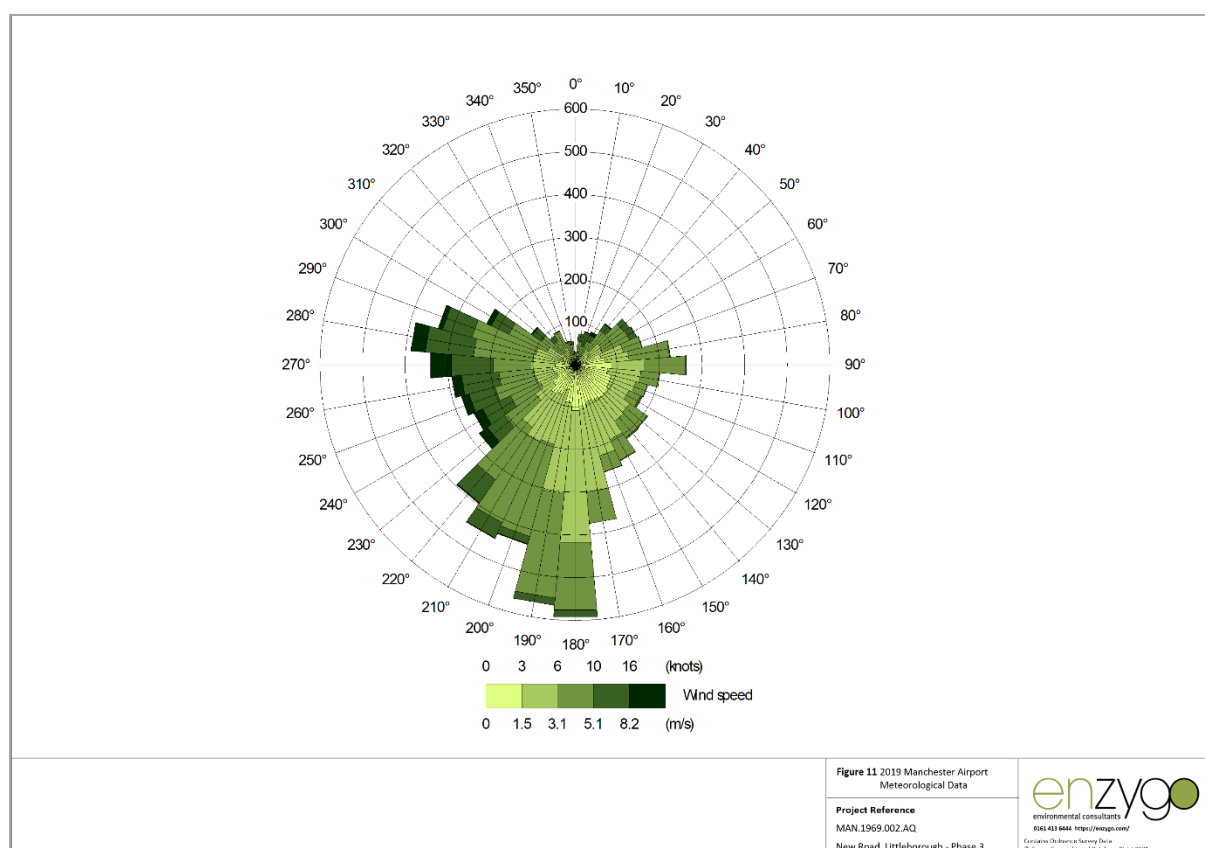
NO_x to NO₂ Conversion

Predicted annual mean NO_x concentrations from the dispersion model were converted to NO₂ concentrations using the NO_x to NO₂ Calculator (v.8.1) provided by DEFRA, which is the method detailed within LAQM (TG16)².

Meteorological Data

Hourly sequential data used in this assessment was obtained from Manchester Airport meteorological station, located 25 km northeast of the Proposed Development at the approximate NGR: 381745, 383960. Reference should be made to for the meteorological wind rose.

Figure 11 – Wind Rose



All meteorological data used in the assessment was provided by ADM Ltd.

Roughness Length

The specific roughness length (z_0) values specified with ADMS-5 are summarised in Table B3.

Table A3: Roughness Lengths

Scenario	Roughness Length (m)	ADMS Description
Verification, DM and DS Scenarios	0.5	Parkland, open suburbia
Manchester Airport Met Station	0.3	Agricultural areas (max)

Both the Proposed Development and meteorological station are located within rural locations and surrounded by agricultural fields. Given the surrounding area is void of significant building structures, which could increase turbulence, a value of between 0.3 – 0.5m is considered appropriate for the morphology of the assessment area.

Monin-Obukhov Length

The Monin-Obukhov length values are summarised in Table B4.

Table A4: Monin-Obukhov Lengths

Scenario	Monin-Obukhov Length (m)	ADMS Description
Verification, DM and DS Scenarios	10	Small towns (<50,000)
Manchester Airport Met Station	30	Mixed urban, industrial

The application of Monin-Obukhov values considers the effect of heat production in populated areas which will influence atmospheric stability. The context of both the Proposed Development and meteorological site suggest a stable conditions and a value of between 10-30 is deemed appropriate.

Background Concentrations

Table B5 displays the specific background concentrations as predicted by DEFRA, utilised to represent the condition at the monitoring locations used within the verification process.

Table A5: Predicted Background Pollutant Concentrations for Monitoring Locations

Monitoring Location	DEFRA Grid Square	Pollutant	2019 Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)
RO12, RO13, RO28	392500, 415500	NO _x	16.73
		NO ₂	12.48

Table B6 displays the predicted background concentrations by DEFRA used in the operational phase assessment for the sensitive receptor locations.

Table A6: Predicted Background Pollutant Concentrations at Sensitive Receptors

Receptor Location	DEFRA Grid Square	Pollutant	2025 Predicted Background Concentration ($\mu\text{g}/\text{m}^3$)
R5 and R6	391500, 415500	NO _x	13.54
		NO ₂	10.29
		PM ₁₀	10.30
		PM _{2.5}	6.92
R4, R7 and R13 -R14	392500, 415500	NO _x	12.97
		NO ₂	9.88
		PM ₁₀	10.04
		PM _{2.5}	6.72
R1 -R3 & R8	392500, 416500	NO _x	11.37
		NO ₂	8.76
		PM ₁₀	9.52
		PM _{2.5}	6.39
R9 – R12	393500, 416500	NO _x	14.85
		NO ₂	11.16
		PM ₁₀	10.25
		PM _{2.5}	6.88

Similar to emission factors, background concentrations for 2025 were used to represent predicted background concentrations during the future year operation scenarios.

Verification

The predicted results from a dispersion model may differ from measured concentrations for many reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;

- Variations in meteorological conditions;
- Overall model limitations; and
- Uncertainties associated with monitoring data, including locations.

Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

For the purpose of this assessment model verification was undertaken for 2019, using traffic data, meteorological data and monitoring results from this year. DEFRA guidance LAQM (TG16)² advises that the initial verification should consider the performance of the model in predicting road sourced NO_x.

RMBC undertakes periodic monitoring of NO₂ concentrations at three roadside diffusion tubes within the assessment extents which are representative of the local road network. Table A7 shows the initial comparison of monitored and predicted annual mean road NO_x concentrations within the first verification area.

Table A7: NO_x Results

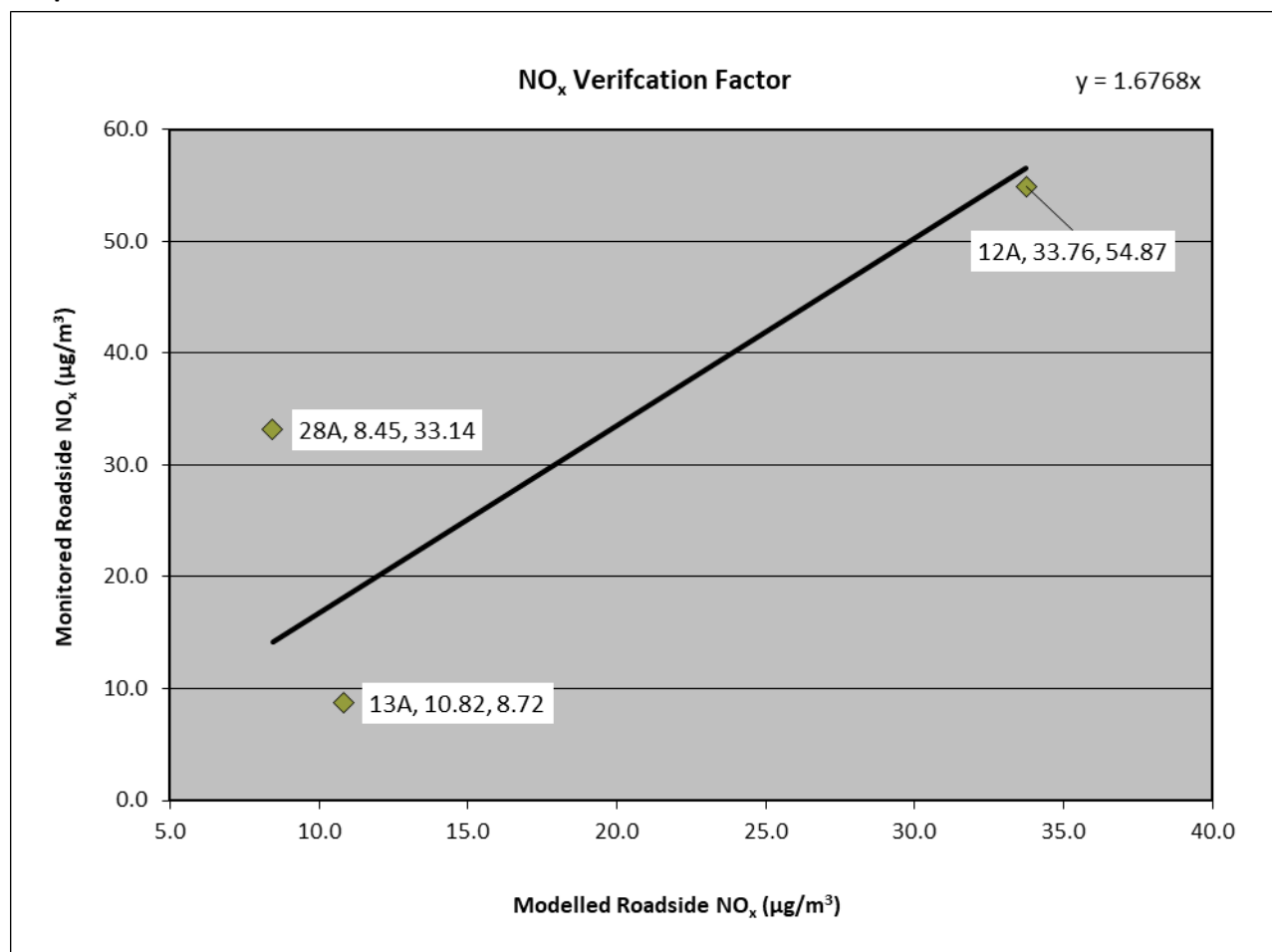
Site ID	Monitored Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)	% Difference ((Modelled – Monitored)/Monitored) * 100
RO12A	54.87	33.76	-38%
RO13A	8.72	10.82	24%
RO28A	33.14	8.45	-75%

The modelled NO_x results show underpredictions which are greater than the 25% threshold specified with LAQM (TG16)². The model was therefore adjusted as far as reasonably practical including adjustments to average speeds and slow down sections.

Following adjustments to the modelling inputs the monitored and modelled NO_x Road contribution concentrations were graphed and the equation of the trend line based on the linear progression through zero was calculated, as shown in Graph 1 below.

This indicated that a verification factor of **1.6768** is to be applied to all receptor locations. Graph 1 is provided below.

Graph 1 – Modelled and Monitored NO_x Road Contributions



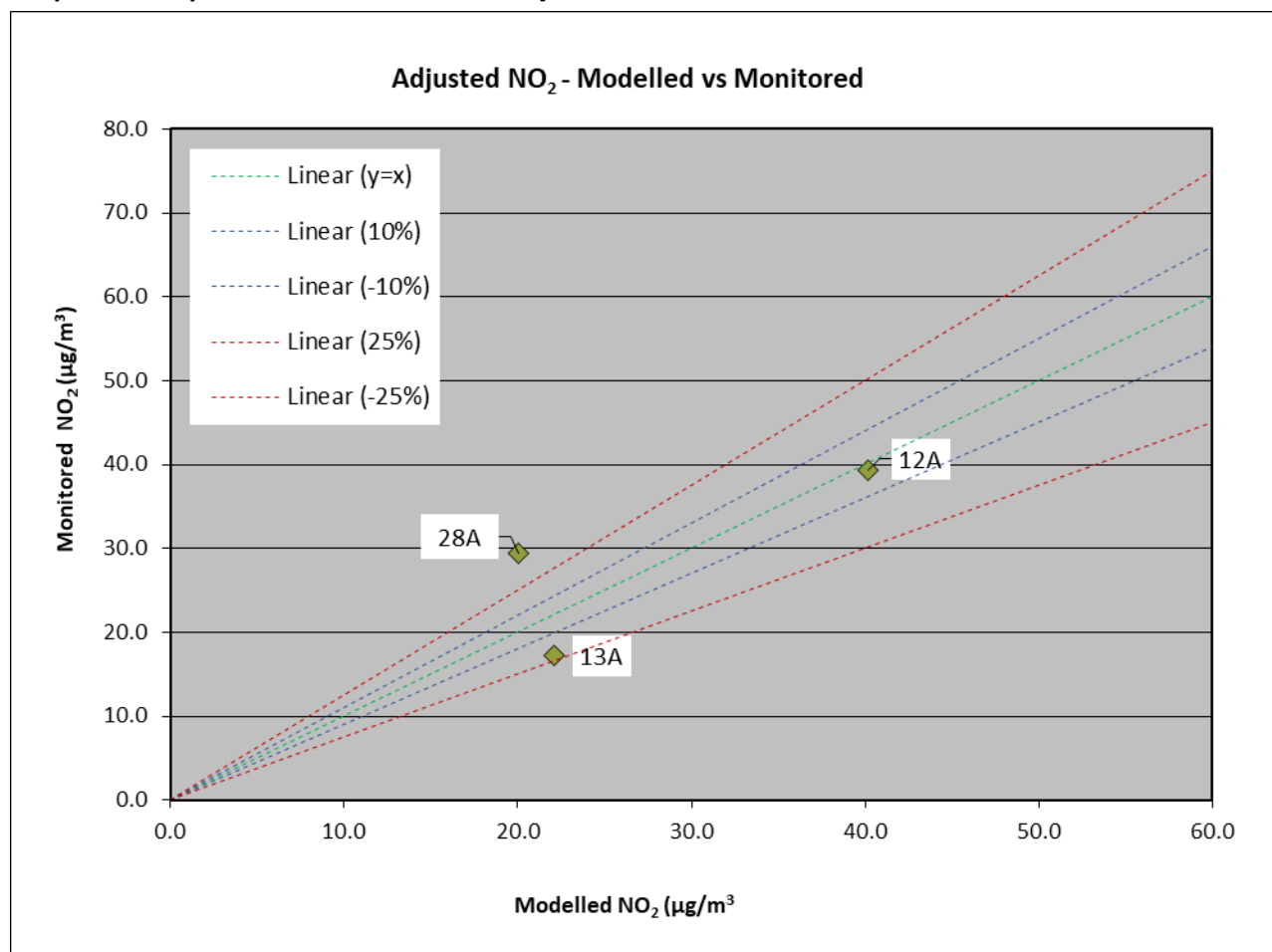
The adjustment factor of **1.6768** was applied to the modelled road NO_x contributions with results presented in Table A8.

Table A8: Adjusted Modelled and Monitored NO₂ Concentrations

Site ID	Monitored NO ₂ Concentration (µg/m³)	Adjusted Modelled NO ₂ Concentration (µg/m³)	% Difference ((Modelled – Monitored)/Monitored) * 100
WF29	39.40	40.15	2%
WF44	17.20	22.10	28%
WF48	29.50	20.06	-32%

A graphical representation of the adjusted NO₂ concentrations is provided within Graph 2.

Graph 2 – Comparison of Monitored and Adjusted Modelled NO₂ Concentrations



As demonstrated in Table A8 and Graph 2, the percentage difference between modelled and monitored concentrations following adjustment is less than 25% at all locations. The adjustments also provide an acceptable Root Mean Squared Error (RMSE) value of 6.16 which adheres to the guidance in LAQM TG(16)² and suggests no further adjustment is necessary.

Additional methods for determining model uncertainty are provided below in accordance with Box 7.20 of LAQM (TG16)². This includes correlation coefficient; root mean square error and fractional bias.

Table A9: Modelled Uncertainty

Method	Calculated Value	Ideal Value
Correlation Coefficient	0.78	1.00
Root Mean Square Error	6.16 (15.39%)	0.0 (<25%)
Fractional Bias	0.05	0.0

The modelled uncertainty detailed in Table A9 provides favourable values which adhere to the guidance provided in LAQM (TG16)² and suggest further post adjustment is unnecessary.

As PM monitoring is not undertaken within the assessment extents, the NO_x adjustment factors detailed above were utilised to adjust model predictions of PM in accordance with the guidance provided within LAQM (TG16)².

10.0 Appendix B - Assessment Results

Predicted Concentrations at Sensitive Receptors

Nitrogen Dioxide (NO₂)

Annual mean NO₂ concentrations were predicted for 2025 DM and DS scenarios and are summarised in Table B1. Reference should be made to Figure 4 for a graphical representation of these locations.

Table B1 Predicted Annual Mean NO₂ Concentrations

Potential Impact		Predicted Annual Mean NO ₂ Concentration (µg/m ³)			% Change in Concentration Relative to AQO	Significance of Impact
		DM	DS	Change		
R1	5 New Road	13.15	13.36	0.21	0.52	Negligible
R2	8 New Road	17.46	17.73	0.27	0.67	Negligible
R3	26 New Road	19.17	19.49	0.32	0.80	Negligible
R4	111 New Road	14.79	14.92	0.13	0.33	Negligible
R5	703 Halifax Road	27.91	28.22	0.31	0.77	Negligible
R6	622 Halifax Road	16.46	16.59	0.13	0.32	Negligible
R7	748 Halifax Road	18.56	18.71	0.15	0.38	Negligible
R8	161 Featherstall Road	12.81	12.94	0.13	0.32	Negligible
R9	St Mary's RC Primary School	13.58	13.65	0.07	0.18	Negligible
R10	Tinkerbelle Nursery	13.39	13.45	0.06	0.15	Negligible
R11	2 Duke Street	19.90	20.13	0.23	0.58	Negligible
R12	105 Church Street	14.65	14.75	0.10	0.25	Negligible
R13	136 New Road	20.61	20.88	0.27	0.67	Negligible
R14	763 Halifax Road	21.03	21.24	0.21	0.52	Negligible

As indicated in Table B1, annual mean NO₂ concentrations were below the relevant AQO at all receptor locations considered and predicted impacts as a result of road vehicle exhaust emissions associated with the development were predicted to be negligible at all receptor locations.

It is therefore considered that the overall impacts as a result of the proposed development are not significant. Further justifications are discussed in Section 5.2 of the main report.

Particulate Matter (PM₁₀)

Annual mean PM₁₀ concentrations were predicted for 2025 DM and DS scenarios and are summarised in Table B2.

Table B2 Predicted Annual Mean PM₁₀ Concentrations

Potential Impact		Predicted Annual Mean NO ₂ Concentration (µg/m ³)			% Change in Concentration Relative to AQO	Significance of Impact
		DM	DS	Change		
R1	5 New Road	11.02	11.09	0.07	0.18	Negligible
R2	8 New Road	12.65	12.75	0.10	0.25	Negligible
R3	26 New Road	12.72	12.82	0.10	0.25	Negligible
R4	111 New Road	11.47	11.51	0.04	0.10	Negligible

Potential Impact		Predicted Annual Mean NO ₂ Concentration (µg/m ³)			% Change in Concentration Relative to AQO	Significance of Impact
		DM	DS	Change		
R5	703 Halifax Road	14.63	14.71	0.08	0.20	Negligible
R6	622 Halifax Road	12.11	12.15	0.04	0.10	Negligible
R7	748 Halifax Road	12.18	12.22	0.04	0.10	Negligible
R8	161 Featherstall Road	10.95	10.99	0.04	0.10	Negligible
R9	St Mary's RC Primary School	11.12	11.14	0.02	0.05	Negligible
R10	Tinkerbelle Nursery	11.04	11.07	0.03	0.08	Negligible
R11	2 Duke Street	13.47	13.55	0.08	0.20	Negligible
R12	105 Church Street	11.51	11.54	0.03	0.07	Negligible
R13	136 New Road	13.19	13.27	0.08	0.20	Negligible
R14	763 Halifax Road	13.31	13.37	0.06	0.15	Negligible

As indicated in Table B2 annual mean PM₁₀ concentrations were below the relevant AQO at all receptor locations considered and predicted impacts as a result of road vehicle exhaust emissions associated with the development are predicted to be negligible at all receptor locations.

It is therefore considered that the overall impacts as a result of the Proposed Development are not significant. Further justifications are discussed in Section 5.2 of the main report.

Particulate Matter (PM_{2.5})

Annual mean PM_{2.5} concentrations were predicted for 2025 DM and DS scenarios and are summarised Table B3.

Table B3 Predicted Annual Mean PM_{2.5} Concentrations

Potential Impact		Predicted Annual Mean NO ₂ Concentration (µg/m ³)			% Change in Concentration Relative to AQO	Significance of Impact
		DM	DS	Change		
R1	5 New Road	7.22	7.26	0.04	0.16	Negligible
R2	8 New Road	8.12	8.18	0.06	0.24	Negligible
R3	26 New Road	8.18	8.24	0.06	0.24	Negligible
R4	111 New Road	7.52	7.54	0.02	0.08	Negligible
R5	703 Halifax Road	9.39	9.44	0.05	0.20	Negligible
R6	622 Halifax Road	7.94	7.96	0.02	0.08	Negligible
R7	748 Halifax Road	7.93	7.95	0.02	0.08	Negligible
R8	161 Featherstall Road	7.18	7.20	0.02	0.08	Negligible
R9	St Mary's RC Primary School	7.36	7.37	0.01	0.04	Negligible
R10	Tinkerbelle Nursery	7.32	7.33	0.01	0.04	Negligible
R11	2 Duke Street	8.66	8.71	0.05	0.20	Negligible
R12	105 Church Street	7.57	7.59	0.02	0.08	Negligible
R13	136 New Road	8.48	8.53	0.05	0.20	Negligible
R14	763 Halifax Road	8.55	8.59	0.04	0.16	Negligible

As indicated in Table B3 annual mean PM_{2.5} concentrations were below the relevant AQO at all receptor locations considered and predicted impacts as a result of road vehicle exhaust emissions associated with the development in combination of the consented phases are predicted to be negligible at all receptor locations.

It is therefore considered that the overall impacts as a result of the Proposed Development are not significant. Further justifications are discussed in Section 5.2 and Table 12.

11.0 Appendix C – IAQM Construction Phase Methodology

Construction Phase Methodology

There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the IAQM guidance³. Activities are divided into four types to reflect their different potential impacts. These are:

- Demolition
- Earthworks;
- Construction; and
- Trackout.

The potential for dust emissions was assessed for each activity that is likely to take place and considered three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors; and
- The risk of health effects due to a significant increase in exposure to PM₁₀ and PM_{2.5}.

The assessment steps are detailed below.

Step 1

Step 1 screened the requirement for a more detailed assessment. Should human receptors be identified within 350m from the site boundary or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should proceed to Step 2. Additionally, should ecological receptors be identified within 50m of the boundary site or 50m from the construction vehicle route up to 500m from the site entrance, then the assessment should also proceed to Step 2.

Should sensitive receptors not be present within the relevant distances then negligible impacts would be expected and further assessment is not necessary.

Step 2

Step 2 assessed the risk of potential dust impacts. A site was allocated to a risk category based on two factors:

- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and
- The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).

The two factors were combined in Step 2C to determine the risk of dust impacts without mitigation applied. Step 2A defined the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table C4.

Table C4: Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Demolition	- Total building volume greater than 50,000m³ - Potentially dusty construction material (e.g. concrete) - On-site crushing and screening - Demolition activities greater than 20m above ground level
	Earthworks	- Total site area greater than 10,000m² - 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 100,000m³ - 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	- Total building volume 20,000m³ to 50,000m³ - Potentially dusty construction material - Demolition activities 10m to 20m above ground level
	Earthworks	- Total site area 2,500m² to 10,000m² - Moderately dusty soil type (e.g. silt) 5 to 10 heavy earth moving vehicles active at any one time - Formation of bunds 4m to 8m in height - Total material moved 20,000 tonnes to 100,000 tonnes
	Construction	- Total building volume 25,000m³ to 100,000m³ - 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	- Total building volume under 20,000m³ - Construction material with low potential for dust release (e.g. metal cladding or timber) - Demolition activities less than 10m above ground level - Demolition during wetter months
	Earthworks	- Total site area less than 2,500m² - 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 25,000m³ - Construction material with low potential for dust release (e.g. metal cladding or timber)

Magnitude	Activity	Criteria
	Trackout	<10 HDV (3.5t) outward movements in any one day - Surface material with low potential for dust release - Unpaved road length <50m

Step 2B defined the sensitivity of the area around the development site for construction, earthworks and trackout. The factors influencing the sensitivity of the area are shown in Table C5.

Table C5: Examples of Factors Defining Sensitivity of an Area

Sensitivity	Receptors	
	Human	Ecological
High	- Users expect of high levels of amenity - High aesthetic or value property - People expected to be present continuously for extended periods of time - Locations where members of the public are exposed over a time period relevant to the AQO for PM₁₀ e.g. residential properties, hospitals, schools and residential care homes	Internationally or nationally designated site e.g. Special Area of Conservation
Medium	- Users would expect to enjoy a reasonable level of amenity - Aesthetics or value of their property could be diminished by soiling - People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work	Nationally designated site e.g. Sites of Special Scientific Interest
Low	- Enjoyment of amenity would not reasonably be expected - Property would not be expected to be diminished in appearance - Transient exposure, where people would only be expected to be present for limited periods. e.g. public footpaths, playing fields, shopping streets, playing fields, farmland, footpaths, short term car park and roads	Locally designated site e.g. Local Nature Reserve

The sensitivity of the area to dust soiling effects on people and property is shown in Table C6.

Table C6: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		Less than 20	Less than 50	Less than 100	Less than 350
High	More than 100	High	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium	More than 1	Medium	Low	Low	Low
Low	More than 1	Low	Low	Low	Low

Table C7 outlines the sensitivity of the area to human health impacts.

Table C7: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from the Source (m)				
			Less than 20	Less than 50	Less than 100	Less than 200	Less than 350
High	Greater than 32µg/m ³	More than 100	High	High	High	Medium	Low
		10 - 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32µg/m ³	More than 100	High	High	Medium	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28µg/m ³	More than 100	High	Medium	Low	Low	Low
		10 - 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	Less than 24µg/m ³	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
	Less than 24µg/m ³	More than 100	Medium	Low	Low	Low	Low
		10 - 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	Greater than 32µg/m ³	More than 10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28 - 32µg/m ³	More than 10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24 - 28µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	Less than 24µg/m ³	More than 10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	More than 1	Low	Low	Low	Low	Low

Table C8 outlines the sensitivity of the area to ecological impacts.

Table C8: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Source (m)	
	Less than 20	Less than 50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C combined the dust emission magnitude with the sensitivity of the area to determine the risk of unmitigated impacts.

Table C9 outlines the risk category from demolition activities.

Table C9: Dust Risk Category from Demolition

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table C10 outlines the risk category from earthworks and construction activities.

Table C10: Dust Risk Category from Earthworks and Construction

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table C11 outlines the risk category from trackout.

Table C11: Dust Risk Category from Trackout

Receptor Sensitivity	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

Step 3

Step 3 required the identification of site-specific mitigation measures within the IAQM guidance to reduce potential dust impacts based upon the relevant risk categories identified in Step 2. For sites with negligible risk mitigation measures beyond those required by legislation were not required. However, additional controls may be applied as part of good practice.

Step 4

Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step was to determine the significance of any residual impacts. For almost all

construction activity, the aim should be to control effects using effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be not significant.



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