

Air Quality Assessment
Keresforth Hill Road, Dodworth

Client: PB Planning Ltd

Reference: 2100r1

Date: 24th April 2018



Report Issue

Report Title: Air Quality Assessment - Keresforth Hill Road, Dodworth

Report Reference: 2100

Field	Report Version			
	1	2	3	4
Prepared by	Pearl Poulton			
Position	Air Quality Consultant			
Reviewed by	Jethro Redmore			
Position	Director			
Date of Issue	24 th April 2018			
Comments	-			

Heliport Business Park, Liverpool Road, Manchester, M30 7RU

info@red-env.co.uk | 0161 706 0075 | www.red-env.co.uk

This report has been prepared by Redmore Environmental Ltd in accordance with the agreed terms and conditions of appointment. Redmore Environmental Ltd cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

Executive Summary

Redmore Environmental Ltd was commissioned by PB Planning Ltd to undertake an Air Quality Assessment in support of a residential development on Keresforth Hill Road, Dodworth.

The development may lead to the exposure of future occupants to elevated pollution levels, as well as adverse air quality effects at sensitive locations. As such, an Air Quality Assessment was required in order to determine baseline conditions, consider site suitability for the proposed end-use and assess potential impacts as a result of the scheme.

Dispersion modelling was undertaken in order to predict pollutant concentrations across the proposed development site as a result of emissions from the local highway network. Outputs were subsequently verified using local monitoring data.

The results of the dispersion modelling assessment indicated that predicted pollutant levels were below the relevant criteria at all sensitive locations across the development. As such, the site is considered suitable for the proposed end use from an air quality perspective.

During the operational phase of the development there is the potential for air quality impacts as a result of traffic exhaust emissions associated with vehicles travelling to and from the site. These were assessed against the relevant screening criteria. Due to the limited number of anticipated vehicle trips associated with the proposals, road traffic impacts were not predicted to be significant.

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

Table of Contents

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Site Location and Context	1
2.0	LEGISLATION AND POLICY	2
2.1	European Directives	2
2.2	UK Legislation	2
2.3	Local Air Quality Management	4
2.4	National Planning Policy	4
2.5	National Planning Practice Guidance	5
2.6	Local Planning Policy	6
3.0	BASELINE	8
3.1	Introduction	8
3.2	Local Air Quality Management	8
3.3	Air Quality Monitoring	8
	BMBC Monitoring Results	8
	Local Monitoring Results	9
3.4	Background Pollutant Concentrations	10
4.0	METHODOLOGY	12
4.1	Introduction	12
4.2	Potential Exposure	12
	Assessment Area	13
	Traffic Flow Data	13
	Noise Barrier	18
	Emission Factors	19
	Meteorological Data	19
	Roughness Length	20
	Monin-Obukhov Length	20
	Background Concentrations	20
	NO _x to NO ₂ Conversion	21
	Verification	21
4.3	Potential Development Impacts	26
5.0	ASSESSMENT	28
5.1	Introduction	28
5.2	Potential Exposure	28

5.3	Potential Development Impacts	29
6.0	CONCLUSION	31
7.0	ABBREVIATIONS	32

1.0 INTRODUCTION

1.1 Background

- 1.1.1 Redmore Environmental Ltd was commissioned by PB Planning Ltd to undertake an Air Quality Assessment in support of a residential development on Keresforth Hill Road, Dodworth.
- 1.1.2 The development may lead to the exposure of future occupants to poor air quality, as well as adverse impacts at sensitive locations. As such, an Air Quality Assessment was required in order to determine baseline conditions at the site, consider its suitability for the proposed end-use and assess potential impacts associated with the scheme.

1.2 Site Location and Context

- 1.2.1 The development is located on Keresforth Hill Road, Dodworth, at approximate National Grid Reference (NGR): 432653, 404830. Reference should be made to Figure 1 for a map of the site and surrounding area.
- 1.2.2 The proposals comprise development of five residential units and associated infrastructure. Reference should be made to Figure 2 for a site layout plan.
- 1.2.3 Barnsley Metropolitan Borough Council (BMBC) have declared an Air Quality Management Area (AQMA) due to exceedences of the annual mean Air Quality Objective (AQO) for nitrogen dioxide (NO₂). The development is located within the AQMA. Subsequently, there are concerns that the proposals will introduce future residents to poor air quality. As such, concentrations at the site have been assessed in the following report in order to consider location suitability for the proposed end-use and define any requirement for mitigation. Potential impacts associated with the scheme have also been considered using standard screening methodologies.

2.0 LEGISLATION AND POLICY

2.1 European Directives

2.1.1 European Union (EU) air quality legislation is provided within Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidated previous legislation which was designed to deal with specific pollutants in a consistent manner and provided new Air Quality Limit Values (AQLVs) for particulate matter with an aerodynamic diameter of less than 2.5µm. The consolidated Directives include:

- Directive 1999/30/EC - the First Air Quality "Daughter" Directive - sets ambient AQLVs for NO₂, oxides of nitrogen (NO_x), sulphur dioxide, lead and particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀);
- Directive 2000/69/EC - the Second Air Quality "Daughter" Directive - sets ambient AQLVs for benzene and carbon monoxide; and,
- Directive 2002/3/EC - the Third Air Quality "Daughter" Directive - seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

2.1.2 The fourth daughter Directive was not included within the consolidation and is described as:

- Directive 2004/107/EC - sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK Legislation

2.2.1 The Air Quality Standards Regulations (2010) came into force on 11th June 2010 and transpose EU Directive 2008/50/EC into UK law. AQLVs were published in these regulations for 7 pollutants, as well as Target Values for an additional 5 pollutants.

2.2.2 Part IV of the Environment Act (1995) requires UK government to produce a national Air Quality Strategy (AQS) which contains standards, objectives and measures for improving ambient air quality. The most recent AQS was produced by the Department for

Environment, Food and Rural Affairs (DEFRA) and published in July 2007¹. The AQS sets out AQOs that 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 AQLVs, although the requirements for the determination of compliance vary.

2.2.3 Table 1 presents the AQOs for pollutants considered within this assessment.

Table 1 Air Quality Objectives

Pollutant	Air Quality Objective	
	Concentration ($\mu\text{g}/\text{m}^3$)	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

2.2.4 Table 2 summarises the advice provided in DEFRA guidance² 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

¹ The AQS for England, Scotland, Wales and Northern Ireland, DEFRA, 2007.

² Local Air Quality Management (TG16), DEFRA, 2018.

Averaging Period	Objective Should Apply At	Objective Should Not Apply At
24-hour mean	All locations where the annual mean objective would apply, together with hotels Gardens of residential properties	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 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

2.3 Local Air Quality Management

- 2.3.1 Under Section 82 of the Environment Act (1995) (Part IV) 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 AQMA. For each AQMA the LA is required to produce an Air Quality Action Plan, the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.4 National Planning Policy

- 2.4.1 The National Planning Policy Framework³ (NPPF) was published on 27th March 2012 and sets out the Government's core policies and principles with respect to land use planning, including air quality. The document includes the following considerations which are relevant to the proposed development:

³ NPPF, Department for Communities and Local Government, 2012.

"The planning system should contribute to and enhance the natural and local environment by: [...]"

Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability"

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

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

2.5 National Planning Practice Guidance

2.5.1 The National Planning Practice Guidance⁴ (NPPG) web-based resource was launched by the Department for Communities and Local Government on 6th March 2014 to support the NPPF and make it more accessible. The air quality pages are summarised under the following headings:

1. Why should planning be concerned about air quality?
2. What is the role of Local Plans 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 be relevant to a planning decision?
6. Where to start if bringing forward a proposal where air quality could be a concern?
7. How detailed does an air quality assessment need to be?
8. How can an impact on air quality be mitigated?
9. How do considerations about air quality fit into the development management process?

⁴ <http://planningguidance.planningportal.gov.uk>.

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

2.6 Local Planning Policy

- 2.6.1 The BMBC Local Development Plan consists of the Core Strategy, the Barnsley Education Sites Development Plan Document, the Joint Waste Plan and saved policies from the Unitary Development Plan (UDP). The Core Strategy⁵ was adopted in September 2011 and sets out the key elements of the planning framework for Barnsley. Review of the Core Strategy identified the following policies of relevance to this report:

"CSP 40 Pollution Control and Protection

Development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in air, surface water and groundwater, noise, smell, dust, vibration, light or other pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.

We will not allow development of new housing or other environmentally sensitive development where existing air pollution, noise, smell, dust, vibration, light or other pollution levels are unacceptable and there is no reasonable prospect that these can be mitigated against.

Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate."

"CSP 41 Development in Air Quality Management Areas

Development in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), or that any such harmful effects can be mitigated against.

⁵ Core Strategy, Local Development Framework, BMBC, 2011.

We will only allow residential development in air quality management areas, where the development provides an assessment that shows living conditions will be acceptable for future users.

We will only allow development in air quality management areas which could cause more air pollution, where the development provides an assessment that shows there will not be a significantly harmful effect on air quality."

2.6.2 The Core Strategy supersedes the majority of the Volume 1: Strategy, Policy and Justification UDP⁶. However, some policies have been saved until the adoption of the new Local Plan. Review of the UDP saved policies document identified the following policy of relevance to this report:

"Economic Development and Residential Amenity

Policy ED4

Proposals for economic development adjoining or close to housing will be assessed with particular regard to the likely impact on residential amenity in terms of:

a) Air Pollution including smell, fumes, smoke, soot, ash, dust or grit.

[...]"

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

⁶ Volume 1: Strategy, Policy and Justification, Barnsley UDP, BMBC, 2000.

3.0 BASELINE

3.1 Introduction

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

3.2 Local Air Quality Management

- 3.2.1 As required by the Environment Act (1995), BMBC has undertaken Review and Assessment of air quality within their area of jurisdiction. This process has indicated that annual mean concentrations of NO₂ are above the AQO within the borough. Six AQMAs are therefore currently declared, with the closest to the development described as:

"An area along the M1 between Junction 35a and Junction 38, including Haigh, Darton, Cawthorne Dike, Higham, Dodworth, Gilroyd, Rockley, Birdwell, and Tankersley. The area extends 100m either side of the central reservation."

- 3.2.2 The development is located within the AQMA. As such, there is the potential for the exposure of future occupants to poor air quality and vehicles travelling to and from the site to increase pollution levels in this sensitive area. These issues have been considered throughout the assessment.
- 3.2.3 BMBC 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.

3.3 Air Quality Monitoring

BMBC Monitoring Results

- 3.3.1 Monitoring of pollutant concentrations is undertaken by BMBC throughout their area of jurisdiction. Recent NO₂ results from the sites nearest to the development are shown in Table 3.

Table 3 BMBC Monitoring Results

Monitoring Site		Monitored NO ₂ Concentration (µg/m ³)	
		2015	2016
CM2	Barnsley A628 Roadside	39	36
CM3	Barnsley Gawber	19	19
DT14	Dodworth Road	49.8	49.2
DT18	Dodworth Road, West of Crossroads	44.4	36.9
DT19	Crown Hill Road	30.9	28.1
DT20	Dodworth Road, Pogmoor	44.7	43.4
DT21	Dodworth Road, Pogmoor	58.1	51.1
DT22	Dodworth Road, Pogmoor	53.2	52.7
DT23	Dodworth Road, Pogmoor	49.8	50.0
DT11	Dodworth Road	43.9	43.2
DT12	Dodworth Road	48.5	45.5
DT13	Traffic Lights Dodworth Rd	48.1	45.1
DT33	Westway	30.8	31.8

3.3.2 As shown in Table 3, annual mean NO₂ concentrations were above the AQO at several monitors in recent years. As the sites are positioned at roadside locations within an AQMA, exceedences would be anticipated.

3.3.3 BMBC do not undertake PM₁₀ monitoring within the vicinity of the development.

Local Monitoring Results

3.3.4 Monitoring of NO₂ concentrations was undertaken by Wardell Armstrong LLP within the vicinity of the M1 motorway during 2016. The results of this study were utilised within an Air Quality Assessment undertaken by Redmore Environmental⁷ for a residential development to the north of the site. The survey data is summarised in Table 4.

⁷ Air Quality Assessment, Keresforth Road, Dodworth (1943r2), Redmore Environmental, 2018.

Table 4 Local Monitoring Results

Monitoring Site	2016 Monitored NO ₂ Concentration (µg/m ³)
DTML1	29.73
DTML2	43.12
DTML3	32.10
DTML4	36.23

3.3.5 As shown in Table 4, annual mean NO₂ concentrations were above the annual mean AQO for NO₂ at DTML2. This was positioned in close proximity to the M1 slip road. Elevated levels would therefore be anticipated. All other locations recorded NO₂ concentrations below the relevant AQO.

3.3.6 Reference should be made to Figure 3 for a map of the survey sites.

3.3.7 It should be noted that the BMBC bias-adjustment factor of 0.87 was used to correct the monitoring results. Details regarding this procedure are provided within the Air Quality Assessment⁸ submitted as part of the planning application for the development to the north.

3.4 Background Pollutant Concentrations

3.4.1 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 grid square NGR: 432500, 404500. Data for this location was downloaded from the DEFRA website⁹ for the purpose of the assessment and is summarised in Table 5.

Table 5 Background Pollutant Concentration Predictions

Pollutant	Predicted Background Pollutant Concentration (µg/m ³)		
	2016	2018	2023
NO ₂	15.04	13.84	10.87

⁸ Air Quality Assessment, Keresforth Road, Dodworth (1943r2), Redmore Environmental, 2018.

⁹ <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015>.

Pollutant	Predicted Background Pollutant Concentration ($\mu\text{g}/\text{m}^3$)		
	2016	2018	2023
PM ₁₀	13.42	13.22	12.91

3.4.2 As shown in Table 5, predicted background NO₂ and PM₁₀ concentrations are below the relevant AQOs at the development site.

4.0 METHODOLOGY

4.1 Introduction

4.1.1 The proposed development has the potential to expose future occupants to poor air quality and increase pollution levels as a result of operational phase vehicle exhaust emissions. These have been assessed in accordance with the following methodology, which was discussed with Chris Shields, Technical Officer at BMBC, between 26th February and 23rd of March 2018.

4.1.2 BMBC have produced 'Air Quality and Emissions Good Practice Planning Guidance'¹⁰ which includes direction on when an air quality assessment will be required and the associated scope of works. The recommendations outlined in the document were applied as necessary throughout the assessment.

4.2 Potential Exposure

4.2.1 Dispersion modelling was undertaken in order to predict NO₂ and PM₁₀ concentrations across the site using the ADMS-Roads dispersion model (version 4.1.1.0). 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.

4.2.2 Modelling was undertaken for 2016 to allow verification against recent monitoring results and 2023 to allow consideration of cumulative impacts associated with other nearby developments.

4.2.3 The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;

¹⁰ Air Quality and Emissions Good Practice Planning Guidance, BMBC, 2014.

- Street width;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

4.2.4 These are detailed in the following Sections.

Assessment Area

4.2.5 Ambient concentrations were predicted over the area NGR: 432600, 404780 to 432780, 404890. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package.

4.2.6 It should be noted that although the grid only covered the proposed site, road links were extended in order to ensure the impact of all relevant vehicle emissions in the vicinity of the development were considered.

4.2.7 Reference should be made to Figure 4 for a graphical representation of the assessment grid extents.

Traffic Flow Data

4.2.8 Baseline traffic data for use in the assessment, including 24-hour Annual Average Daily Traffic (AADT) flows and fleet composition as Heavy Duty Vehicle (HDV) proportion, was obtained from a previous Air Quality Assessment¹¹ undertaken by Redmore Environmental for a site in the vicinity of the proposed development.

4.2.9 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 6.

¹¹ Air Quality Assessment, Keresforth Road, Dodworth (1943r2), Redmore Environmental, 2018.

Table 6 Traffic Data

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)		Road Width (m)	Mean Vehicle Speed (km/h)
		2016	2023	2016	2023		
L1	A628 Winby Road, West of Higham Lane	13,278	15,225	5.36	5.34	6.9	60
L2	A628 Winby Road, West of Higham Lane, Slow Phase (SP)	13,278	15,225	5.36	5.34	9.7	20
L3	A628 Winby Road, East of Higham Lane, SP	13,278	15,197	5.36	5.36	9.7	20
L4	A628 Winby Road, East of Higham Lane	13,278	15,197	5.36	5.36	7.3	60
L5	A628 Winby Road, West of Capitol Close, SP	13,278	15,197	5.36	5.36	9.7	20
L6	A628 Winby Road, South of Capitol Close Roundabout, Southbound (SB)	6,639	7,819	5.36	5.36	7.4	45
L7	A628 Winby Road, South of Capitol Close Roundabout, Northbound (NB)	6,639	7,819	5.36	5.36	6.8	45
L8	B6449 Barnsley Road, Between Roundabouts	9,300	10,981	8.90	8.51	7.8	45
L9	B6449 Barnsley Road, West of Roundabout, SP	9,300	10,981	8.90	8.51	8.8	20
L10	B6449 Barnsley Road	9,300	10,981	8.90	8.51	9.3	60
L11	A628 Winby Road, Eastbound (EB)	11,086	12,978	7.52	7.42	7.6	60
L12	A628 Winby Road, EB, SP	11,086	12,978	7.52	7.42	9.9	20
L13	A628 Winby Road, Westbound (WB)	11,086	12,978	7.52	7.42	6.9	60
L14	A628 Winby Road, WB, SP	11,086	12,978	7.52	7.42	6.9	20
L15	M1 NB Slip Road, North of Roundabout	5,052	5,808	4.60	4.52	6.3	80
L16	M1 NB, North of Roundabout	41,551	47,003	11.28	11.25	12.3	110
L17	M1 SB, North of Roundabout	43,784	49,486	12.96	12.94	11.4	110
L18	M1 SB Slip Road, North of Roundabout	6,251	7,106	6.70	6.63	6.6	80

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)		Road Width (m)	Mean Vehicle Speed (km/h)
		2016	2023	2016	2023		
L19	M1 SB Slip Road, North of Roundabout, SP	6,251	7,106	6.70	6.63	5.5	35
L20	M1 NB, Between Slip Roads	35,939	40,643	10.11	10.11	10.4	110
L21	M1 NB, South of Roundabout	45,458	51,412	9.67	9.66	11.3	110
L22	M1 SB, Between Slip Roads	37,533	42,385	14.00	14.00	10.2	110
L23	M1 SB, South of Roundabout	45,385	51,357	12.65	12.63	11.2	110
L24	M1 NB Slip Road, South of Roundabout	9,519	10,775	8.00	7.96	6.4	80
L25	M1 NB Slip Road, South of Roundabout, SP	9,519	10,775	8.00	7.96	6.2	35
L26	M1 SB Slip Road, South of Roundabout	8,843	10,051	8.00	7.94	6.9	80
L27	A628 Dodworth Road, EB	12,851	14,641	4.23	4.20	6.9	25
L28	A628 Dodworth Road, WB, SP	12,851	14,612	4.23	4.20	10.1	20
L29	A628 Dodworth Road	25,702	29,253	4.23	4.20	9.2	20
L30	A628 Dodworth Road, West of Broadway	25,702	29,253	4.23	4.20	9.3	20
L31	A628 Dodworth Road, West of Broadway, SP	25,702	29,253	4.23	4.20	9.2	20
L32	Pogmoor Road, SP	7,286	8,771	0.01	0.01	9.3	20
L33	Pogmoor Road	7,286	8,771	0.01	0.01	6.8	40
L34	A628 Dodworth Road, East of Broadway, SP	15,753	18,188	4.29	4.27	9	20
L35	A628 Dodworth Road, East of Broadway	15,753	18,188	4.29	4.27	9.9	30
L36	A6133 Broadway, SP	10,039	11,442	3.40	3.40	7.4	20
L37	A6133 Broadway	10,039	11,741	3.40	3.40	10.1	40
L38	A6133 Broadway Slip Road	2,008	2,528	3.40	3.40	4.2	20
L39	B6099 Station Road, North of Barnsley Road	7,347	8,451	1.50	1.48	6.6	60

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)		Road Width (m)	Mean Vehicle Speed (km/h)
		2016	2023	2016	2023		
L40	B6099 Station Road	7,347	8,518	1.50	1.46	6.5	40
L41	B6449 Barnsley Road, North of Station Road	9,300	10,981	8.90	8.51	7.3	45
L42	B6449 Barnsley Road, North of Station Road, SP	9,300	10,981	8.90	8.51	8.2	20
L43	B6099 High Street, SP	7,385	9,060	2.60	2.39	11.8	20
L44	B6099 High Street	7,385	9,060	2.60	2.39	9.6	45
L45	B6099 Keresforth Road, Between Water Royd and Rose Hill	6,629	7,802	1.79	1.72	9.3	45
L46	B6099 Keresforth Road, Between Woodend Court and Water Royd Drive	6,410	7,779	1.78	1.66	7.2	45
L47	B6099 Keresforth Road, Between Gilroyd Lane and Woodend Court	6,410	7,779	1.78	1.66	10.1	45
L48	B6099 Keresforth Road, East of Gilroyd Lane	7,912	9,377	2.73	2.60	7.2	65
L49	B6099 Keresforth Road, East of Gilroyd Lane, SP	7,912	9,377	2.73	2.60	7.2	20
L50	A6133, East of Keresforth Road, SP	11,015	12,886	7.64	7.42	21.5	20
L51	A6133, East of Keresforth Road	11,015	12,886	7.64	7.42	18	45
L52	A6133, West of Racecommon Road, SP	11,015	12,886	7.64	7.42	18	20
L53	A6133 Par, East of Racecommon Road, SP	11,015	12,549	7.64	7.53	14.9	20
L54	A6133, East of Racecommon Road	11,015	12,549	7.64	7.53	7.5	45
L55	Racecommon Road, North of Park Road, SP	6,515	7,569	6.36	6.20	9	20
L56	Racecommon Road, North of Park Road	6,515	7,569	6.36	6.20	8.4	45
L57	Racecommon Road, Approach to A628 Roundabout, SP	6,515	7,569	6.36	6.20	16.1	20

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)		Road Width (m)	Mean Vehicle Speed (km/h)
		2016	2023	2016	2023		
L58	A6133 Broadway, North of Assembly Road	10,039	11,741	3.40	3.40	16.8	60
L59	A6133 Broadway, North of Assembly Road SP	10,039	11,741	3.40	3.40	16.8	20
L60	A6133 Broadway, South of Assembly Road	10,039	11,577	3.40	3.40	17.2	60
L61	A6133 Broadway, West of Keresforth Road, SP	10,039	11,577	3.40	3.40	22.2	20
L62	A628 Dodworth Road, East of Grosvenor Drive	15,753	18,188	4.29	4.27	9.2	30
L63	A628 Dodworth Road, West of Racecommon Road, SP	15,753	18,188	4.29	4.27	18.9	20
L64	Rosehill Drive, West of Bark Meadows	303	1,034	0.00	0.00	6.4	35
L65	Rosehill Drive, East of Bark Meadows	280	838	1.67	0.62	6.3	35
L66	A6133 Broadway	10,039	11,741	3.40	3.40	9.7	60
L67	A628 Westway EB	14,404	16,508	2.69	2.67	6.8	40
L68	A628 Westway EB, SP	14,404	16,508	2.69	2.67	7.3	20
L69	A628 Westway WB	14,404	16,508	2.69	2.67	7.3	40
L70	A628 Westway WB, SP	14,404	16,508	2.69	2.67	7.7	20
L71	A6133 Broadway, South of Assembly Road, SP	10,039	11,577	3.40	3.40	16.8	20
L72	A628 Dodworth, East of Shaw Lane, 1	15,753	18,188	4.29	4.27	7.2	30
L73	A628 Dodworth, East of Shaw Lane, 2	15,753	18,188	4.29	4.27	7.2	30
L74	A628 Dodworth, West of Racecommon Road, 3	15,753	18,188	4.29	4.27	13.4	20
R1	A628 Whinby Road/Higham Lane Roundabout	13,278	15,005	5.36	5.35	9.2	30
R2	A628 Whinby Road/Capitol Close Roundabout	13,278	15,469	5.36	5.36	9.3	30

Link		24-hour AADT Flow		HDV Proportion of Fleet (%)		Road Width (m)	Mean Vehicle Speed (km/h)
		2016	2023	2016	2023		
R3	B6449 Roundabout	9,300	10,652	8.90	8.70	5.9	30
R4	A628 Whinby Road/B6449 Roundabout Roundabout	14,917	17,332	7.52	7.41	10.2	30
R5	M1 Roundabout	12,923	15,101	8.00	7.87	8.7	35
R6	A628 Roundabout	17,025	19,418	6.36	6.32	9.2	30
L75	M1 NB, Noise Barrier Section 1	45,458	51,412	9.67	9.66	11.2	110
L76	M1 NB, Noise Barrier Section 2	45,458	51,412	9.67	9.66	11.2	110
L77	M1 NB, Noise Barrier Section 3	45,458	51,412	9.67	9.66	11.2	110
L78	M1 NB, South of Site	45,458	51,412	9.67	9.66	11.2	110
L79	M1 SB, Noise Barrier Section 1	45,385	51,357	12.65	12.63	11.2	110
L80	M1 SB, Noise Barrier Section 2	45,385	51,357	12.65	12.63	11.2	110
L81	M1 SB, Noise Barrier Section 3	45,385	51,357	12.65	12.63	11.2	110
L82	M1 SB, South of Site	45,385	51,357	12.65	12.63	11.2	110

4.2.10 Reference should be made to Figure 4 for a graphical representation of the road link locations.

Noise Barrier

4.2.11 Developments located in close proximity to sources of noise pollution, such as road traffic, may be required to incorporate acoustic mitigation. This could be in the form of a barrier, which is positioned between the source and sensitive location. Subsequently, this has the potential to provide a beneficial air quality effect due to the obstruction of emissions from the highway network.

4.2.12 ADMS-Roads incorporates a noise barrier module which allows a number of parameters to be included in the dispersion model in order to predict pollutant dispersion patterns which better reflect air flow with a noise barrier in place.

4.2.13 It is proposed to incorporate an acoustic barrier along the eastern boundary of the development in order to mitigate noise arising from the M1 motorway. This has therefore been incorporated into the model. The parameters used in the assessment are outlined in Table 7.

Table 7 Noise Barrier Parameters

Link	Parameter	
	Height (m)	Distance from Road Centre Line (m)
L75	3.0	34
L76	3.0	30
L77	3.0	27
L79	3.0	45
L80	3.0	42
L81	3.0	38

Emission Factors

4.2.14 Emission factors for each link were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 8.0.1). This has been produced by DEFRA and incorporates COPERT5 vehicle emission factors and fleet information.

4.2.15 There is current uncertainty over NO₂ concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2016 emission factors were utilised in preference to the development future year in order to provide robust concentration predictions. As predictions for 2016 were verified, it is considered the results are an indication of worst case concentrations during the operation of the proposals.

Meteorological Data

4.2.16 Meteorological data used in the assessment was taken from Robin Hood Airport meteorological station over the period 1st January 2016 to 31st December 2016 (inclusive). Robin Hood Airport is located at NGR: 465930, 398920 which is approximately 33.9km east of the development. 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.

- 4.2.17 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 4 for a wind rose of the utilised meteorological data.

Roughness Length

- 4.2.18 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 value of z_0 is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'cities, woodlands'.
- 4.2.19 A z_0 of 0.2m was used to describe the meteorological site. This value of z_0 is considered appropriate for the morphology of the area and is suggested within ADMS-Roads as being suitable for 'agricultural areas (min)'.

Monin-Obukhov Length

- 4.2.20 The Monin-Obukhov length provides a measure of the stability of the atmosphere. A minimum Monin-Obukhov length of 30m 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 'cities and large towns'.
- 4.2.21 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 'rural location'.

Background Concentrations

- 4.2.22 A review of DEFRA data and local monitoring results was undertaken in order to identify an appropriate background value for use in the assessment. This indicated the annual mean NO₂ concentration recorded at the CM3 - Barnsley Gawber automatic station during 2016 was 19.00µg/m³, higher than the DEFRA background of 15.04µg/m³. As such, the monitoring result was used in order to provide worst-case predictions.

4.2.23 A PM₁₀ background concentration of 13.42µg/m³ for use in the assessment was obtained from the DEFRA mapping study for the grid square containing the development site, as shown in Table 5.

4.2.24 Similarly to emission factors, background concentrations from 2016 were utilised in preference to the development future year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

NO_x to NO₂ Conversion

4.2.25 Predicted annual mean NO_x concentrations were converted to NO₂ concentrations using the spreadsheet (version 6.1) provided by DEFRA, which is the method detailed within DEFRA guidance¹².

Verification

4.2.26 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.

4.2.27 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.

4.2.28 For the purpose of the assessment model verification was undertaken for 2016 using traffic data, meteorological data and monitoring results from this year.

¹² Local Air Quality Management (TG16), DEFRA, 2018.

Verification Factor Calculation

4.2.29 Monitoring of NO₂ concentrations was undertaken at 16 locations within the modelling extents during 2016. Results from the survey sites were obtained and the road contributions to total NO_x concentrations calculated following the methodology contained within DEFRA guidance¹³. The monitored annual mean NO₂ concentrations and calculated road NO_x concentrations are summarised in Table 8.

Table 8 Verification - Monitoring Result

Monitoring Location		Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO _x Concentration (µg/m ³)
CM2	Barnsley A628 Roadside	36.0	35.14
DT14	Dodworth Road	49.2	67.01
DT18	Dodworth Road, West of Crossroads	36.9	37.18
DT19	Crown Hill Road	28.1	18.08
DT20	Dodworth Road, Pogmoor	43.4	52.46
DT21	Dodworth Road, Pogmoor	51.1	71.96
DT22	Dodworth Road, Pogmoor	52.7	76.21
DT23	Dodworth Road, Pogmoor	50.0	69.08
DT11	Dodworth Road	43.2	51.97
DT12	Dodworth Road	45.5	57.62
DT13	Traffic Lights Dodworth Rd	45.1	56.63
DT33	Westway	31.8	25.90
DTML1	Diffusion Tube Monitor Location 1	29.7	21.49
DTML2	Diffusion Tube Monitor Location 2	43.1	51.77
DTML3	Diffusion Tube Monitor Location 3	32.1	26.54
DTML4	Diffusion Tube Monitor Location 4	36.2	35.67

¹³ Local Air Quality Management (TG16), DEFRA, 2018.

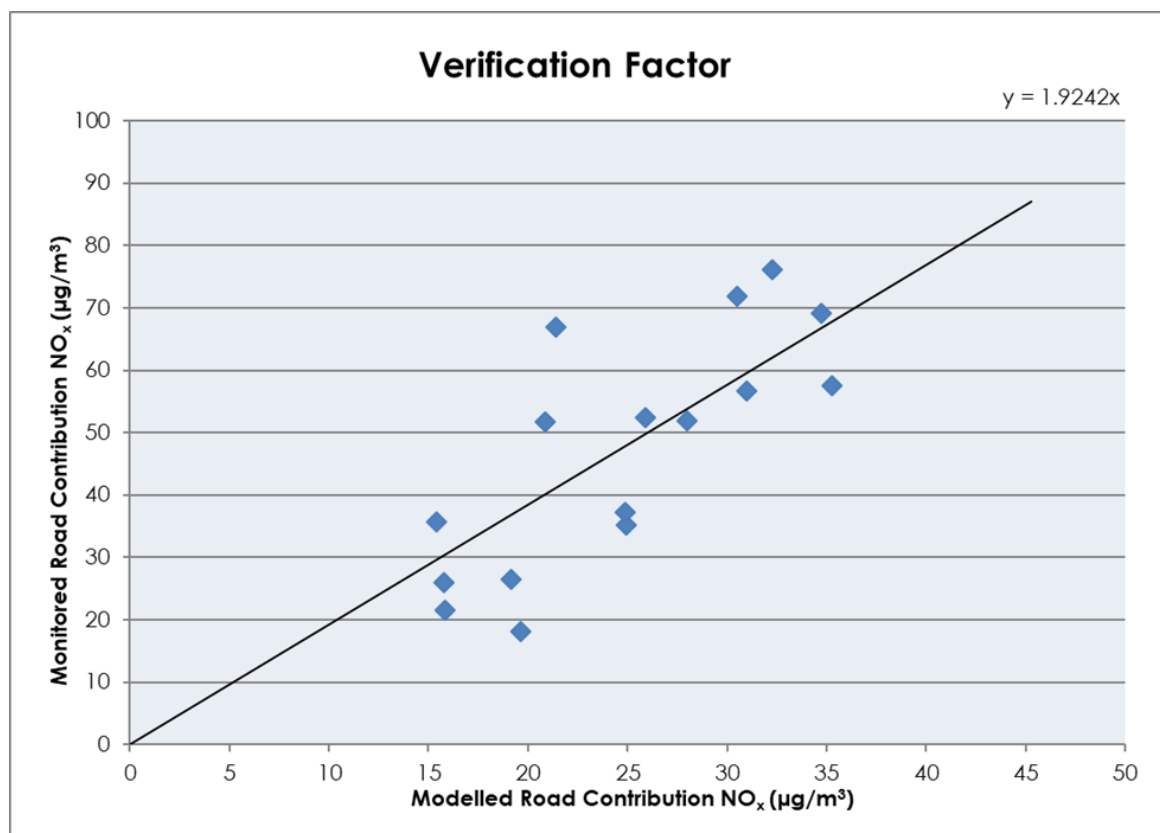
4.2.30 The annual mean road NO_x concentrations predicted from the dispersion model and the calculated 2016 road NO_x monitoring results are summarised in Table 9.

Table 9 Verification - Modelling Result

Monitoring Location		Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
CM2	Barnsley A628 Roadside	35.14	24.93
DT14	Dodworth Road	67.01	21.42
DT18	Dodworth Road, West of Crossroads	37.18	24.88
DT19	Crown Hill Road	18.08	19.64
DT20	Dodworth Road, Pogmoor	52.46	25.89
DT21	Dodworth Road, Pogmoor	71.96	30.53
DT22	Dodworth Road, Pogmoor	76.21	32.26
DT23	Dodworth Road, Pogmoor	69.08	34.76
DT11	Dodworth Road	51.97	28.00
DT12	Dodworth Road	57.62	35.28
DT13	Traffic Lights Dodworth Rd	56.63	30.99
DT33	Westway	25.90	15.79
DTML1	Diffusion Tube Monitor Location 1	21.49	15.85
DTML2	Diffusion Tube Monitor Location 2	51.77	20.89
DTML3	Diffusion Tube Monitor Location 3	26.54	19.15
DTML4	Diffusion Tube Monitor Location 4	35.67	15.38

4.2.31 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 1.9242 was required to be applied to all road NO_x modelling results, as shown in Graph 1.

Graph 1 Verification Factor



4.2.32 Monitoring of PM₁₀ concentrations is not undertaken within the assessment extents. The NO_x verification factor was therefore used to adjust model predictions of these species in accordance with DEFRA guidance¹⁴.

Comparison Between Measured and Modelled NO₂ Concentrations

4.2.33 The difference between the measured and modelled NO₂ calculations at each survey location was calculated. This is summarised in Table 10.

Table 10 Comparison Between Measured and Modelled NO₂ Concentrations

Survey Location	Measured NO ₂ Concentration (µg/m³)	Modelled NO ₂ Concentration (µg/m³)	Difference between Measured and Modelled Values (%)
CM2	36.0	41.54	+15.39

¹⁴ Local Air Quality Management (TG16), DEFRA, 2018.

Survey Location	Measured NO ₂ Concentration (µg/m ³)	Modelled NO ₂ Concentration (µg/m ³)	Difference between Measured and Modelled Values (%)
DT14	49.2	38.66	-21.42
DT18	36.9	41.49	+12.44
DT19	28.1	37.17	+32.28
DT20	43.4	42.31	-2.51
DT21	51.1	45.95	-10.08
DT22	52.7	47.27	-10.30
DT23	50.0	49.15	-1.70
DT11	43.2	43.98	+1.81
DT12	45.5	49.54	+8.88
DT13	45.1	46.30	+2.66
DT33	31.8	33.86	+6.48
DTML1	29.7	33.92	+14.08
DTML2	43.1	38.22	-11.36
DTML3	32.1	36.76	+14.52
DTML4	36.2	33.50	-7.54

4.2.34 As shown in Table 10, further to verification, modelled NO₂ concentrations at 15 of the 16 survey locations are within 25% of the measured value.

4.2.35 The Root Mean Squared Error (RMSE) has been calculated to define the average error or uncertainty of the model. In accordance with DEFRA guidance¹⁵, if the RMSE value is higher than +/- 25% of the AQO being assessed, it is recommended that the model inputs and verification is revisited in order to make improvements. The annual mean AQO of relevance to the assessment is 40µg/m³. As such, a RMSE value of +/-10µg/m³ is required in order to have confidence in the predicted values. The RMSE calculated for the study is 4.98µg/m³, the model is therefore considered to be performing to an acceptable standard.

¹⁵ Local Air Quality Management (TG16), DEFRA, 2018.

4.3 **Potential Development Impacts**

4.3.1 The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the site during the operational phase. A screening assessment was therefore undertaken using the criteria contained within the Highways Agency 'Design Manual for Roads and Bridges' (DMRB)¹⁶ and Institute of Air Quality Management (IAQM) 'Land-Use Planning & Development Control: Planning for Air Quality'¹⁷ guidance documents to determine the potential for trips generated by the development to affect local air quality.

4.3.2 The DMRB¹⁸ provides the following criteria for determination of road links potentially affected by changes in traffic flow:

- AADT flows change by 1,000 or more;
- Daily HDV AADT flows change by 200 or more;
- Daily average speed changes by 10km/hr or more; or,
- Peak hour speed changes by 20km/hr or more.

4.3.3 The IAQM 'Land-Use Planning & Development Control: Planning for Air Quality' guidance¹⁹ document provides the following criteria to help establish when an assessment of potential impacts on the local area is likely to be considered necessary:

- A change of Light Duty Vehicle (LDV) flows of more than 100 AADT within or adjacent to an AQMA or more than 500 AADT elsewhere;
- A change of HDV flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere;
- Realignment of roads where the change is 5m or more and the road is within an AQMA; or,
- Introduction of a new junction or removal of an existing junction near to relevant receptors.

¹⁶ DMRB Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

¹⁷ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

¹⁸ DMRB Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

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

- 4.3.4 Should these criteria not be met, then the DMRB²⁰ and IAQM guidance²¹ documents consider air quality impacts associated with a scheme to be **negligible** and no further assessment is required.
- 4.3.5 Should screening of the relevant data indicate that any of the above criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the change in pollutant concentrations as a result of the proposed development. The significance of predicted impacts can then be determined in accordance with the methodology outlined in the IAQM guidance²².

²⁰ DMRB Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

²¹ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

²² Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

5.0 **ASSESSMENT**

5.1 **Introduction**

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

5.2 **Potential Exposure**

5.2.1 The proposed development has the potential to cause exposure of future occupants to elevated pollution levels. Dispersion modelling was therefore undertaken with the inputs described in Section 4.0 to quantify air quality conditions at the development location.

5.2.2 Modelling was undertaken to predicted pollutant concentrations at five discrete receptor points representing the closest residential properties to the M1 motorway. A graphical representation of the positions is shown in Figure 6.

5.2.3 A summary of predicted annual mean NO₂ and PM₁₀ concentrations at the Proposed Receptor (PR) locations is shown in Table 11.

Table 11 Annual Mean NO₂ and PM₁₀ Concentrations at Proposed Receptor Locations

Receptor	NGR (m)		Predicted Annual Mean NO ₂ Concentration (µg/m ³)	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)
	X	Y		
PR1	432635.5	404847.9	35.47	15.24
PR2	432650.4	404849.1	38.42	15.55
PR3	432657.5	404830.2	38.21	15.56
PR4	432657.4	404809.6	37.19	15.55
PR5	432629.1	404814.7	33.97	15.21

5.2.4 As shown Table 11, predicted annual mean NO₂ and PM₁₀ concentrations are below the relevant AQOs at the PR locations.

5.2.5 Graphical representations of pollutant levels across the site are shown in Figures 7 and 8. These indicate predicted concentrations of NO₂ and PM₁₀ are below the relevant AQOs at all residential unit locations.

5.2.6 It should be noted the predicted NO₂ and PM₁₀ concentrations are likely to be over-estimated due to the following reasons:

- 2016 background concentrations and emission factors were utilised within the future year scenario. This assumes no improvement in ambient air quality between the verification year of 2016 and future year of 2023; and,
- The M1 carriageway is below the development site. This provides an increased distance between the emission source and location of proposed residential units, as well as containment of pollutants within the cutting. This effect has not been considered within the modelling assessment. As such, the predicted concentrations are likely to be higher than actual concentrations.

5.2.7 Due to the over factors, the assessment provides worst-case predictions of future air quality conditions at the development location. The results are therefore considered to be sufficiently robust.

5.3 Potential Development Impacts

5.3.1 Any additional vehicle movements associated with the development will generate exhaust emissions on the local and regional road networks. Predicted trip generation was not available to inform the assessment. However, the proposals include only 5 units. It is therefore considered that changes in traffic flow as a result of vehicles travelling to and from the scheme are unlikely to be significant.

5.3.2 Based on the above information, the development is not anticipated to result in a change in AADT flows of more than 1,000, produce over 200 HDV movements per day or significantly affect average speeds on the local road network. Additionally, the development is not anticipated to result in a change of LDV flows of more than 100 AADT within or adjacent to the AQMA, the proposals do not include road realignment or the introduction of a junction and there will not be a requirement for more than 25 HDV deliveries per day. As such, potential air quality impacts associated with operational

phase road vehicle exhaust emissions are predicted to be **negligible**, in accordance with the DMRB²³ and IAQM²⁴ screening criteria shown in Section 3.3.

Mitigation

5.3.3 A number of mitigation measures have been proposed following the methodology provided within the BMBC 'Air Quality and Emissions Good Practice Planning Guidance'²⁵ document. Review of the relevant criteria indicated the proposals were classified as **minor** as they fall below the threshold for the following category:

- Dwellings for individuals, families or not more than six people in a single household - threshold of greater than 50 units.

5.3.4 The guidance²⁶ subsequently provides mitigation options that should be included on all minor scale developments. These were reviewed and the following proposed for inclusion within the development:

- Incorporation of green infrastructure through supplementary landscape planting along the eastern development boundary;
- Provision of one electric vehicle (EV) charging point per dwelling; and,
- Consideration of air quality conditions when designing the site layout to allow a suitable stand-off distance between the M1 and property facades to limit exposure of future residents to road vehicle exhaust emissions.

5.3.5 Taking into account the above information, the proposals are considered to address the requirements of the BMBC air quality guidance²⁷.

²³ DMRB Volume 11, Section 3, Part 1, HA207/07, Highways Agency, 2007.

²⁴ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

²⁵ Air Quality and Emissions Good Practice Planning Guidance, BMBC, 2014.

²⁶ Air Quality and Emissions Good Practice Planning Guidance, BMBC, 2014.

²⁷ Air Quality and Emissions Good Practice Planning Guidance, BMBC, 2014.

6.0 CONCLUSION

- 6.1.1 Redmore Environmental Ltd was commissioned by PB Planning Ltd to undertake an Air Quality Assessment in support of a residential development on Keresforth Hill Road, Dodworth.
- 6.1.2 The development may lead to the exposure of future occupants to elevated pollution levels, as well as adverse air quality effects at sensitive locations. As such, an Air Quality Assessment was required in order to determine baseline conditions, consider site suitability for the proposed end-use and assess potential impacts as a result of the scheme.
- 6.1.3 Dispersion modelling was undertaken in order to predict pollutant concentrations across the proposed development site as a result of emissions from the local highway network. Outputs were subsequently verified using local monitoring data.
- 6.1.4 The results of the dispersion modelling assessment indicated that predicted annual mean NO₂ and PM₁₀ concentrations were below the relevant AQOs at all PR locations. As such, the site is considered suitable for the proposed use from an air quality perspective.
- 6.1.5 During the operational phase of the development there is the potential for air quality impacts as a result of traffic exhaust emissions associated with vehicles travelling to and from the site. These were assessed against the screening criteria provided within the DMRB and IAQM guidance documents. Due to the limited number of anticipated vehicle trips associated with the proposals, road traffic exhaust impacts were predicted to be **negligible**.
- 6.1.6 Based on the assessment results, air quality factors are not considered a constraint to planning consent for the development.

7.0 **ABBREVIATIONS**

AADT	Annual Average Daily Traffic
ADM	Atmospheric Dispersion Modelling
AQLV	Air Quality Limit Value
AQMA	Air Quality Management Area
AQO	Air Quality Objective
AQS	Air Quality Strategy
BMBC	Barnsley Metropolitan Borough Council
CERC	Cambridge Environmental Research Consultants
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
EB	Eastbound
EU	European Union
EV	Electric Vehicle
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LAQM	Local Air Quality Management
LDV	Light Duty Vehicle
NB	Northbound
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NPPG	National Planning Policy Guidance
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
PR	Proposed Receptor
RMSE	Root Mean Squared Error
UDP	Unitary Development Plan
SB	Southbound
SP	Slow Phase
WB	Westbound
Z ₀	Roughness length

Figures



Legend



Site Boundary

Title

Figure 1 - Site Location Plan

Project

Air Quality Assessment
Keresforth Hill Road, Dodworth

Project Reference

2100

Client

PB Planning Ltd

Contains Ordnance Survey Data
© Crown Copyright and Database Act 2016



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



Legend

Title
Figure 2 - Site Layout Plan

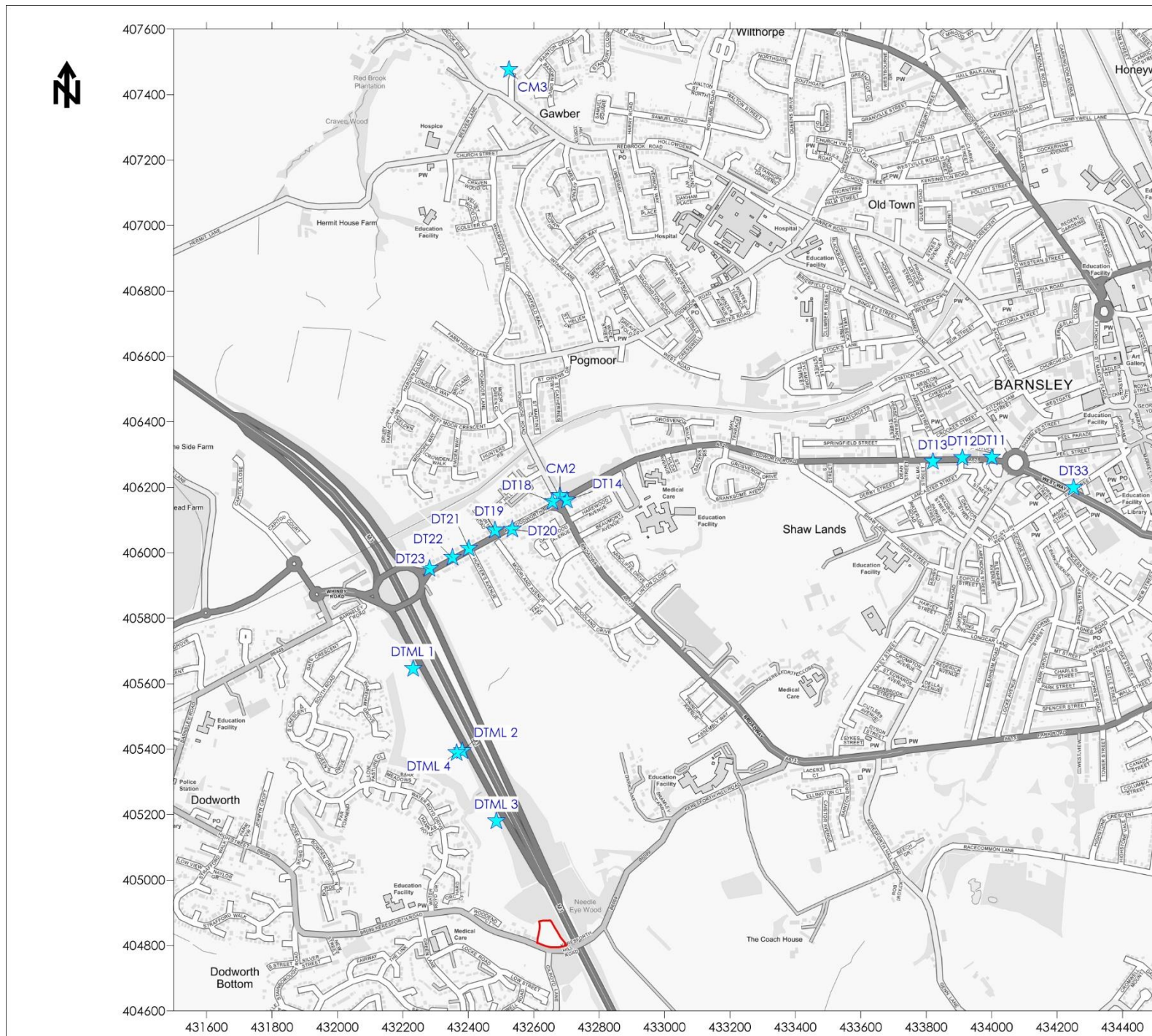
Project
Air Quality Assessment
Keresforth Hill Road, Dodworth

Project Reference
2100

Client
PB Planning Ltd



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



Legend



Site Boundary



Monitor

Title

Figure 3 - Monitoring Locations

Project

Air Quality Assessment
Keresforth Hill Road, Dodworth

Project Reference

2100

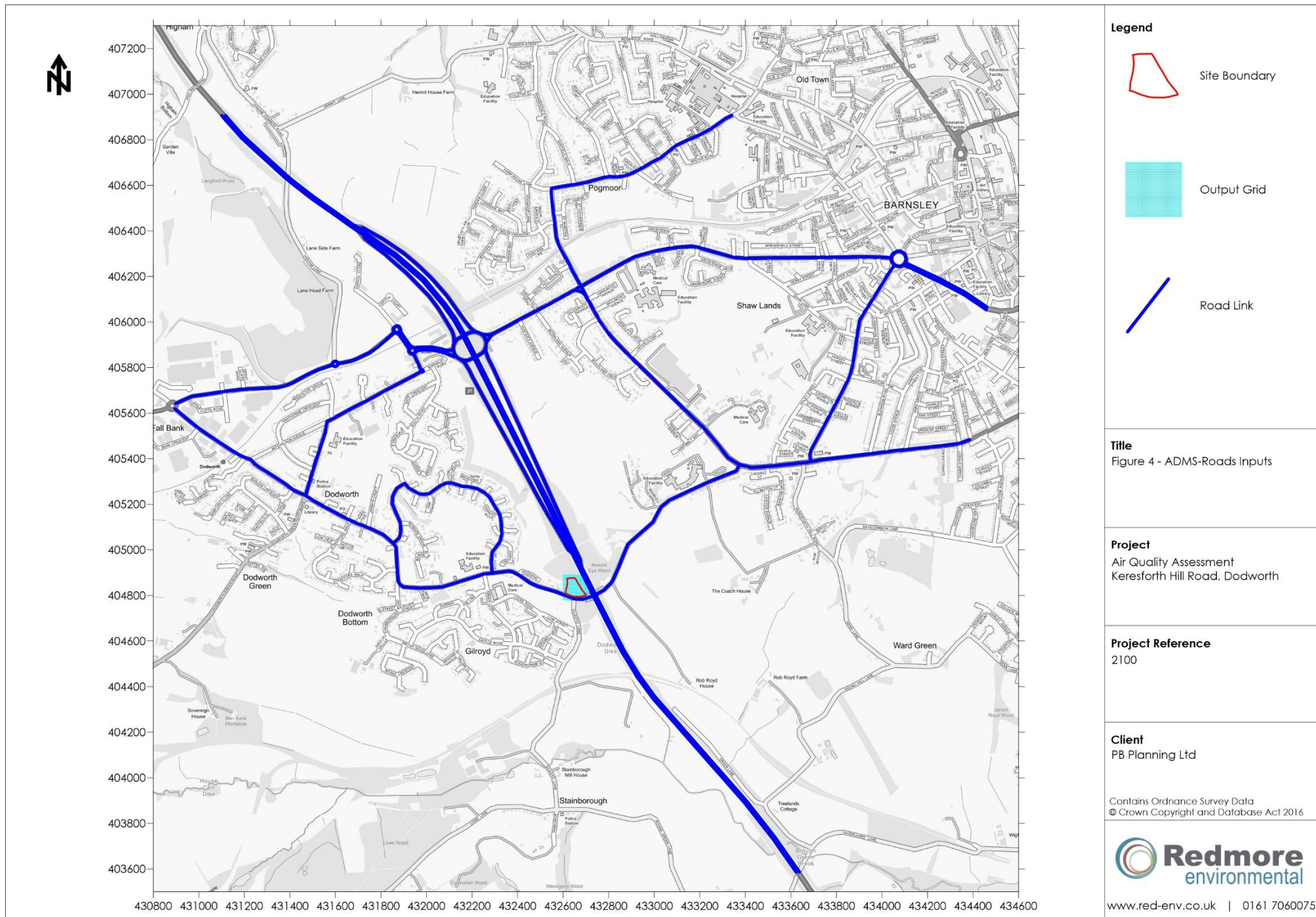
Client

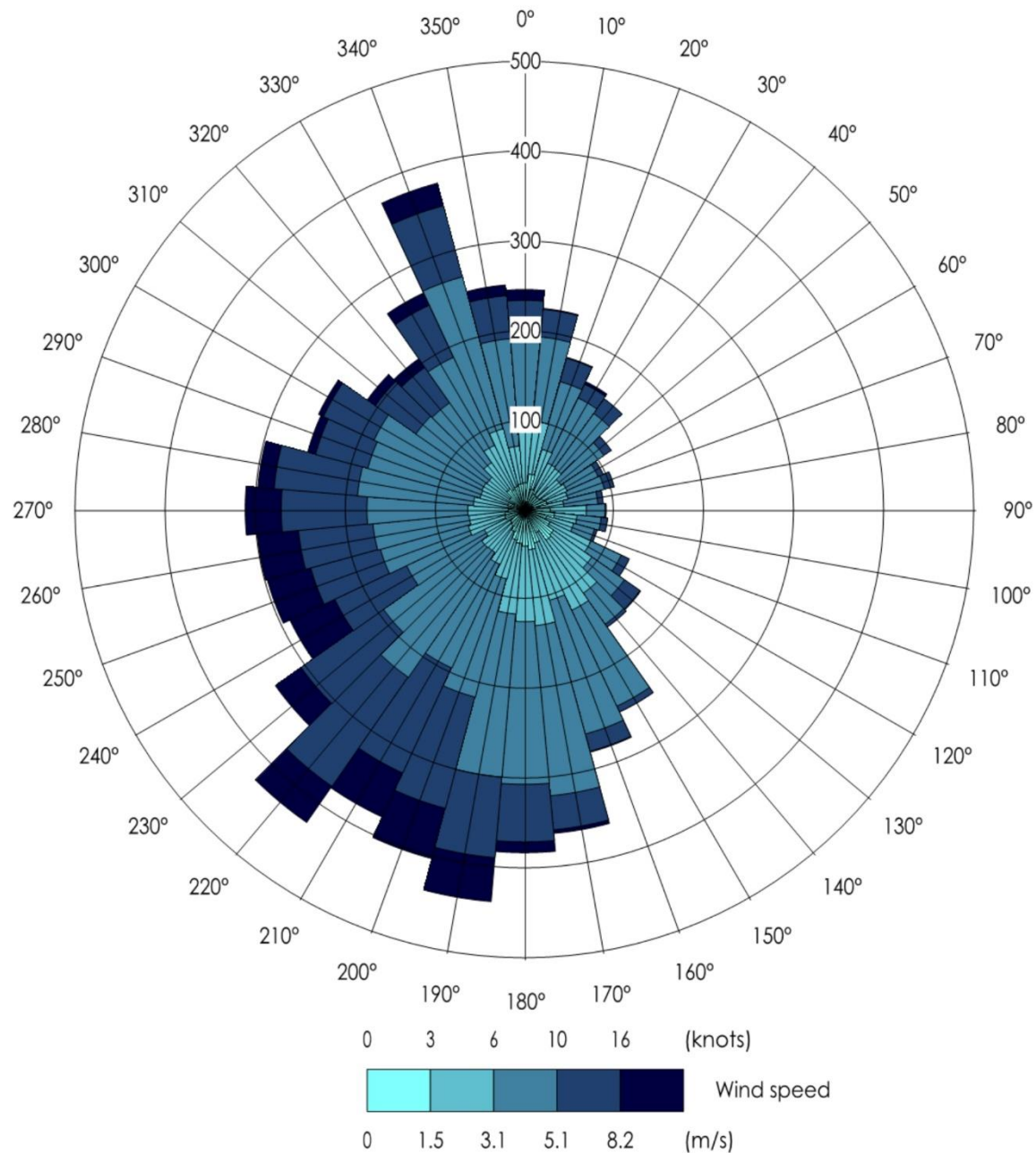
PB Planning Ltd

Contains Ordnance Survey Data
© Crown Copyright and Database Act 2016



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





Legend

Title

Figure 5 - Wind Rose of 2016
Robin Hood Airport
Meteorological Data

Project

Air Quality Assessment
Keresforth Hill Road, Dodworth

Project Reference

2100

Client

PB Planning Ltd

