Air Quality Assessment

Lindley Moor Road, Lindley

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Executive Summary

Redmore Environmental Ltd was commissioned by 2SH Developments to undertake an Air Quality Assessment in support of a mixed-use development on land off Lindley Moor Road, Lindley.

The development may lead to adverse air quality effects at sensitive locations during the construction and operational phases. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and assess potential impacts as a result of the scheme.

Potential construction phase air quality impacts from fugitive dust emissions were assessed as a result of earthworks, construction and trackout activities. It is considered that the use of identified site-specific control measures would provide suitable mitigation for a development of this size and nature and reduce potential impacts to an acceptable level.

Potential impacts during the operational phase of the proposals may occur due to road traffic exhaust emissions associated with vehicles travelling to and from the site. Dispersion modelling was therefore undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the highway network both with and without the development in place. Results were subsequently verified using local monitoring data.

Review of the dispersion modelling results indicated that air quality impacts as a result of traffic generated by the development were not predicted to be significant at any sensitive location in the vicinity of the site.

Consideration was made to the West Yorkshire air quality technical guidance in order to determine the scale of the scheme and associated requirement for mitigation. Measures for inclusion in the development can be conditioned by the Local Authority if required.

Based on the assessment results, air quality factors are not considered a constraint to the development.

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1.0 INTRODUCTION

1.1 Background

1.1.1 Redmore Environmental Ltd was commissioned by 2SH Developments to undertake an Air Quality Assessment in support of a mixed-use development on land off Lindley Moor Road, Lindley.

1.1.2 The development may lead to adverse air quality effects at sensitive locations during the construction and operational phases. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and assess potential impacts as a result of the scheme.

1.2 Site Location and Context

1.2.1 The site is located on land off Lindley Moor Road, Lindley, at approximate National Grid Reference (NGR): 410892, 419008. Reference should be made to Figure 1 for a map of the site and surrounding area.

1.2.3 The proposals comprise the construction of 15 units covering land use classes B2, B8, E(b) and E(g) along with associated infrastructure. The proposed layout concentrates the retail and leisure uses in the northern part of the site with the industrial development in the southern part, separated by an internal access road.

1.2.4 The development has the potential to cause air quality impacts at sensitive locations. These may include fugitive dust emissions associated with construction works and road traffic exhaust emissions from vehicles travelling to and from the site during the operational phase. An Air Quality Assessment was therefore undertaken in order to determine baseline conditions and assess potential effects as a result of the proposals. This is detailed in the following report.

2.0 LEGISLATION AND POLICY

2.1 Legislation

2.1.1 The Air Quality Standards Regulations (2010) and subsequent amendments include Air Quality Limit Values (AQLVs) for the following pollutants:

- Nitrogen dioxide (NO_2);
- Sulphur dioxide;
- Lead;
- Particulate matter with an aerodynamic diameter of less than 10µm (PM_{10});
- Particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$);
- Benzene; and,
- Carbon monoxide.

2.1.2 Air Quality Target Values (AQTVs) were also provided for several additional pollutants. It should be noted that the Interim Target for $PM_{2.5}$ stated in the Air Quality Standards Regulations (2010) was amended in the Environment (Miscellaneous Amendments) (EU Exit) Regulations (2020).

2.1.3 The Air Quality Strategy (AQS) was produced by the Department for Environment, Food and Rural Affairs (DEFRA) and published on 28th April 2023[1]. The document contains standards, objectives and measures for improving ambient air quality, including a number of Air Quality Objectives (AQOs). These are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedences over a specified timescale. These are generally in line with the Interim Targets, although the requirements for the determination of compliance vary.

2.1.4 The Environmental Improvement Plan 2023[2] was published in January 2023, providing long term and Interim Targets in order to reduce population exposure to $PM_{2.5}$. The concentration target for 2040 was subsequently adopted in the Environmental Targets (Fine Particulate Matter) (England) Regulations (2023).

[1] AQS: Framework for Local Authority Delivery, DEFRA, 2007.

[2] Environmental Improvement Plan 2023, DEFRA, 2023.

2.1.5 Table 1 presents the AQOs and Interim Target for pollutants considered within this assessment.

Table 1 Air Quality Objectives/Interim Target

Pollutant	Air Quality Objective/Interim Target	
	Concentration (µg/m³)	Averaging Period
NO_2	40	Annual mean
	200	1-hour mean, not to be exceeded on more than 18 occasions per annum
PM_{10}	40	Annual mean
	50	24-hour mean, not to be exceeded on more than 35 occasions per annum
$PM_{2.5}$	12(a)	Annual mean

Note: (a) Interim Target to be achieved by end of January 2028.

2.1.6 Table 2 summarises the advice provided in DEFRA guidance[3] on where the AQOs for pollutants considered within this report apply.

Table 2 Examples of Where the Air Quality Objectives Apply

Averaging Period	Objective Should Apply At	Objective 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 façades of offices or other places of work where members of the public do not have regular access Hotels, unless people live there as their permanent residence Gardens of residential properties Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
24-hour mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term

3 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. 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

2.2 WHO Guidelines

2.2.1 The World Health Organisation (WHO) provides Air Quality Guideline (AQG) levels for health-harmful concentrations of key air pollutants both outdoors and inside buildings and homes, based on global synthesis of scientific evidence. These are often utilised by national and international governing bodies when determining appropriate air quality standards for inclusion in relevant legislation. For example, the WHO guidelines were used to inform the AQLVs and AQTVs stated within European Union Directive 2008/50/EC.

2.2.2 The WHO Global AQG[4] provides recommended limits for NO_2, PM_{10} and $PM_{2.5}$. These are summarised in Table 3.

Table 3 WHO AQGs

Pollutant	WHO Guideline Levels	
	Concentration (µg/m³)	Averaging Period
NO_2	10	Annual mean
PM_{10}	15	Annual mean
$PM_{2.5}$	5	Annual mean

2.2.3 It should be noted that the WHO values are guidelines only and there is no legislative or planning requirement to consider these criteria within the UK. As such, when determining

[4] WHO Global Air Quality Guidelines, WHO, 2021.

the potential for air quality impacts at sensitive receptor locations, the assessment predictions were compared with the relevant AQOs and Interim Targets stated within UK Legislation, rather than the WHO guideline levels.

2.3 Local Air Quality Management

2.3.1 Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of Local Air Quality Management (LAQM). This review and assessment of air quality involves comparing present and likely future pollutant concentrations against the AQOs. If it is predicted that levels at locations of relevant exposure, as summarised in Table 2, are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 Dust

2.4.1 The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2016) and subsequent amendments, such as construction sites, is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines nuisance as:

> "any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance."

2.4.2 Enforcement of the Act, in regard to nuisance, is currently under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). The only defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to best practicable means.

2.5 National Planning Policy

2.5.1 The revised National Planning Policy Framework[5] (NPPF) was published in December 2023 and sets out the Government's planning policies for England and how these are expected to be applied.

2.5.2 The purpose of the planning system is to contribute to the achievement of sustainable development. In order to ensure this, the NPPF recognises three overarching objectives including the following of relevance to air quality:

> "c) an environmental objective - to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy."

2.5.3 Chapter 15 of the NPPF details objectives in relation to conserving and enhancing the natural environment. It states that:

> "Planning policies and decisions should contribute to and enhance the natural and local environment by:
>
> […]
>
> e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality […]."

2.5.4 The NPPF specifically recognises air quality as part of delivering sustainable development and states that:

5 NPPF, Ministry of Housing, Communities and Local Government, 2023.

> "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."

2.5.5 The implications of the NPPF have been considered throughout this assessment.

2.6 National Planning Practice Guidance

2.6.1 The National Planning Practice Guidance[6] (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 and updated on 1st November 2019 to support the NPPF and make it more accessible. The air quality pages are summarised under the following headings:

1. What air quality considerations does planning need to address?
2. What is the role of plan-making with regard to air quality?
3. Are air quality concerns relevant to neighbourhood planning?
4. What information is available about air quality?
5. When could air quality considerations be relevant to the development management process?
6. What specific issues may need to be considered when assessing air quality impacts?
7. How detailed does an air quality assessment need to be?
8. How can an impact on air quality be mitigated?

2.6.2 These were reviewed and the relevant guidance considered as necessary throughout the undertaking of this assessment.

[6] https://www.gov.uk/guidance/air-quality--3.

2.7 Local Planning Policy

2.7.1 The Kirklees Local Plan[7] (KLP) was adopted by Kirklees Council (KC) on 27th February 2019. The KLP sets out the spatial vision and strategy for the development of Kirklees for the period up to 2031 and is used to guide decisions on planning, development and regeneration.

2.7.2 A review of the KLP indicated the following policies in relation to air quality that are relevant to this assessment:

> "Policy LP 47 - Healthy, active and safe lifestyles
>
> The council will, with its partners, create an environment which supports healthy, active and safe communities and reduces inequality.
> Healthy, active and safe lifestyles will be enabled by:
>
> […]
>
> g. ensuring that the current air quality in the district is monitored and maintained and, where required, appropriate mitigation measures included as part of new development proposals; […]"
>
> "Policy LP 51 - Protection and improvement of local air quality
>
> 1. Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air pollution which would unacceptably affect or cause a nuisance to the national or build environment or to people.
>
> 2. Proposals that have the potential to increase local air pollution either individually or cumulatively must be accompanied by evidence to show that the impact of the development has been assessed in accordance with the relevant guidance. Development which has the potential to cause levels of local air pollution to increase to unsafe levels must incorporate sustainable mitigation

[7] KLP, KC, 2019.

measures that reduce this impact to a safe level. If sustainable measures cannot be introduced the development will not be permitted.

3. Where the development introduces new receptors into Air Quality Management Areas or Areas of Concern or near other areas of relatively poor air quality, for example near roads or junctions, the development must incorporate sustainable mitigation measures that protect the new receptors from unacceptable levels of air pollution. Where sustainable mitigation measures cannot be introduced which prevent receptors from being exposed to unsafe levels of air pollution, development will not be permitted."

2.7.3 The above policies were taken into consideration throughout the undertaking of the assessment.

3.0 METHODOLOGY

3.1 Introduction

3.1.1 The proposed development has the potential to cause air quality impacts during the construction and operational phases. These have been assessed in accordance with the following methodology, which is based on the 'Air Quality and Emissions: Technical Planning Guidance'[8] produced by KC.

3.2 Construction Phase Assessment

3.2.1 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 Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction V2.2'[9].

3.2.2 Activities on the proposed construction site have been divided into three types to reflect their different potential impacts. These are:

- Earthworks;
- Construction; and,
- Trackout.

3.2.3 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 PM_{10}.

3.2.4 The assessment steps are detailed below.

[8] Air Quality and Emissions: Technical Planning Guidance, West Yorkshire Low Emissions Group.

[9] Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

Step 1

3.2.5 Step 1 screens the requirement for a more detailed assessment. Should human receptors be identified within 250m from the boundary or 50m from the construction vehicle route up to 250m from the site entrance, then the assessment proceeds to Step 2. Additionally, should ecological receptors be identified within 50m of the site or the construction vehicle route up to 250m from the site entrance, then the assessment also proceeds to Step 2.

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

Step 2

3.2.7 Step 2 assesses the risk of potential dust impacts. A site is allocated 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).

3.2.8 The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.

3.2.9 Step 2A defines the potential magnitude of dust emission through the construction phase. The relevant criteria are summarised in Table 4.

Table 4 Construction Dust - Magnitude of Emission

Magnitude	Activity	Criteria
Large	Earthworks	• Total site area greater than 110,000m^2 • Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) • More than 10 heavy earth moving vehicles active at any one time • Formation of bunds greater than 6m in height

Magnitude	Activity	Criteria
	Construction	• Total building volume greater than 75,000m^3 • On site concrete batching • Sandblasting
	Trackout	• More than 50 Heavy Duty Vehicle (HDV) trips per day • Potentially dusty surface material (e.g. high clay content) • Unpaved road length greater than 100m
Medium	Earthworks	• Total site area 18,000m^2 to 110,000m^2 • Moderately dusty soil type (e.g. silt) • 5 to 10 heavy earth moving vehicles active at any one time • Formation of bunds 3m to 6m in height
	Construction	• Total building volume 12,000m^3 to 75,000m^3 • Potentially dusty construction material (e.g. concrete) • On site concrete batching
	Trackout	• 20 to 50 HDV trips per day • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50m to 100m
Small	Earthworks	• Total site area less than 18,000m^2 • Soil type with large grain size (e.g. sand) • Less than 5 heavy earth moving vehicles active at any one time • Formation of bunds less than 3m in height
	Construction	• Total building volume less than 12,000m^3 • Construction material with low potential for dust release (e.g. metal cladding or timber)
	Trackout	• Less than 20 HDV trips per day • Surface material with low potential for dust release • Unpaved road length less than 50m

3.2.10 Step 2B defines the sensitivity of the area around the development to potential dust impacts. The influencing factors are shown in Table 5.

Table 5 Construction Dust - Examples of Factors Defining Sensitivity of an Area

Receptor Sensitivity	Examples	
	Human Receptors	Ecological Receptors
High	• Users expect 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 PM_{10}. 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, farmland, short term car parks and roads	• Locally designated site e.g. Local Nature Reserve

3.2.11 The guidance also provides the following factors to consider when determining the sensitivity of an area to potential dust impacts:

- Any history of dust generating activities in the area;
- The likelihood of concurrent dust generating activity on nearby sites;
- Any pre-existing screening between the source and receptors;
- Any conclusions drawn from analysing local meteorological data which accurately represent the area; and if relevant the season during which works will take place;
- Any conclusions drawn from local topography;
- Duration of the potential impact, as a receptor may become more sensitive over time; and,

- Any known specific receptor sensitivities which go beyond the classifications given in the document.

3.2.12 These factors were considered in the undertaking of this assessment.

3.2.13 The criteria for determining the sensitivity of the area to dust soiling effects on people and property is summarised in Table 6.

Table 6 Construction Dust - 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 250
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

3.2.14 Table 7 outlines the criteria for determining the sensitivity of the area to human health impacts.

Table 7 Construction Dust - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Background Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)			
			Less than 20	Less than 50	Less than 100	Less than 250
High	Greater than 32µg/m^3	More than 100	High	High	High	Medium
		10 - 100	High	High	Medium	Low
		1 - 10	High	Medium	Low	Low
	28 - 32µg/m^3	More than 100	High	High	Medium	Low
		10 - 100	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low
	24 - 28µg/m^3	More than 100	High	Medium	Low	Low

Receptor Sensitivity	Background Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)			
			Less than 20	Less than 50	Less than 100	Less than 250
		10 - 100	High	Medium	Low	Low
		1 - 10	Medium	Low	Low	Low
	Less than 24µg/m³	More than 100	Medium	Low	Low	Low
		10 - 100	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low
Medium	Greater than 32µg/m³	More than 10	High	Medium	Low	Low
		1 - 10	Medium	Low	Low	Low
	28 - 32µg/m³	More than 10	Medium	Low	Low	Low
		1 - 10	Low	Low	Low	Low
	24 - 28µg/m³	More than 10	Low	Low	Low	Low
		1 -10	Low	Low	Low	Low
	Less than 24µg/m³	More than 10	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low
Low	-	1 or more	Low	Low	Low	Low

3.2.15 Table 8 outlines the criteria for determining the sensitivity of the area to ecological impacts.

Table 8 Construction Dust - 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

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

3.2.17 Table 9 outlines the risk category from earthworks, construction and trackout activities.

Table 9 Construction Dust - Dust Risk Category from Earthworks, Construction and Trackout Activities

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

Step 3

3.2.18 Step 3 requires the identification of site specific mitigation measures within the IAQM guidance[10] 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 are not required. However, additional controls may be applied as part of good practice.

Step 4

3.2.19 Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be **not significant**.

3.2.20 The determination of significance relies on professional judgement and reasoning should be provided as far as practicable. The IAQM guidance suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix 2.

[10] Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

3.3 Operational Phase Assessment

3.3.1 The development has the potential to affect existing air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the site. Potential impacts have therefore been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling for the following scenarios:

- 2022 - Verification;
- Assessment year Do-Minimum (DM) (predicted traffic flows in 2026 should the proposals not proceed); and,
- Assessment year Do-Something (DS) (predicted traffic flows in 2026 should the proposals be completed).

3.3.2 Reference should be made to Appendix 1 for assessment input data and details of the verification process.

3.3.3 Locations sensitive to potential changes in off-site pollutant concentrations were identified within 200m of the highway network in accordance with the guidance provided within the Design Manual for Roads and Bridges (DMRB)[11] on the likely limits of pollutant dispersion from road sources. The criteria provided within DEFRA guidance[12] on where the AQOs apply, as summarised in Table 2, was utilised to determine worst-case receptor positions in the vicinity of links likely to be affected by changes in traffic flows as a result of the development.

3.3.4 The significance of predicted air quality impacts was determined in accordance with the guidance provided within the IAQM document 'Land-Use Planning & Development Control: Planning for Air Quality'[13]. Using this methodology impacts were defined based on the interaction between the predicted pollutant concentration from the DS scenario and the magnitude of change between the DM and DS scenarios, as outlined in Table 10.

11 LA 105 Air Quality, Highways England, 2019.

12 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

13 Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

Table 10 Significance of Road Vehicle Exhaust Emission Impacts

Concentration at Receptor in Assessment Year	Predicted Concentration Change as Proportion of AQO/Interim Target (%)			
	1	2 - 5	6 - 10	> 10
75% or less of AQO/Interim Target	Negligible	Negligible	Slight	Moderate
76 - 94% of AQO/Interim Target	Negligible	Slight	Moderate	Moderate
95 - 102% of AQO/Interim Target	Slight	Moderate	Moderate	Substantial
103 - 109% of AQO/Interim Target	Moderate	Moderate	Substantial	Substantial
110% or more of AQO/Interim Target	Moderate	Substantial	Substantial	Substantial

3.3.5 The matrix shown in Table 10 is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which makes it clearer which cell the impact falls within. It should be noted that changes of 0%, i.e. less than 0.5%, are described as **negligible**.

3.3.6 Following the prediction of impacts at discrete receptor locations, the IAQM document[14] provides guidance on determining the overall air quality impact significance of the operation of a development. The following factors are identified for consideration by the assessor:

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

3.3.7 The IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is **moderate** or **substantial**, the effect is likely to be considered **significant**, whilst if the impact is **slight** or **negligible**, the impact is likely to be considered **not significant**. It should be noted that this is a binary judgement of either it is **significant** or it is **not significant**.

[14] Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

3.3.8 The determination of significance relies on professional judgement and reasoning has been provided as far as practicable. The IAQM guidance[15] suggests the provision of details of the assessor's qualifications and experience. These are provided in Appendix 2.

15 Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

4.0 BASELINE

4.1 Introduction

4.1.1 Existing air quality conditions in the vicinity of the proposed development site were identified in order to provide a baseline for assessment. These are detailed in the following Sections.

4.2 Local Air Quality Management

4.2.1 As required by the Environment Act (1995), KC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean NO_2 and PM_{10} concentrations are above the AQO within the district. Ten AQMAs have therefore been declared. The closest to the site is described as follows:

> "Kirklees AQMA 3: The designated area incorporates Halifax Road (A629), Lindley Moor Road Bradley Road (A643), Warren House Lane and Stirling Wood Close, which is in close proximity to the Ainley Top Roundabout at Birchencliffe."

4.2.2 The development is located approximately 15m west of the AQMA. As such, there is the potential for vehicles travelling to and from the site to increase pollution levels in this sensitive area. This has been considered throughout the assessment.

4.2.3 KC has concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

4.3 Air Quality Monitoring

4.3.1 Monitoring of pollutant concentrations is undertaken by KC throughout their area of jurisdiction. Recent results recorded in the vicinity of the site are shown in Table 11.

Table 11 Monitoring Results - NO_2

Monitoring Site		Monitored NO_2 Concentration (µg/m³)		
		2020	2021	2022
CM3	RS6 - Ainley Top	36.2	-(a)	18.3
K15, K16, K17(b)	Ainley Top 3	29.4	33.8	30.7
K71	Lindley Moor Road 2	22.6	28.8	24.1

Note: (a) Data not available.
(b) Monitor collocated with CM3.

4.3.2 As shown in Table 11, annual mean NO_2 concentrations were below the relevant AQO at all monitoring sites in recent years.

4.3.3 Recent $PM_{2.5}$ results recorded in the vicinity of the development are shown in Table 12.

Table 12 Monitoring Results - $PM_{2.5}$

Monitoring Site		Monitored $PM_{2.5}$ Concentration (µg/m³)		
		2020	2021	2022
CM3	RS6 - Ainley Top	9.3	-(a)	8.9

Note: (a) Data not available.

4.3.4 As shown in Table 12, annual mean $PM_{2.5}$ concentrations were below the Interim Target at the CM3 - RS6 Ainley Top monitoring site in recent years.

4.3.5 Pollutant concentrations during 2020 and 2021 were lower than affected by changes to travel patterns associated with the COVID-19 pandemic. The results should therefore be viewed with caution.

4.3.6 KC do not undertake monitoring of PM_{10} concentrations within the vicinity of the site.

4.3.7 Reference should be made to Figure 2 for a map of the survey positions.

4.4 Background Pollutant Concentrations

4.4.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist LAs in their Review and Assessment of air quality. The proposed development site is located in a number of grid squares. Data for these locations was downloaded from the DEFRA website[16] for the purpose of the assessment and is summarised in Table 13.

Table 13 Background Pollutant Concentration Predictions

NGR (m)	Predicted Background Pollutant Concentration (µg/m³)								
	2022			2024			2026		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
410500, 418500	13.05	12.27	8.03	11.89	12.06	7.87	10.96	11.95	7.78
410500, 419500	13.52	12.43	8.04	12.37	12.22	7.88	11.44	12.11	7.79
411500, 419500	16.99	12.78	8.37	15.33	12.56	8.20	13.97	12.44	8.10

4.4.2 As shown in Table 13, predicted background NO_2, PM_{10} and $PM_{2.5}$ concentrations are below the relevant AQOs and Interim Target at the development site.

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 dust and road vehicle exhaust emission impacts in the following Sections.

Construction Phase Sensitive Receptors

4.5.2 Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 250m from the development boundary. These are summarised in Table 14.

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

Table 14 Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Up to 20	10 - 100	0
Up to 50	10 - 100	0
Up to 100	More than 100	-
Up to 250	More than 100	-

4.5.3 Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 250m of the site access. These are summarised in Table 15.

Table 15 Trackout Dust Sensitive Receptors

Distance from Site Access Route (m)	Approximate Number of Human Receptors	Approximate Number of Ecological Receptors
Up to 20	More than 100	0
Up to 50	More than 100	0

4.5.4 There are no ecological receptors within 50m of the development boundary or the access route within 250m of the site entrance. As such, ecological impacts have not been assessed further within this report.

4.5.5 Based on the criteria shown in Table 4, the sensitivity of the receiving environment to potential dust impacts was determined as a **high**. This was because the identified receptors included residential properties.

4.5.6 The sensitivity of the receiving environment to specific potential dust impacts, based on the criteria shown in Section 3.2, is shown in Table 16.

Table 16 Sensitivity of the Surrounding Area to Potential Dust Impacts

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	High

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Human Health	Low	Low	Medium

Operational Phase Sensitive Receptors

4.5.7 Locations sensitive to potential operational phase road vehicle exhaust emission impacts were identified from a desk-top study and are summarised in Table 17.

Table 17 Operational Phase Road Vehicle Exhaust Emissions Sensitive Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential - Kew Hill Bottom	410836.2	419376.7
R2	Residential - Lindley Moor Road	410980.9	419274.5
R3	Residential - St Albans Avenue	411230.5	419456.2
R4	Residential - New Hey Road	411442.0	419477.9
R5	Residential - Branch Road	411498.8	419605.3
R6	Residential - West Lodge Crescent	411709.7	419666.0
R7	Residential - Marling Road	411561.4	419359.9
R8	Residential - Halifax Road	411670.8	419141.0
R9	Residential - Halifax Road	411716.3	419070.6
R10	Residential - Halifax Road	411749.5	418961.3
R11	Residential - Warren House Lane	411199.0	419241.4
R12	Residential - Lindley Moor Road	411109.4	419283.3
R13	Residential - Lindley Moor Road	410675.1	418990.9
R14	Residential - Stirling Wood Close	410994.1	419156.7
R15	Residential - Weatherhill Road	411235.0	418796.6
R16	Residential - Weatherhill Road	411131.1	419035.1

4.5.8 Reference should be made to Figure 3 for a graphical representation of road vehicle exhaust emission sensitive receptor locations.

5.0 ASSESSMENT

5.1 Introduction

5.1.1 There is the potential for air quality impacts as a result of the construction and operation of the proposed development. These are assessed in the following Sections.

5.2 Construction Phase Assessment

Step 1

5.2.1 The undertaking of activities such as excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul roads and highway surfaces.

5.2.2 The potential for impacts at sensitive locations depends significantly on local meteorology during the undertaking of dust generating activities, with the most significant effects likely to occur during dry and windy conditions.

5.2.3 The desk-study undertaken to inform the baseline identified a number of sensitive receptors within 250m of the site boundary. As such, a detailed assessment of potential dust impacts was required.

Step 2

Earthworks

5.2.4 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as site levelling and landscaping. The proposed development site covers an area between 18,000m^2 and 110,000m^2. In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from earthworks is therefore **medium**.

5.2.5 Table 16 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 14, the development is considered to be a **medium** risk site for dust soiling as a result of earthworks.

5.2.6 Table 16 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 9 the development is considered to be a **low** risk site for human health impacts as a result of earthworks.

Construction

5.2.7 Due to the size of the development, the total building volume is likely to be greater than 75,000m^3. In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from construction is therefore **large**.

5.2.8 Table 16 indicates the sensitivity of the area to dust soiling effects on people and property is **high**. In accordance with the criteria outlined in Table 9, the development is considered to be a **high** risk site for dust soiling as a result of construction activities.

5.2.9 Table 16 indicates the sensitivity of the area to human health impacts is **low**. In accordance with the criteria outlined in Table 9, the development is considered to be a **low** risk site for human health impacts as a result of construction activities.

Trackout

5.2.10 Based on the site area, it is anticipated that the unpaved road length is likely to be greater than 100m during certain stages of construction. In accordance with the criteria outlined in Table 4, the magnitude of potential dust emissions from trackout is therefore **large**.

5.2.11 Table 16 indicates the sensitivity of the area to dust soiling effects to people and property is **high**. In accordance with the criteria outlined in Table 9, the development is considered to be a **high** risk site for dust soiling as a result of trackout activities.

5.2.12 Table 16 indicates the sensitivity of the area to human health impacts is **medium**. In accordance with the criteria outlined in Table 9, the development is considered to be a **medium** risk site for human health impacts as a result of trackout activities.

Summary of the Risk of Dust Effects

5.2.13 A summary of the risk from each dust generating activity is provided in Table 18.

Table 18 Summary of Potential Unmitigated Dust Risks During Construction

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

5.2.14 As indicated in Table 18, the potential risk of dust soiling is **high** from construction and trackout and **medium** from earthworks. The potential risk of human health impacts is **medium** from trackout and **low** from earthworks and construction.

5.2.15 It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the site boundary closest to each sensitive area. Therefore, actual risk is likely to be lower than that predicted during the majority of the construction phase.

Step 3

5.2.16 The IAQM guidance[17] provides potential mitigation measures to reduce impacts as a result of fugitive dust emissions during the construction phase. These have been adapted for the development site as summarised in Table 19. These may be reviewed prior to the commencement of construction works and incorporated into a Construction Environmental Management Plan or similar if required by the LA.

17 Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

Table 19 Fugitive Dust Emission Mitigation Measures

Issue	Control Measure
Communications	• Develop and implement a stakeholder communications plan that includes community engagement before work commences on site • Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager • Display the head or regional office contact information • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LA
Site management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken • Make the complaints log available to the LA upon request • Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book • Hold regular liaison meetings with other high risk construction sites within 250m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised
Monitoring	• Undertake daily on-site and off-site inspection to monitor dust, record inspection results, and make the log available to the LA upon request • Carry out regular site inspections, record inspection results, and make an inspection log available to the LA upon request • Increase the frequency of site inspections when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Site preparation	• Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible • Fully enclose site or specific operations where there is a high potential for dust production and they are active for an extensive period • Avoid site runoff of water or mud • Keep site fencing, barriers and scaffolding clean using wet methods • Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used • Cover, seed or fence stockpiles to prevent wind whipping
Operating vehicle/machinery and sustainable travel	• Ensure all vehicles switch off engines when stationary - no idling vehicles • Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable

Issue	Control Measure
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques • Ensure an adequate water supply on the site for effective dust suppression, using non-potable water where possible and appropriate • Use enclosed chutes and conveyors and covered skips • Minimise drop heights and use fine water sprays wherever appropriate • Ensure equipment is available to clean any dry spillages, and clean up spillages as soon as reasonably practicable using wet cleaning methods
Waste management	• Avoid bonfires or burning of waste materials
Earthworks	• Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable • Only remove the cover in small areas during work and not all at once
Construction	• Avoid scabbling (roughening of concrete surfaces) if possible • 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 • Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos
Trackout	• Use water-assisted dust sweeper on access and local roads, if required • Avoid dry sweeping of large areas • Ensure vehicles entering and leaving site are covered to prevent escape of materials • Implement a wheel washing system, if required • Access gates to be located at least 10m from receptors where possible

Step 4

5.2.17 Assuming the relevant mitigation measures outlined in Table 19 are implemented, the residual impacts from all dust generating activities is predicted to be **not significant**, in accordance with the IAQM guidance[18].

[18] Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

5.3 Operational Phase Assessment

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

5.3.2 The assessment considered the following scenarios:

- 2022 - Verification;
- 2026 - DM; and,
- 2026 - DS.

5.3.3 The DM scenario (i.e. without development) included anticipated baseline traffic data, inclusive of anticipated growth, for the relevant assessment year. The DS scenario (i.e. with development) included anticipated baseline traffic data, inclusive of anticipated growth, in addition to predicted vehicle trips associated with the operation of the proposals.

5.3.4 Reference should be made to Appendix 1 for full assessment input details.

Predicted Concentrations

5.3.5 Annual mean NO_2 concentrations were predicted at the sensitive receptor locations for the DM and DS scenarios. These are summarised in Table 20.

Table 20 Predicted Annual Mean NO_2 Concentrations

Receptor		Predicted Annual Mean NO_2 Concentration (µg/m³)		
		DM	DS	Change
R1	Residential - Kew Hill Bottom	19.46	19.49	0.03
R2	Residential - Lindley Moor Road	21.57	21.65	0.08
R3	Residential - St Albans Avenue	25.02	25.10	0.08
R4	Residential - New Hey Road	23.04	23.11	0.07
R5	Residential - Branch Road	38.49	38.55	0.06

Receptor		Predicted Annual Mean NO_2 Concentration (µg/m³)		
		DM	DS	Change
R6	Residential - West Lodge Crescent	31.49	31.54	0.05
R7	Residential - Marling Road	22.28	22.38	0.10
R8	Residential - Halifax Road	28.90	29.12	0.22
R9	Residential - Halifax Road	22.78	22.93	0.15
R10	Residential - Halifax Road	15.27	15.33	0.06
R11	Residential - Warren House Lane	19.35	19.49	0.14
R12	Residential - Lindley Moor Road	21.36	21.63	0.27
R13	Residential - Lindley Moor Road	18.51	18.58	0.07
R14	Residential - Crosland Road	13.15	13.30	0.15
R15	Residential - Weatherhill Road	12.27	12.29	0.02
R16	Residential - Weatherhill Road	14.53	14.58	0.05

5.3.6 As indicated in Table 20, predicted annual mean NO_2 concentrations were below the AQO of 40µg/m³ at all positions in both the DM and DS scenarios.

5.3.7 Reference should be made to Figures 4 and 5 for graphical representations of annual mean NO_2 concentrations across the assessment area for the DM and DS scenarios, respectively.

5.3.8 Annual mean PM_{10} concentrations were predicted at the sensitive receptor locations for the DM and DS scenarios. These are summarised in Table 21.

Table 21 Predicted Annual Mean PM_{10} Concentrations

Receptor		Predicted Annual Mean PM_{10} Concentration (µg/m³)		
		DM	DS	Change
R1	Residential - Kew Hill Bottom	12.97	12.97	0.00
R2	Residential - Lindley Moor Road	13.32	13.34	0.02
R3	Residential - St Albans Avenue	13.87	13.88	0.02

Receptor		Predicted Annual Mean PM_{10} Concentration (µg/m³)		
		DM	DS	Change
R4	Residential - New Hey Road	13.68	13.69	0.01
R5	Residential - Branch Road	16.07	16.08	0.01
R6	Residential - West Lodge Crescent	14.70	14.71	0.01
R7	Residential - Marling Road	13.50	13.52	0.02
R8	Residential - Halifax Road	14.72	14.76	0.04
R9	Residential - Halifax Road	14.08	14.11	0.03
R10	Residential - Halifax Road	12.51	12.52	0.01
R11	Residential - Warren House Lane	13.02	13.04	0.03
R12	Residential - Lindley Moor Road	13.41	13.46	0.05
R13	Residential - Lindley Moor Road	12.90	12.91	0.01
R14	Residential - Crosland Road	12.11	12.15	0.03
R15	Residential - Weatherhill Road	11.91	11.92	0.00
R16	Residential - Weatherhill Road	12.29	12.30	0.01

5.3.9 As indicated in Table 21, predicted annual mean PM_{10} concentrations were below the relevant AQO at all sensitive receptors in both scenarios.

5.3.10 Reference should be made to Figures 6 and 7 for graphical representations of annual mean PM_{10} concentrations across the assessment area for the DM and DS scenarios, respectively.

5.3.11 Annual mean $PM_{2.5}$ concentrations were predicted at the sensitive receptor locations for the DM and DS scenarios. These are summarised in Table 22.

Table 22 Predicted Annual Mean $PM_{2.5}$ Concentrations

Receptor		Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)		
		DM	DS	Change
R1	Residential - Kew Hill Bottom	8.43	8.43	0.00

Receptor		Predicted Annual Mean $PM_{2.5}$ Concentration (µg/m³)		
		DM	DS	Change
R2	Residential - Lindley Moor Road	8.64	8.65	0.01
R3	Residential - St Albans Avenue	8.97	8.97	0.01
R4	Residential - New Hey Road	8.82	8.83	0.01
R5	Residential - Branch Road	10.34	10.35	0.01
R6	Residential - West Lodge Crescent	9.53	9.54	0.00
R7	Residential - Marling Road	8.68	8.69	0.01
R8	Residential - Halifax Road	9.32	9.34	0.02
R9	Residential - Halifax Road	8.96	8.97	0.02
R10	Residential - Halifax Road	8.10	8.11	0.01
R11	Residential - Warren House Lane	8.44	8.45	0.01
R12	Residential - Lindley Moor Road	8.66	8.69	0.03
R13	Residential - Lindley Moor Road	8.37	8.37	0.01
R14	Residential - Crosland Road	7.88	7.90	0.02
R15	Residential - Weatherhill Road	7.78	7.78	0.00
R16	Residential - Weatherhill Road	8.00	8.00	0.01

5.3.12 As indicated in Table 22, predicted annual mean $PM_{2.5}$ concentrations were below the Interim Target at all sensitive receptors in both scenarios.

5.3.13 Reference should be made to Figures 8 and 9 for graphical representations of annual mean $PM_{2.5}$ concentrations across the assessment area for the DM and DS scenarios, respectively.

Predicted Impacts

5.3.14 Predicted impacts on annual mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 23.

Table 23 Predicted Impacts - NO_2

Receptor		Predicted Annual Mean NO_2 Concentration	Predicted Concentration Change as Proportion of AQO (%)	Impact Significance
R1	Residential - Kew Hill Bottom	Below 75% of AQO	0	Negligible
R2	Residential - Lindley Moor Road	Below 75% of AQO	0	Negligible
R3	Residential - St Albans Avenue	Below 75% of AQO	0	Negligible
R4	Residential - New Hey Road	Below 75% of AQO	0	Negligible
R5	Residential - Branch Road	95 - 102% of AQO	0	Negligible
R6	Residential - West Lodge Crescent	76 - 94% of AQO	0	Negligible
R7	Residential - Marling Road	Below 75% of AQO	0	Negligible
R8	Residential - Halifax Road	Below 75% of AQO	1	Negligible
R9	Residential - Halifax Road	Below 75% of AQO	0	Negligible
R10	Residential - Halifax Road	Below 75% of AQO	0	Negligible
R11	Residential - Warren House Lane	Below 75% of AQO	0	Negligible
R12	Residential - Lindley Moor Road	Below 75% of AQO	1	Negligible
R13	Residential - Lindley Moor Road	Below 75% of AQO	0	Negligible
R14	Residential - Crosland Road	Below 75% of AQO	0	Negligible
R15	Residential - Weatherhill Road	Below 75% of AQO	0	Negligible
R16	Residential - Weatherhill Road	Below 75% of AQO	0	Negligible

5.3.15 As indicated in Table 23, impacts on annual mean NO_2 concentrations as a result of the proposed development were predicted to be **negligible** at all receptor locations.

5.3.16 Predicted impacts on annual mean PM_{10} concentrations at the sensitive receptor locations are summarised in Table 24.

Table 24 Predicted Impacts - PM_{10}

Receptor		Predicted Annual Mean PM_{10} Concentration	Predicted Concentration Change as Proportion of AQO (%)	Impact Significance
R1	Residential - Kew Hill Bottom	Below 75% of AQO	0	Negligible
R2	Residential - Lindley Moor Road	Below 75% of AQO	0	Negligible
R3	Residential - St Albans Avenue	Below 75% of AQO	0	Negligible
R4	Residential - New Hey Road	Below 75% of AQO	0	Negligible
R5	Residential - Branch Road	Below 75% of AQO	0	Negligible
R6	Residential - West Lodge Crescent	Below 75% of AQO	0	Negligible
R7	Residential - Marling Road	Below 75% of AQO	0	Negligible
R8	Residential - Halifax Road	Below 75% of AQO	0	Negligible
R9	Residential - Halifax Road	Below 75% of AQO	0	Negligible
R10	Residential - Halifax Road	Below 75% of AQO	0	Negligible
R11	Residential - Warren House Lane	Below 75% of AQO	0	Negligible
R12	Residential - Lindley Moor Road	Below 75% of AQO	0	Negligible
R13	Residential - Lindley Moor Road	Below 75% of AQO	0	Negligible
R14	Residential - Crosland Road	Below 75% of AQO	0	Negligible
R15	Residential - Weatherhill Road	Below 75% of AQO	0	Negligible
R16	Residential - Weatherhill Road	Below 75% of AQO	0	Negligible

5.3.17 As indicated in Table 24, impacts on annual mean PM_{10} concentrations as a result of the proposed development were predicted to be **negligible** at all receptor locations.

5.3.18 Predicted impacts on annual mean $PM_{2.5}$ concentrations at the sensitive receptor locations are summarised in Table 25.

Table 25 Predicted Impacts - $PM_{2.5}$

Receptor		Predicted Annual Mean $PM_{2.5}$ Concentration	Predicted Concentration Change as Proportion of Interim Target (%)	Impact Significance
R1	Residential - Kew Hill Bottom	Below 75% of Interim Target	0	Negligible
R2	Residential - Lindley Moor Road	Below 75% of Interim Target	0	Negligible
R3	Residential - St Albans Avenue	Below 75% of Interim Target	0	Negligible
R4	Residential - New Hey Road	Below 75% of Interim Target	0	Negligible
R5	Residential - Branch Road	76 - 94% of Interim Target	0	Negligible
R6	Residential - West Lodge Crescent	76 - 94% of Interim Target	0	Negligible
R7	Residential - Marling Road	Below 75% of Interim Target	0	Negligible
R8	Residential - Halifax Road	76 - 94% of Interim Target	0	Negligible
R9	Residential - Halifax Road	Below 75% of Interim Target	0	Negligible
R10	Residential - Halifax Road	Below 75% of Interim Target	0	Negligible
R11	Residential - Warren House Lane	Below 75% of Interim Target	0	Negligible
R12	Residential - Lindley Moor Road	Below 75% of Interim Target	0	Negligible
R13	Residential - Lindley Moor Road	Below 75% of Interim Target	0	Negligible
R14	Residential - Crosland Road	Below 75% of Interim Target	0	Negligible
R15	Residential - Weatherhill Road	Below 75% of Interim Target	0	Negligible
R16	Residential - Weatherhill Road	Below 75% of Interim Target	0	Negligible

5.3.19 As indicated in Table 25, impacts on annual mean $PM_{2.5}$ concentrations as a result of the proposed development were predicted to be **negligible** at all receptor locations.

Overall Impact Significance

5.3.20 The overall significance of operational phase road traffic emission impacts was determined as **negligible**. This was based on the overall predicted impacts at discrete receptor locations and the considerations outlined previously. Further justification is provided in Table 26.

Table 26 Overall Impact Significance of Road Vehicle Exhaust Emission Impacts

Guidance	Comment
The existing and future air quality in the absence of the development	Predicted annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations were below the relevant AQOs and Interim Target at all locations in the DM scenario It is considered unlikely that future air quality conditions will change significantly in the absence of the development given the relatively established nature of the area
The extent of current and future population exposure to the impacts	The development is not predicted to affect the population exposed to exceedences of the AQOs and Interim Target
The influence and validity of any assumptions adopted when undertaking the prediction of impacts	The assessment assumed that vehicle exhaust emission rates and background pollutant levels will not reduce in future years. This provides worst-case results when compared with DEFRA and National Highways methodologies Due to the adopted assumptions it is considered the presented results are sufficiently robust for an assessment of this nature

5.3.21 The IAQM guidance[19] states that only if the impact is greater than **slight**, the effect is considered **significant**. As impacts were predicted to be **negligible**, overall effects are considered **not significant**, in accordance with the stated methodology.

[19] Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

5.4 West Yorkshire Technical Planning Guidance

5.4.1 The West Yorkshire LAs have produced air quality technical guidance[20] as part of an overarching Low Emission Strategy to reduce road transport emissions in the county. It is aimed at helping LAs deliver AQO compliance through cost effective service planning brought about by the joint working and relevant Local Plan policies. This was considered in the context of the development as summarised in the following Sections.

Development Classification

5.4.2 The guidance provides a methodology for determining the scale of a development as minor, medium or major and the required air quality mitigation for the relevant banding. Review of the relevant criteria indicated the proposals were classified as **major** due to the following:

- The proposed development is for a range of uses including E(b), E(g), B2 and B8 with a total gross floor area (GFA) of approximately 16,818m^2; and,
- The scheme is predicted to increase vehicle movements on roads with greater than 10,000 Annual Average Daily Traffic (AADT) flows by more than 5%.

5.4.3 The guidance[21] indicates that a Pollution Damage Costs Assessment is required for all **major** developments to determine the appropriate amount of required mitigation. This is provided in the following Section.

Pollution Damage Costs Assessment

5.4.4 The guidance[22] sets out the methodology to be used in order to assess emissions from a development and determine the appropriate level of mitigation required to help reduce the potential effect on health and/or the local environment.

20 Air Quality and Emissions: Technical Planning Guidance, West Yorkshire Low Emissions Group.

21 Air Quality and Emissions: Technical Planning Guidance, West Yorkshire Low Emissions Group.

22 Air Quality and Emissions: Technical Planning Guidance, West Yorkshire Low Emissions Group.

5.4.5 The first step of the assessment is to undertake a calculation to identify the monetary value of predicted emissions from the proposals and detail the mitigation measures to control air quality impacts associated with the scheme.

5.4.6 The calculation utilises the Emissions Factor Toolkit (EFT) to calculate the amount of transport related pollutant emissions the development is likely to produce. The output is then multiplied by the Interdepartmental Group on Costs and Benefits damage costs for the key pollutants NO_x and $PM_{2.5}$, and finally multiplied by 5 to provide a five-year exposure cost value. This has been summarised in the following equation:

5 Year Exposure Cost Value = EFT Output x Damage Costs x 5

5.4.7 It should be noted that the calculation has been undertaken using the most recent damage costs released by DEFRA in March 2023[23].

5.4.8 The input data values used in the assessment are shown in Table 27.

Table 27 Pollution Damage Costs Assessment - Inputs

Data	Value
Daily Vehicle Movements Produced by Development	1,507
HDV Proportion (%)	0
Average Speed (km/h)	50
Average Trip Length (km)	10
NO_x Output (kg/year)	564.77
$PM_{2.5}$ Output (kg/year)	94.21
NO_x Output (tonnes/year)	0.56
$PM_{2.5}$ Output (tonnes/year)	0.09
NO_x Damage Costs (£/tonne)	9,054
$PM_{2.5}$ Damage Costs (£/tonne)	63,766

5.4.9 The calculation is shown in Table 28.

[23] Air Quality Appraisal: Damage Cost Guidance, DEFRA, 2023.

Table 28 Total Emissions Assessment - Results

Data	Value
Annual Cost of NO_x Emissions (£)	5,113
Annual Cost of $PM_{2.5}$ Emissions (£)	6,007
Total Annual Exposure Cost Value (£)	11,121
Total Five Year Exposure Cost Value (£)	55,604

Mitigation

5.4.10 As shown in Table 28, the calculation determined the development should include mitigation measures to reduce the air quality impacts of road traffic emissions equal to £55,604.

5.4.11 The planning application for the development is currently in outline format. As such, specific mitigation measures to be implemented along with associated costs were not available at the time of reporting. However, these can be secured via planning condition requiring a Low Emission Strategy to be produced and submitted to KC once the proposals have been finalised.

6.0 CONCLUSION

6.1.1 Redmore Environmental Ltd was commissioned by 2SH Developments to undertake an Air Quality Assessment in support of a mixed-use development on land off Lindley Moor Road, Lindley.

6.1.2 The development may lead to adverse air quality effects at sensitive locations during the construction and operational phases. As such, an Air Quality Assessment was undertaken in order to determine baseline conditions and assess potential impacts as a result of the scheme.

6.1.3 During the construction phase of the development there is the potential for air quality impacts as a result of fugitive dust emissions from the site. These were assessed in accordance with the IAQM methodology. Assuming the identified site-specific dust control measures are implemented, the residual significance of potential air quality impacts from dust generated by earthworks, construction and trackout activities was predicted to be **not significant**.

6.1.4 Potential impacts during the operational phase of the proposals may occur due to road traffic exhaust emissions associated with vehicles travelling to and from the site. Dispersion modelling was therefore undertaken in order to predict pollutant concentrations at sensitive locations as a result of emissions from the local highway network both with and without the development in place. Results were subsequently verified using local monitoring data.

6.1.5 Review of the dispersion modelling results indicated that impacts on annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of traffic generated by the development were predicted to be **negligible** at all sensitive receptor locations. Following consideration of the relevant issues, residual impacts as a result of the operation of the development were considered to be **not significant**, in accordance with the IAQM guidance.

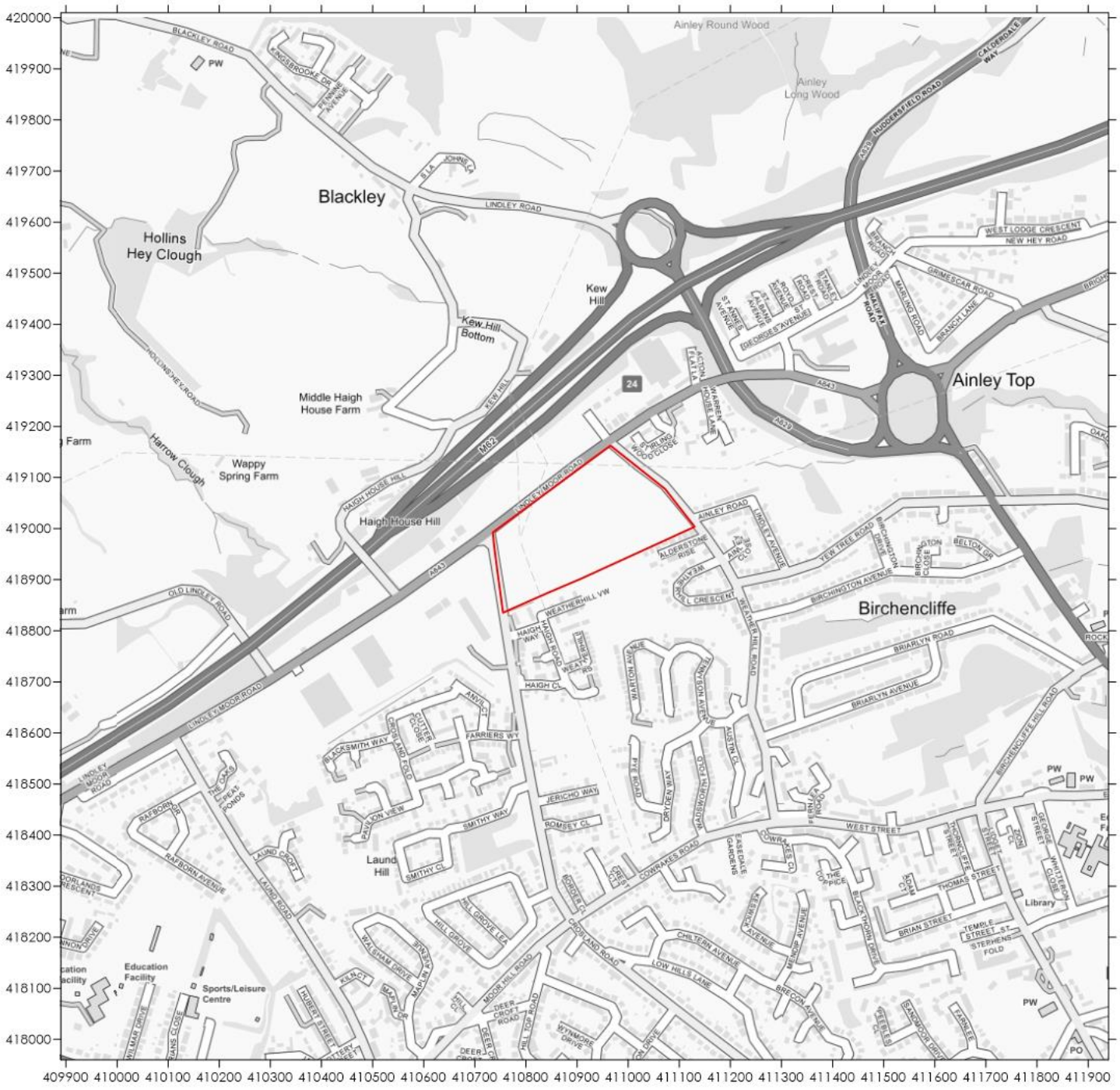
6.1.6 Consideration was made to the West Yorkshire air quality technical guidance in order to determine the scale of the development. A damage cost assessment was subsequently completed. Mitigation measures for inclusion in the development can be conditioned by the LA if required.

6.1.7 Based on the assessment results, air quality factors are not considered a constraint to the development.

7.0 ABBREVIATIONS

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQAP	Air Quality Action Plan
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DM	Do-Minimum
DMP	Dust Management Plan
DMRB	Design Manual for Roads and Bridges
DS	Do-Something
EFT	Emission Factor Toolkit
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
KC	Kirklees Council
KLP	Kirklees Local Plan
LA	Local Authority
LAQM	Local Air Quality Management
NB	Northbound
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
SB	Southbound
SP	Slow Phase
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10µm
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5µm
z_0	Roughness length

Figures



Legend

Site Boundary

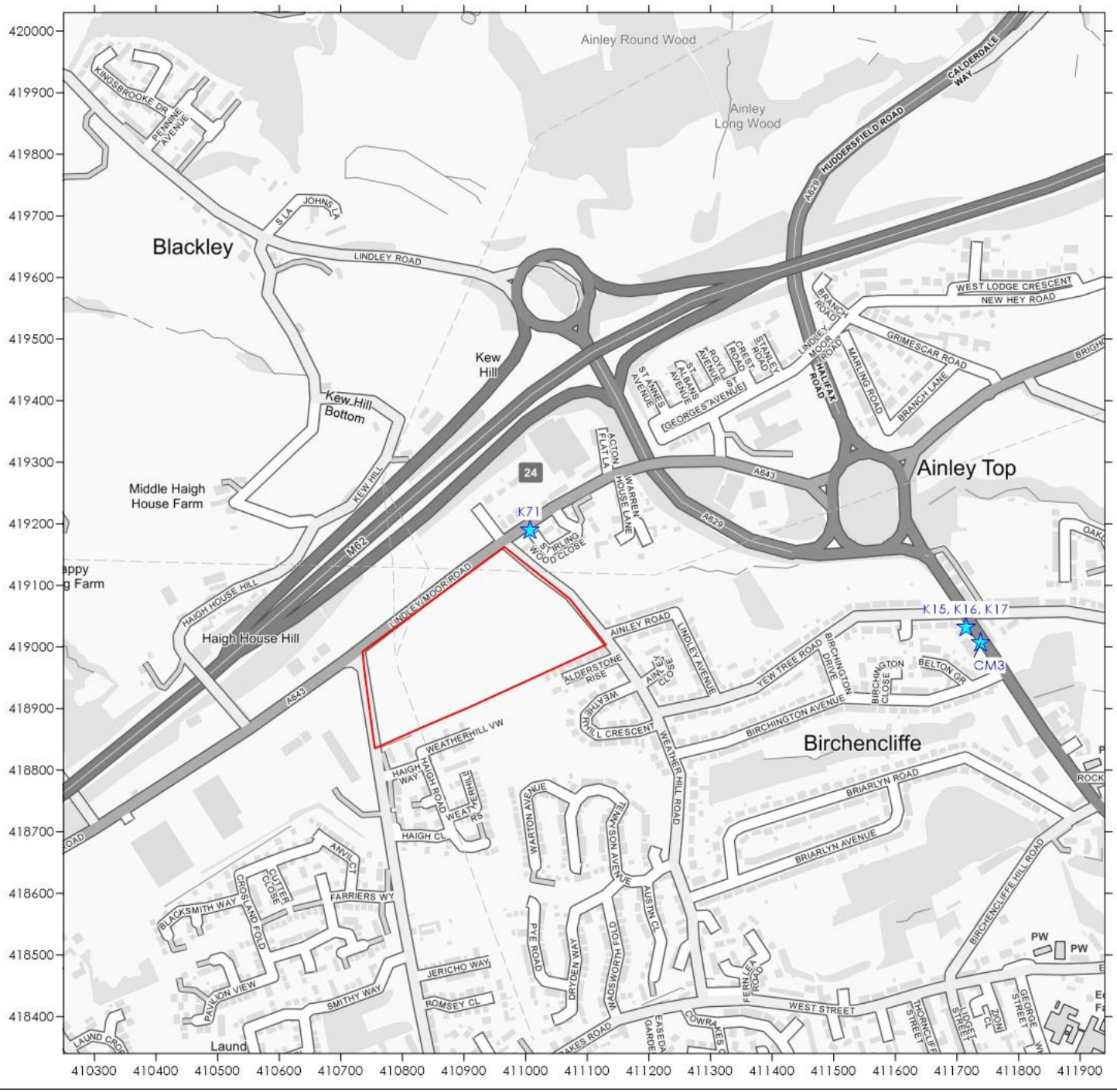
Title
Figure 1 - Site Location Plan

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
2SH Developments

Redmore environmental
www.red-env.co.uk | 0161 7060075



Legend

Site Boundary

Monitor

Title
Figure 2 - Monitoring Locations

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
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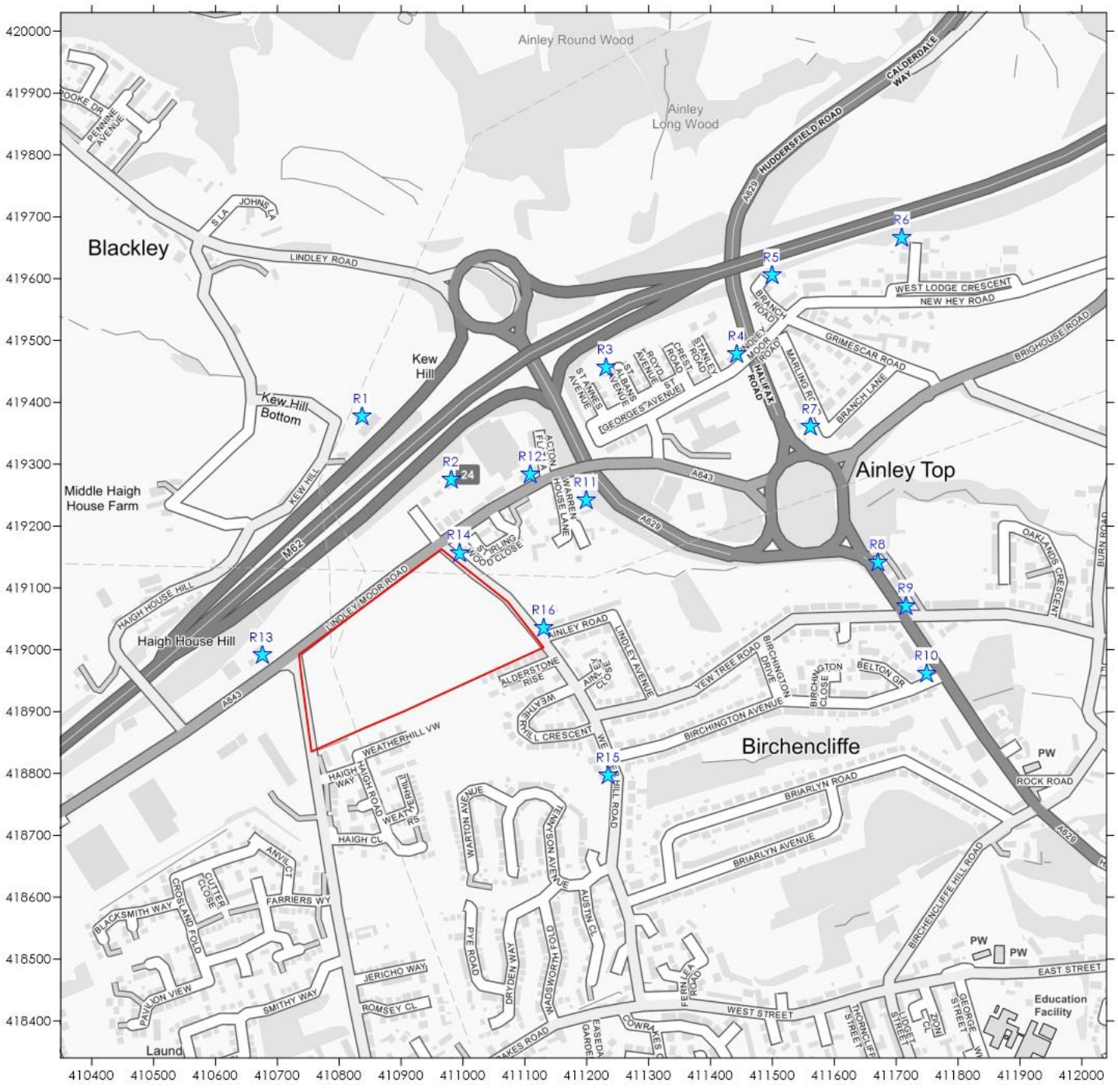

Legend

Site Boundary

Receptor

Title
Figure 3 - Road Vehicle Exhaust Emissions Sensitive Human Receptor Locations

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

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Legend

Site Boundary

60
56
52
48
44
40
36
32
28
24
20

Annual Mean NO_2 Concentration (µg/m³)

Title

Figure 4 - Predicted Annual Mean NO_2 Concentrations (µg/m³)
Do-Minimum

Project

Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference

3552-1

Client

2SH Developments

Redmore environmental
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Legend

Site Boundary

60
56
52
48
44
40
36
32
28
24
20

Annual Mean NO_2 Concentration (µg/m³)

Title

Figure 5 - Predicted Annual Mean NO_2 Concentrations (µg/m³) Do-Something

Project

Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference

3552-1

Client

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Legend

Site Boundary

Annual Mean PM_{10} Concentration ($\mu g/m^3$)

28
26
24
22
20
18
16
14

Title
Figure 6 - Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$)
Do-Minimum

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552

Client
2SH Developments

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Legend

Site Boundary

Annual Mean PM_{10} Concentration ($\mu g/m^3$)

28
26
24
22
20
18
16
14

Title
Figure 7 - Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$)
Do-Something

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
2SH Developments

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Legend

Site Boundary

20
18
16
14
12
10

Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)

Title
Figure 8 - Predicted Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)
Do-Minimum

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
2SH Developments

Redmore environmental
www.red-env.co.uk | 0161 7060075

Legend

Site Boundary

Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)

20
18
16
14
12
10

Title
Figure 9 - Predicted Annual Mean $PM_{2.5}$ Concentrations ($\mu g/m^3$)
Do-Something

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
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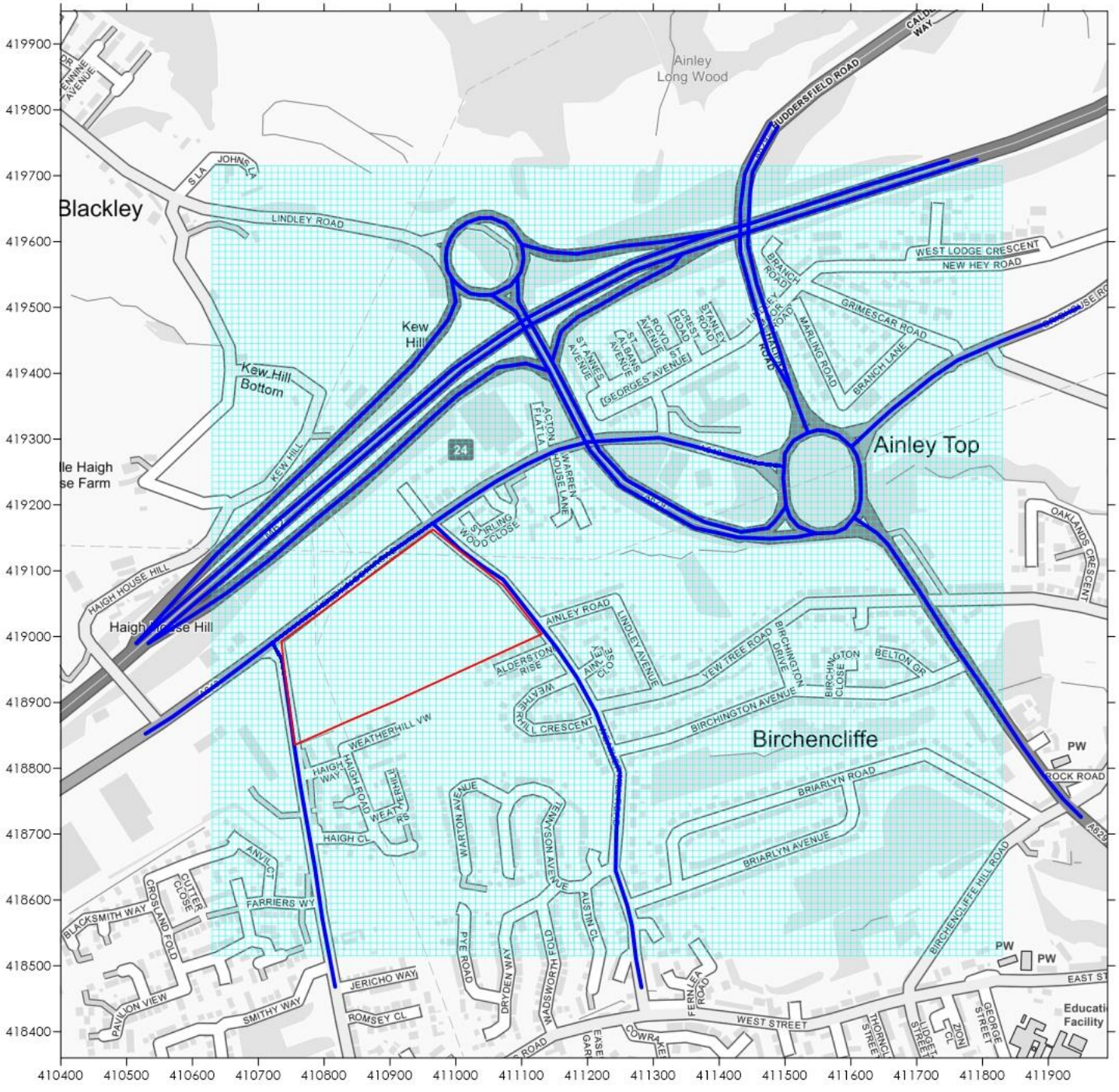

Legend

Site Boundary

Road Link

Output Grid

Title
Figure 10 - ADMS-Roads Inputs

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
2SH Developments

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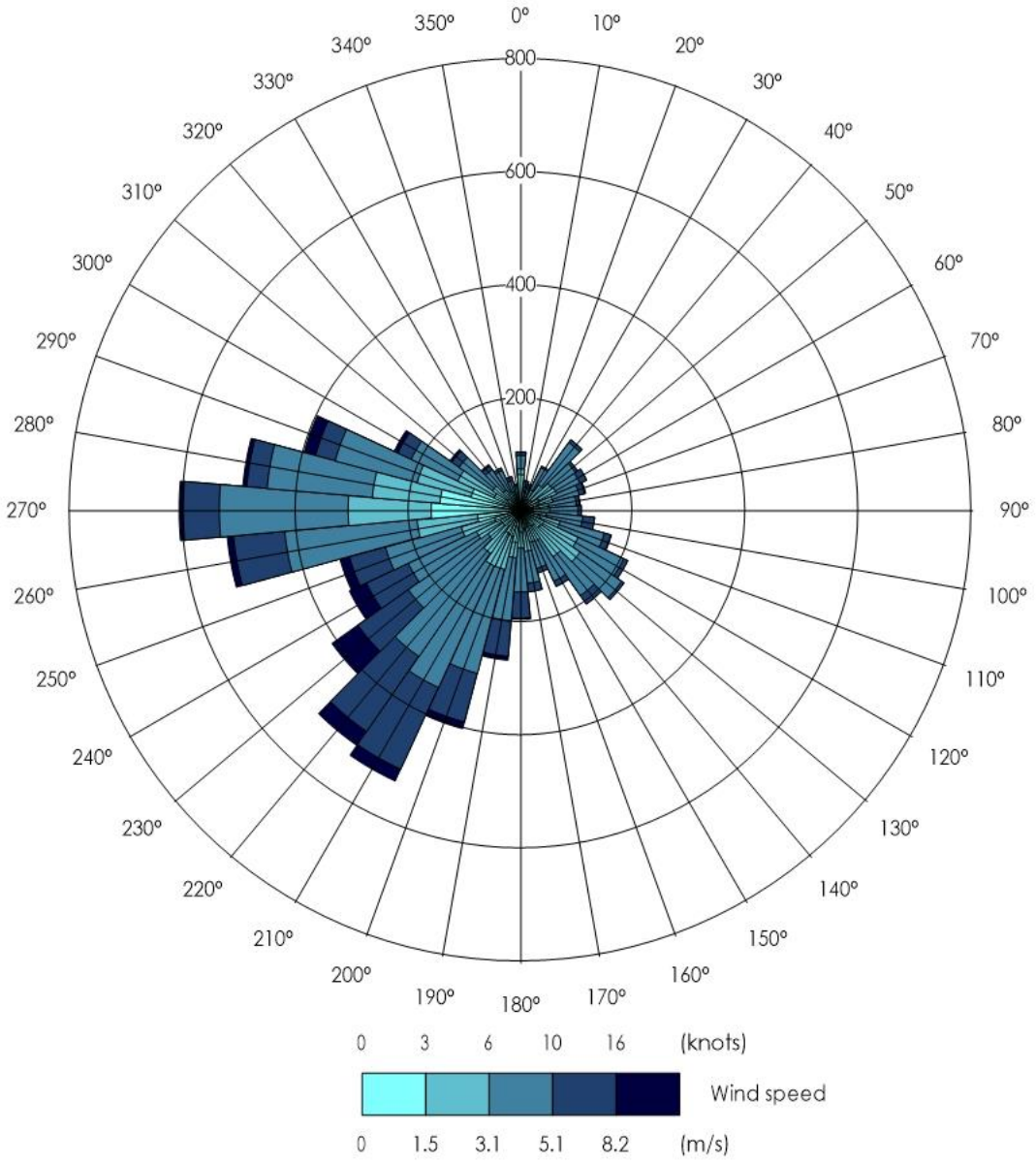

Legend

Title
Figure 11 - Wind Rose of 2022
Bingley Meteorological Station
Data

Project
Air Quality Assessment
Lindley Moor Road, Lindley

Project Reference
3552-1

Client
2SH Developments

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Appendix 1 - Assessment Input Data

Introduction

The proposed development has the potential to cause air quality impacts as a result of exhaust emissions associated with vehicles travelling to and from the site. In order to assess NO_2, PM_{10} and $PM_{2.5}$ concentrations at sensitive locations, detailed dispersion modelling was undertaken in accordance with the following methodology.

Dispersion Model

Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.0.1.3). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

The relevant inputs are detailed in the following Sections.

Assessment Area

Ambient concentrations were predicted over the area NGR: 410630, 418515 to 411830, 419715. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package.

Receptors sensitive to potential changes in pollutant concentrations were included in the assessment as outlined in the main report text.

Reference should be made to Figure 10 for a graphical representation of the assessment grid extents.

Traffic Flow Data

Traffic data for use in the assessment, including 24-hour AADT flows and fleet composition as HDV proportion, was provided by Paragon Highways, the Transport Consultants for the project.

Baseline traffic data was not available for the M62, A629 - Halifax Road/Huddersfield Road and Brighouse Road as these were outside the extents of the Transport Assessment. As such, data was obtained from the Department for Transport (DfT)[24]. The DfT web tool enables the user to view and download traffic flows on every link of the 'A' road and motorway network, as well as selected minor roads, in Great Britain for the years 1999 to 2022. It should be noted that the DfT web tool is referenced in DEFRA guidance[25] as being a suitable source of data for air quality assessments and it is therefore considered to provide a reasonable estimate of traffic flows in the vicinity of the site.

The baseline traffic data was converted to the site opening year utilising a factor obtained from TEMPro (version 8.0). This software package has been development by the DfT to calculate future traffic growth throughout the UK.

Road widths and vehicle speeds were estimated from aerial photography and UK highway design standards. A summary of the traffic data used in the assessment is provided in Table A1.1.

Table A1.1 Traffic Data

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)	Road Width (m)	Avg. Vehicle Speed (km/h)
		2022	2026 DM	2026 DS			
L1	A643 Lindley Moor Road, west of Crosland Road	11,890	12,392	12,543	2.28	9.3	65
L2	A643 Lindley Moor Road, west of site access	13,113	13,661	14,175	2.30	8.0	65

[24] https://roadtraffic.dft.gov.uk/#6/55.254/-11.107/basemap-regions-countpoints.

[25] Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)	Road Width (m)	Avg. Vehicle Speed (km/h)
		2022	2026 DM	2026 DS			
L3	A643 Lindley Moor Road, east of site access	13,068	13,615	14,608	2.18	7.7	65
L4	A643 Lindley Moor Road, east of Weatherhill Road	6,022	14,154	15,118	2.10	10.0	50
L5	A643 Lindley Moor Road, east of Weatherhill Road, Slow Phase (SP)	6,022	14,154	15,118	2.10	28.1	20
L6	Crosland Road, SP	4,563	4,754	5,117	2.02	16.9	20
L7	Crosland Road	4,563	4,754	5,117	2.02	6.7	45
L8	Weatherhill Road, SP	2,564	2,674	2,703	0.34	7.9	20
L9	Weatherhill Road	2,564	2,674	2,703	0.34	6.3	45
L10	A629 Halifax Road, SP	16,203	16,832	17,063	5.03	30.8	20
L11	A629 Halifax Road	16,203	16,832	17,063	5.03	8.1	45
L12	A643 Brighouse Road, SP	16,203	16,832	16,947	5.03	30.3	20
L13	A643 Brighouse Road	16,203	16,832	16,947	5.03	9.5	80
L14	A629 Huddersfield Road, SP	16,203	16,832	16,919	5.03	28.7	20
L15	A629 Huddersfield Road, northbound (NB)	14,694	15,264	15,308	8.05	7.6	65
L16	A629 Huddersfield Road, southbound (SB)	13,961	14,503	14,547	8.06	9.1	65
L17	A629 Lindley Road, NB	14,380	14,938	15,029	7.17	7.8	80
L18	A629 Lindley Road, NB SP	14,380	14,938	15,029	7.17	7.0	20
L19	A629 Lindley Road, SB SP	18,028	18,727	18,818	7.10	8.1	20
L20	A629 Lindley Road, SB	18,028	18,727	18,818	7.10	7.0	80
L21	M62, west of Junction 24, NB	33,816	35,128	35,128	18.10	11.4	95
L22	M62, east of Junction 24, NB	49,714	51,643	51,734	18.58	11.4	95
L23	M62, west of Junction 24, SB	33,611	34,915	34,915	18.54	11.0	95
L24	M62, east of Junction 24, SB	56,366	58,553	58,644	17.58	13.5	95
L25	M62 NB, off-slip	4,900	5,090	5,090	18.10	5.6	35
L26	M62 NB, on-slip	4,900	5,090	5,181	18.10	6.0	55

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)	Road Width (m)	Avg. Vehicle Speed (km/h)
		2022	2026 DM	2026 DS			
L27	M62 SB, on-slip	4,900	5,090	5,090	18.54	6.4	55
L28	M62 SB, off-slip	4,900	5,090	5,181	18.54	5.1	35
R1	A629/ A643 Roundabout	7,253	8,193	8,325	7.17	13.3	20
R2	A629/ M62 Roundabout	5,276	5,481	5,515	7.17	9.5	20

Reference should be made to Figure 10 for a graphical representation of the road link locations.

Emission Factors

Emission factors for each link were calculated using the relevant traffic flows and the EFT (version 12.0.1). This has been produced by DEFRA and incorporates COPERT 6 vehicle emission factors and fleet information.

There is current uncertainty over NO_2 concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore 2022 emissions factors were utilised in preference to the development opening year in order to provide robust concentration predictions. As predictions for 2022 were verified, it is considered the results are a robust indication of worst-case concentrations for the future year.

Meteorological Data

Meteorological data used in the assessment was taken from Bingley meteorological station over the period 1st January 2022 to 31st December 2022 (inclusive). Bingley meteorological station is located at NGR: 408874, 435015, which is approximately 16.0km north of the development site. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 11 for a wind rose of the utilised meteorological data.

Roughness Length

The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents. This is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'parkland, open suburbia'.

A z_0 of 0.3m was used to describe the meteorological site. This is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'agricultural areas (max)'.

Monin-Obukhov Length

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

A minimum Monin-Obukhov length of 1m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for a 'rural area'.

Background Concentrations

Background mean NO_2, PM_{10} and $PM_{2.5}$ concentrations for use in the assessment were obtained from the DEFRA mapping study for the grid square containing the development site (NGR: 410500, 418500). In order to avoid 'double-counting' of road vehicle exhaust emissions, the proportion of the relevant background concentrations from motorways, primary A-roads and minor roads within the grid square was removed in accordance with the methodology outlined in DEFRA guidance[26]. These sectors were considered to be most representative of those being modelled within ADMS-Roads. Background concentrations before and after adjustment are shown in Table A1.2.

[26] Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Table A1.2 Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m³)	
	Total Predicted 2022 Background	Predicted Background with Sector Removed
NO_2	13.05	10.33
PM_{10}	12.27	12.08
$PM_{2.5}$	8.03	7.92

Similar to emission factors, background concentrations from 2022 were utilised in preference to the opening year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

NO_x to NO_2 Conversion

Predicted annual mean NO_x concentrations were converted to NO_2 concentrations using the spreadsheet (version 8.1) provided by DEFRA, which is the method detailed within DEFRA guidance[27].

Verification

The predicted results from a dispersion model may differ from measured concentrations for a large number of 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.

27 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

For the purpose of the assessment, model verification was undertaken for 2022 using traffic data, meteorological data and monitoring results from this year.

NO_x Verification

Monitoring of NO_2 concentrations was undertaken at two locations in the vicinity of roads included within the model during 2022. The results were obtained and the road contributions to total NO_x concentrations calculated following the methodology contained within DEFRA guidance[28]. The monitored annual mean NO_2 concentrations and calculated road NO_x concentrations are summarised in Table A1.3.

Table A1.3 Verification - Monitoring Results

Monitoring Location		Monitored NO_2 Concentration ($\mu g/m^3$)	Calculated Road NO_x Concentration ($\mu g/m^3$)
CM3	RS6 - Ainley Top	18.30	14.82
K71	Lindley Moor Road 2	24.10	26.24

The annual mean road NO_x concentrations predicted from the dispersion model and the 2019 road NO_x concentrations calculated from the monitoring results are summarised in Table A1.4.

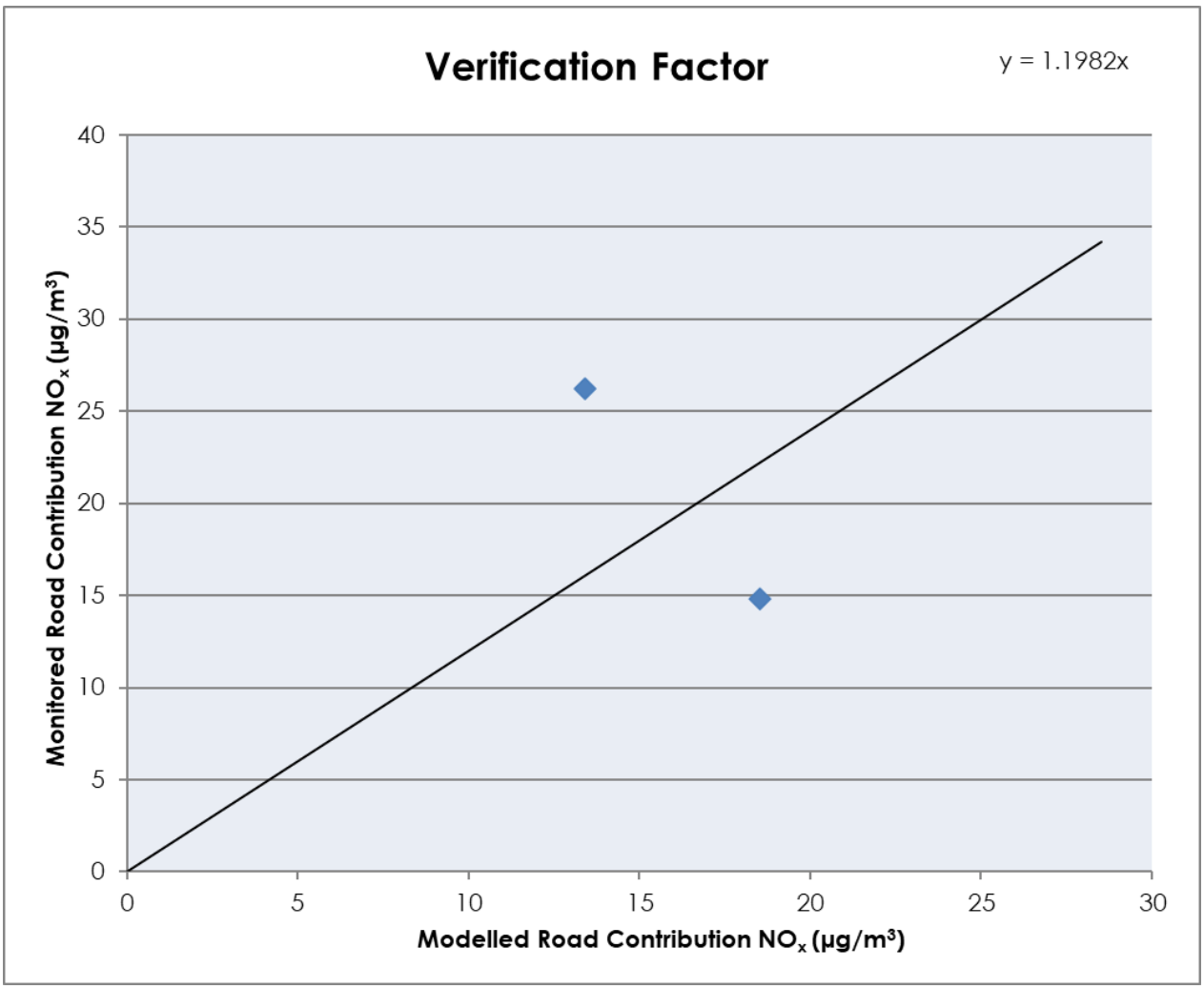
Table A1.4 Verification - Modelling Results

Monitoring Location		Calculated Road NO_x Concentration ($\mu g/m^3$)	Modelled Road NO_x Concentration ($\mu g/m^3$)
CM3	RS6 - Ainley Top	14.82	18.52
K71	Lindley Moor Road 2	26.24	13.41

The monitored and modelled road NO_x concentrations were graphed and the equation of the trendline based on linear progression through zero calculated. This indicated that a verification factor of 1.1982 was required to be applied to all modelling results, as shown in Graph 1.

28 Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Graph 1 NO_x Verification Factor



$PM_{2.5}$ Verification

KC undertook monitoring of $PM_{2.5}$ concentrations at one location within the modelling extents during 2022. The monitored annual mean $PM_{2.5}$ concentration and modelled $PM_{2.5}$ concentration is shown in Table A1.5.

Table A1.5 Verification - Modelling Result

Monitoring Location		Monitored $PM_{2.5}$ Concentration (µg/m³)	Modelled $PM_{2.5}$ Concentration (µg/m³)
CM3	RS6 - Ainley Top	8.90	9.3

The monitored and modelled $PM_{2.5}$ concentrations were compared to calculate the associated ratio. This indicated a verification factor of 0.9572 was required to be applied to all $PM_{2.5}$ modelling results.

Monitoring of PM_{10} concentrations is not undertaken within the assessment extents. The $PM_{2.5}$ verification factor was therefore used to adjust model predictions of this species in lieu of more accurate data in accordance with DEFRA guidance[29].

[29] Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Appendix 2 - Curricula Vita

JETHRO REDMORE

Director

BEng (Hons), MSc, MIAQM, MIEnvSc, PIEMA, CEnv

KEY EXPERIENCE:

Jethro is a Chartered Environmentalist and Director of Redmore Environmental with specialist experience in the air quality and odour sectors. His key capabilities include:

- Production and management of Air Quality, Dust and Odour Assessments for a wide-range of clients from the retail, residential, infrastructure, commercial and industrial sectors.
- Production and co-ordination of Environmental Permit applications for a variety of industrial sectors.
- Detailed dispersion modelling of road vehicle and industrial emissions using ADMS-Roads, ADMS-5, AERMOD-PRIME and BREEZE-ROADS. Studies have included impact assessment of ground level pollutant and odour concentrations and assessment of suitability of development sites for proposed end-use.
- Project management and co-ordination of Environmental Impact Assessments and scoping reports for developments throughout the UK.
- Provision of expert witness services at Planning Inquiries.
- Design and project management of pollutant monitoring campaigns.
- Co-ordination and management of large-scale multi-disciplinary projects and submissions.
- Provision of expert advice to local government and international environmental bodies, as well as involvement in production of industry guidance.

SELECT PROJECTS SUMMARY:

Industrial

Shanks Waste Management - Odour Assessments of two waste management facilities to support Environmental Permit Applications.

Tatweer Petroleum - dispersion modelling of Bahrain oil field.

Doha South Sewage Treatment Works - AQA for works extension in Qatar.

IRIS Environmental Appraisal Report Reviews, Isle of Man Government - odour assessment reviews.

Lankem, Greater Manchester - Environmental Permit Application for chemical manufacturing plant.

Newport Docks Bulk Drying, Pelleting and CHP Facility - air quality EIA for gas CHP.

Springshades, Leicester - Environmental Permit Variation Application for textile manufacturing plant.

Valspar, Chester - Odour Assessment and production of Odour Management Plan for a paint manufacturing plant in response to neighbour complaints.

Agrivert - dispersion modelling of odour and CHP emissions from numerous AD plants.

James Cropper Paper Mill, Cumbria - air quality EIA, Environmental Permit Variation and Human Health Risk Assessment for new biomass boiler adjacent to SSSI.

Rigg Approach, Leyton - Air Quality Assessment in support of waste transfer site.

Lynchford Lane Waste Transfer Station - biomass facility energy recovery plant.

Barnes Wallis Heat and Power, Cobham - biomass facility adjacent to AQMA.

Residential

Wood St Mill, Bury - residential development adjacent to scrap metal yard.

Hyams Lane, Holbrook - Odour Assessment to support residential development adjacent to sewage works.

North Wharf Gardens, London - peer review of EIA undertaken for large residential development.

Loxford Road, Alford - Air Quality EIA for residential development, included consideration of impacts from associated package sewage works

Elephant and Castle Leisure Centre - baseline AQA for redevelopment.

Carr Lodge, Doncaster - EIA for large residential development.

Queensland Road, Highbury - residential scheme including CHP.

Bicester Ecotown - dispersion modelling of energy centre.

Castleford Growth Delivery Plan - baseline air quality constraints assessment for town redevelopment.

York St, Bury - residential development adjacent to AQMA.

Temple Point Leeds - residential development adjacent to M1.

Commercial and Retail

Etihad Stadium - Air Quality EIA for the extension to the capacity of the Etihad Stadium, Manchester.

Wakefield College - redevelopment of city centre campus in AQMA.

Manchester Airport Cargo Shed - commercial development.

Manchester Airport Apron Extension - EIA including aircraft emission modelling.

National Youth Theatre, Islington - redevelopment to provide new arts space and accommodation.

EMILY PEARS-RYDING

Associate Director

BSc (Hons), MIAQM, MIEnvSc

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KEY EXPERIENCE:

Emily is an Associate Director with specialist experience in the air quality sector. Her key capabilities include:

- Production of Air Quality Assessments in accordance with Department for Environment, Food and Rural Affairs (DEFRA) methodologies for a range of residential, commercial and industrial sectors.
- Detailed dispersion modelling of road vehicle and industrial emissions using ADMS-Roads and ADMS-5. Studies have included impact assessment of ground level pollutant and odour concentrations and assessment of suitability of development sites for proposed end-use.
- Project management and co-ordination of Environmental Impact Assessments and scoping reports for developments throughout the UK.
- Assessment of fugitive dust impacts from a range of mineral extraction developments.
- Assessment of petrol stations to address benzene concentrations and their impact on adjacent developments.
- Production of air quality mitigation strategies specifically tailored to address issues at individual sites.
- Assessment of potential effects associated with network realignment schemes and highway developments.

SELECT PROJECTS SUMMARY:

Broad Street, Birmingham

Air Quality Assessment in support of a residential-led development on land at Broad Street, Birmingham. The proposals were located adjacent to a section of the Midland Metro Westside which runs along Broad Street. Consideration was made to the potential for re-alignment of the local road network as a result of the Metro to effect pollution levels at the development. The assessment indicated NO_2 concentrations exceeded air quality criteria from ground to third floor level as a result of road vehicle exhaust emissions. Mitigation was therefore specified for the affected units.

Home Farm, Forest Road, Warfield

Ecological Air Quality Assessment in support of a residential development. Natural England held concerns regarding potential impacts at sensitive ecological designations as a result of traffic exhaust emissions associated with the development. The predicted change in NO_x and ammonia concentrations and nitrogen and acid deposition was below the relevant criteria at all locations within the ecological designations. Impacts were therefore not considered to be significant.

Saltcoats Road, Stevenston

Air Quality Assessment in support of an educational campus and associated energy centre. Impacts associated with emissions from the proposed gas and biomass boilers were assessed through detailed dispersion modelling. This indicated impacts on annual mean NO_2 and PM_{10} concentrations were predicted to be not significant.

Blackthorn & Piddington

Environmental Impact Assessment in support of a railway embankment scheme on land at the Network Railway Embankment between Piddington and Blackthorn. Due to the extensive stabilisation works a Fugitive Dust Emissions Assessment was undertaken in addition to consideration of road vehicle exhaust emissions. Due to the location of the site in relation to nearby sensitive receptors, potential impacts associated with construction works were not considered to be significant.

Blackmoorfoot Road, Huddersfield

Air Quality in support of a residential-led development in close proximity to an operational minerals facility. Due to the presence of the Johnsons Wellfield Quarry to the south of the site a Fugitive Dust Emissions Assessment was undertaken to determine potential impacts. Dispersion modelling of road vehicle exhaust emissions was also undertaken in support of the scheme. Results indicated the overall significance of fugitive dust emissions from the quarry and air quality impacts associated with operation of the development itself were not significant.

Lockwood Bar, Huddersfield

Air Quality Assessment for the proposed highway realignment scheme along Lockwood Road, Huddersfield. Changes in pollution levels were considered at sensitive receptors as a result of variations to road geometry and associated redistribution of vehicle trips across the local area. Results of the dispersion modelling study indicated air quality impacts as a result of the scheme were not significant.