Harworth Group

Land at Hay Green Lane, Birdwell

Air Quality Assessment

April 2020

Executive Park, Avalon Way, Anstey, Leicester, LE7 7GR

[redacted]

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Executive Summary

WYG has undertaken an Air Quality Assessment to support an application for a proposed residential development at land at Hay Green Lane, Birdwell.

Construction Phase

The potential effects during the demolition and construction phases include fugitive dust emissions from site activities, such as earthworks, construction and trackout. The impacts during the operational phase take into account exhaust emissions from additional road traffic generated due to the proposed development.

During the construction phase, site specific mitigation measures detailed within this assessment will be implemented. With these mitigation measures in place, the effects from the construction phase are not predicted to be significant.

Operational Phase

An operational year assessment for 2022 traffic emissions has been undertaken to assess the effects of Proposed Development.

The maximum predicted annual average exposure to NO_2, PM_{10} and $PM_{2.5}$ at any proposed residential receptor is below the annual average AQO and therefore no additional mitigation is required.

The assessment of the impact description of the effects associated with the proposed development, with respect to NO_2, PM_{10} and $PM_{2.5}$ exposure, the impact description of the proposed development is determined 'negligible' for all identified existing sensitive receptors. The effect on ecological receptors has been assessed and is determined to be 'negligible'.

1. Introduction

Harworth Group commissioned WYG Environment to prepare an Air Quality Assessment to support an application for a proposed employment development at land at Hay Green Lane, Birdwell.

1.1 Site Location and Context

The approximate United Kingdom National Grid Reference (NGR) is approximately 434874, 401389. The Site is bounded to the north and west by residential properties, and to the south and east by open farmland.

Reference should be made to Figure 8.1 for a map of the proposed development site and surrounding area.

The following assessment stages have been undertaken as part of this assessment:

- Baseline evaluation;
- Assessment of potential air quality impacts during the construction phase;
- Assessment of potential air quality impacts during the operational phase; and,
- Identification of mitigation measures (as required).

The results of the assessment are detailed in the following sections of this report.

The construction phase assessment considers the potential effects of dust and particulate emissions from site activities and materials movement based on a qualitative risk assessment method based on the Institute of Air Quality Management's (IAQM) 'Guidance on the Assessment of Dust from Demolition and Construction' document, published in 2014.

The assessment of the potential air quality impacts that are associated with the operational phase has focused on the predicted impact of changes in ambient nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 µm (PM_{10}) and less than 2.5 µm ($PM_{2.5}$) as a result of the development at key local receptor locations. The changes have been referenced to EU air quality limits and UK air quality objectives and the magnitude and significance of the changes have been referenced to non-statutory guidance issued by the IAQM and Environmental Protection UK (EPUK).

2. Policy and Legislative Context

2.1 Documents Consulted

The following documents were consulted during the undertaking of this assessment:

Legislation and Best Practice Guidance

- National Planning Policy Framework, Ministry for Housing, Communities and Local Government, Revised February 2019;
- Planning Practice Guidance: Air Quality, Ministry for Housing, Communities and Local Government, November 2019;
- The Air Quality Standards Regulations (Amendments), 2016;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG16, Defra, 2018;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, LA 105 Air quality, November 2019;
- Guidance on the Assessment of Dust from Demolition and Construction, IAQM, 2014.
- Land-Use Planning & Development Control: Planning for Air Quality, EPUK & IAQM, 2017;
- Guidance on Monitoring in the Vicinity of Demolition and Construction Sites, IAQM, October 2018; and,
- A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites (Version 1.0), IAQM, June 2019.

Websites Consulted

- Google maps (maps.google.co.uk);
- The UK National Air Quality Archive (www.airquality.co.uk);
- Department for Transport Matrix (www.dft.go.uk/matrix);
- emapsite.com;
- Multi-Agency Geographic Information for the Countryside (http://magic.defra.gov.uk/);
- Planning Practice Guidance (http://planningguidance.planningportal.gov.uk/); and
- Barnsley Metropolitan Borough Council (http://www.barnsley.gov.uk/).

Site Specific Reference Documents

- Barnsley Metropolitan Borough Council, 2018 Air Quality Annual Status Report (Published June 2018);
- Barnsley Metropolitan Borough Council, Air Quality and Emissions Good Practice Planning Guidance (October 2018); and,
- Barnsley Metropolitan Borough Council: Local Plan, Adopted January 2019.

2.2 Air Quality Legislative Framework

European Legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- **Directive 1999/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for NO_2 and oxides of nitrogen, sulphur dioxide, lead and PM_{10};
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values 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.

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.

UK Legislation

The Air Quality Standards Regulations (Amendments 2016) seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive within the UK. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2010 No. 1001, Part 7 Regulation 31 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK Air Quality Strategy is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution.

For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. Adopted national standards are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) and have been translated into a set of Statutory Objectives within the Air Quality (England) Regulations (2000) SI 928, and subsequent amendments.

The AQOs for pollutants included within the Air Quality Strategy and assessed as part of the scope of this report are presented in Table 2.1 and Table 2.2 long with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 2.1 Human Health Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as[10]	Date to be achieved and maintained thereafter	European Obligations	Date to be achieved and maintained thereafter	New or existing
PM_{10}	UK	50µg/m³ by end of 2004 (max 35 exceedances a year)	24-hour Mean	1st January 2005	50µg/m³ by end of 2004 (max 35 exceedances a year)	1st January 2005	Retain Existing
	UK	40µg/m³ by end of 2004	Annual Mean	1st January 2005	40µg/m³	1st January 2005	
$PM_{2.5}$	UK	25µg/m³	Annual Mean	31st December 2010	25µg/m³	1st January 2010	Retain Existing
NO_2	UK	200µg/m³ not to be exceeded more than 18 times a year	1-Hour Mean	31st December 2005	200µg/m³ not to be exceeded more than 18 times a year	1st January 2010	Retain Existing
	UK	40µg/m³	Annual Mean	31st December 2005	40µg/m³	1st January 2010	

Table 2.2 Ecological Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as[10]
NO_x	UK	30µg/m³	Annual Mean

Within the context of this assessment, the annual mean objectives are those against which facades of residential receptors will be assessed and the short-term objectives apply to all other receptor locations, where people may be exposed over a short duration, both residential and non-residential such as using gardens, balconies, walking along streets, using playgrounds, footpaths or external areas of employment uses.

Local Air Quality Management

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 assessing present and likely future air quality against the AQOs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) 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.

2.3 Planning and Policy Guidance

National Policy

The National Planning Policy Framework (NPPF), revised February 2019, principally brings together and summarises the suite of Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) which previously guided planning policy making. The NPPF states that:

> *'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 or 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 or 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'*

The Planning Practice Guidance (PPG) web-based resource was updated by the Ministry for Housing, Communities and Local Government (MHCLG) on 1st November 2019 to support the National Planning Policy Framework and make it more accessible. A review of PPG: Air Quality identified the following guidance (Paragraph: 001 Reference ID: 32-001-20191101):

> *"The 2008 Ambient Air Quality Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that affect public health such as particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2).*
>
> *The UK also has national emission reduction commitments for overall UK emissions of 5 damaging air pollutants:*
>
> - *fine particulate matter ($PM_{2.5}$)*

- *ammonia (NH_3)*
- *nitrogen oxides (NO_x)*
- *sulphur dioxide (SO_2)*
- *non-methane volatile organic compounds (NMVOCs)*

As well as having direct effects on public health, habitats and biodiversity, these pollutants can combine in the atmosphere to form ozone, a harmful air pollutant (and potent greenhouse gas) which can be transported great distances by weather systems. Odour and dust can also be a planning concern, for example, because of the effect on local amenity."

Local Policy

The Barnsley Metropolitan Borough Council (BMBC) Local Plan (adopted in January 2019) sets out and provided guidance for managing development and land use within the borough. Following a review of the BMBC Local Plan, the following policies have been identified:

"***Policy T5 Reducing the Impact of Road Travel***

We will reduce the impact of road travel by:

- *Developing and implementing robust, evidence based air quality action plans to improve air quality;*
- *Working with our sub regional partners, fleet and freight operators to improve the efficiency of vehicles and goods delivery, and reduce exhaust emissions; and*
- *Implementing measures to ensure the current road system is used efficiently."*

"***Policy CL1 Contaminated and Unstable Land***

Where the future users or occupiers of a development would be affected by contamination or stability issues, or where contamination may present a risk to the water environment, proposals must be accompanied by a report which:

- *shows that investigations have been carried out to work out the nature and extent of contamination or stability issues and the possible effect it may have on the development and its future users, the natural and historic environment; and*
- *sets out detailed measures to allow the development to go ahead safely, including, as appropriate:*
    - *removing the contamination;*
    - *treating the contamination;*
    - *protecting or separating the development from the effects of the contamination; and*

- *addressing land stability issues resulting from former coal mining activities.*

Where measures are needed to allow the development to go ahead safely, these will be required as a condition of any planning permission."

*"**Policy Poll1 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."

*"**Policy AQ1 Development in Air Quality Management Areas***

Development which impacts on areas sensitive to air pollution(13)in air quality management areas will be expected to demonstrate that it will not have a harmful effect on the health or living conditions of any future users of the development in terms of air quality (including residents, employees, visitors and customers), taking into account any suitable and proportionate mitigation required for the development.

We will only allow residential development which impacts on areas sensitive to air pollution, where the developer provides an assessment that shows living conditions will be acceptable for future residents, subject to any required mitigation.

We will only allow development which impacts on areas sensitive to air pollution which could cause more air pollution, where the developer provides an assessment that shows there will not be a significantly harmful effect on air quality, subject to any required mitigation.

Furthermore, development which impacts on areas sensitive to air pollution due to traffic emissions will be expected to demonstrate suitable and proportionate mitigation relative to the increased traffic emissions generated by the development."

3. Assessment Methodology

The potential environmental effects of the operational phase of the proposed development are identified as far as current knowledge of the site and development allows. The impact description of potential environmental effects is assessed according to the latest guidance produced by EPUK and IAQM in January 2017 '*Land-Use Planning & Development Control: Planning for Air Quality*' and June 2019 '*A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites*'.

The methodology used to determine the potential air quality effects of the construction phase of the proposed development has been derived from the IAQM '*Guidance on the Assessment of the Impacts of Dust from Demolition and Construction'* document and is summarised in Section 5.

3.1 Determining the Impact Magnitude of the Air Quality Effects

The impact magnitude of the effects during the operational phase of the development is based on the latest guidance produced by EPUK and IAQM in January 2017. The guidance provides a basis for a consistent approach that could be used by all parties associated with the planning process to professionally judge the overall impact description of the air quality effects based on severity of air quality impacts.

The following rationale is used in determining the severity of the air quality effects at individual receptors:

1. The change in concentration of air pollutants, air quality effects, are quantified and evaluated in the context of AQOs. The impacts are provided as a percentage of the Air Quality Objective (AQO), which may be an EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)';
2. The absolute concentrations are also considered in terms of the AQO and are divided into categories for long term concentration. The categories are based on the sensitivity of the individual receptor in terms of harm potential. The degree of harm potential to change increases as absolute concentrations are close to or above the AQO;
3. Severity of the effect is described as qualitative descriptors; negligible, slight, moderate or substantial, by taking into account in combination the harm potential and air quality effect. This means that a small increase at a receptor which is already close to or above the AQO will have higher severity compared to a relatively large change at a receptor which is significantly below the AQO;
4. The impacts can be adverse when pollutant concentrations increase or beneficial when concentration decrease as a result of development;
5. The judgement of overall impact description of the effects is then based on severity of effects on all the individual receptors considered; and,

6. Where a development is not resulting in any change in emissions itself, the impact description of effect is based on the effect of surrounding sources on new residents or users of the development, i.e., will they be exposed to levels above the AQO.

Table 3.1 Impact Descriptors for Individual Receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to AQO			
	1	2-5	6-10	>10
≤75% of AQO	Negligible	Negligible	Slight	Moderate
76-94% of AQO	Negligible	Slight	Moderate	Moderate
95-102% of AQO	Slight	Moderate	Moderate	Substantial
103-109 of AQO	Moderate	Moderate	Substantial	Substantial
≥110 of AQO	Moderate	Substantial	Substantial	Substantial

In accordance with explanation note 2 of Table 6.3 of the EPUK & IAQM guidance, the Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.

4. Baseline Conditions

4.1 Air Quality Review

This section provides a review of the existing air quality in the vicinity of the proposed development site in order to provide a benchmark against which to assess potential air quality impacts of the proposed development. Baseline air quality in the vicinity of the proposed development site has been defined from several sources, as described in the following sections.

Local Air Quality Management (LAQM)

As required under section 82 of the Environment Act 1995, BMBC has conducted an ongoing exercise to review and assess air quality within its area of jurisdiction. Due to high pollutant levels of NO_2, BMBC has designated six Air Quality Management Area (AQMA) within the borough which are listed below:

- Barnsley AQMA No. 1: An area along the M1 between Junction 35a and Junction 38, including Haigh, Darton, Cawthorne Dike, Higham, Dodworth, Gilroyd, Rockley, Birdwell, and Tankersley. The area extends 100m either side of the central reservation;
- Barnsley AQMA No. 2: An area encompassing the A628 from junction 37 of the M1 to Town End roundabout, including part of Summer Lane from Town End roundabout to Wharncliffe Street;
- Barnsley AQMA No. 4: An area encompassing the southbound carriageway of the A61 Harborough Hill Road from the PC World gyratory to the southbound slip road of the A61 near to its junction with Queens Road;
- Barnsley AQMA No. 5: An area encompassing the junction of Rotherham Road and Burton Road;
- Barnsley AQMA No. 6: Incorporating the A616 road through Langsett; and,
- Barnsley AQMA No. 7: Incorporating the southbound carriageway of the A61 Sheffield Road adjacent to the junction with the A6133 Cemetery Road.

The closest AQMA to the Proposed Development Site is Barnsley AQMA No. 1 which is located 0.3 km west of the site boundary. As part of the air quality assessment receptors within the AQMA are assessed to determine any effects in air quality as a result of the Proposed Development.

Air Quality Monitoring

Monitoring of air quality within BMBC is undertaken through both continuous and non-continuous monitoring methods. These have been reviewed in order to provide an indication of existing air quality in the area surrounding the proposed development site.

Continuous Monitoring

BMBC operated three automatic monitoring station in 2018. The closest automatic monitoring site, CM1, which is located 4.5 km north-east of the Proposed Development site boundary. The most recently available automatic monitoring data is from 2018, which is presented in Table 4.1.

Table 4.1 Monitored Annual Mean NO_2 Concentrations at Automatic Monitoring Stations

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)	2018 Annual Mean PM_{10} Concentration ($\mu g/m^3$)
CM1	Barnsley A635	Roadside	5.0	1.45	-	18.0
CM2	Barnsley A635	Roadside	3.5	1.70	32.0	-
CM3	Barnsley Gawber	Urban Background	N/A	4.00	16.0	-

As indicated in Table 4.1, all identified NO_2 automatic monitoring stations monitored a concentration below the AQO for NO_2 (40 $\mu g/m^3$ annual mean) during 2018. With automatic monitoring station CM1 monitored a concentration below the AQO for PM_{10} (40 $\mu g/m^3$ annual mean) during 2018.

Due to the distance from the Proposed Development site, no automatic monitoring stations were used as part of the model verification.

Non-Continuous Monitoring

BMBC operated a network of 55 diffusion tubes during 2018. Reference should be made to Figure 1 for the locations of the diffusion tubes within the extents of the air quality study area. The closest diffusion tube to the Proposed Development site is DT32, which is located 46 m west of the site boundary.

The most recently available diffusion tube monitoring data is from 2018, which is presented in Table 4.2.

Table 4.2 Monitored Annual Mean NO_2 Concentrations

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)
DT24	A6135 Hoyland	Kerbside	1	2.8	30.2
DT25	A61 Sheffield Road, Birdwell	Roadside	1.5	2.9	34.3
DT26	A61 Sheffield Road, Birdwell	Roadside	1.5	2.8	40.1
DT27	A61 Sheffield Road, Birdwell	Roadside	n/a	2.9	39.1
DT28*	Tankersley School	Roadside	n/a	2.8	23.9
DT29*	Moor Lane, Birdwell	Urban Background	n/a	2.7	27.6
DT30*	The Walk, Birdwell	Roadside	n/a	2.6	29.5
DT31	Sheffield Rd – Birdwell	Roadside	2.5	3.0	29.7
DT32	Sheffield Rd – Chapel Street, Birdwell	Roadside	n/a	2.75	32.8

Site ID	Location	Site Type	Distance from Kerb (m)	Inlet Height (m)	2018 Annual Mean NO_2 Concentration ($\mu g/m^3$)
*Located within the AQMA					

As indicated in Table 4.2, diffusion tube DT26 monitored an exceedance of the NO_2 AQO (40µg/m^3 annual mean) in 2018. The remaining diffusion tubes did not monitored exceedances of the NO_2 AQO (40µg/m^3 annual mean) in 2018.

4.2 Meteorology

Meteorological conditions have significant influence over air pollutant concentrations and dispersion. Pollutant levels can vary significantly from hour to hour as well as day to day, thus any air quality predictions need to be based on detailed meteorological data. The ADMS model calculates the dispersion of pollutants on an hourly basis using a year of local meteorological data. The 2018 meteorological data used in the assessment is derived from Emley Moor No.2 Meteorological Station. This is the nearest meteorological station, which is considered representative of the development site, with all the complete parameters necessary for the ADMS model. Reference should be made to Figure 2 for an illustration of the prevalent wind conditions at the Emley Moor No.2 Meteorological Station site.

4.3 Emission Sources

A desktop assessment has identified that traffic movements are likely to be the most significant local source of pollutants affecting the site and its surroundings. The principal traffic derived pollutants likely to impact local receptors are NO_2, PM_{10} and $PM_{2.5}$.

The assessment has therefore modelled all roads within the immediate vicinity of the proposed development site which are considered likely to experience significant changes in traffic flow as a result of the proposed development. Reference should be made to Figure 1 for a graphical representation of the traffic data utilised within the ADMS Roads 4.1 model.

It should be noted that the pollutant contribution of minor roads and rail sources that are not included within the dispersion model is considered to be accounted for via the use of background air quality levels.

4.4 Sensitive Receptors

Receptors that are considered as part of the air quality assessment are primarily those existing receptors that are situated along routes predicted to experience significant changes in traffic flow as a result of the proposed development.

The existing receptor locations are summarised in Table 4.3 (overleaf) and the spatial locations of all of the receptors are illustrated in Figure 8.1.

Table 4.3 Modelled Existing Sensitive Receptor Locations

Discrete Sensitive Receptor		Receptor Height (m)
R1	179 Upper Hoyland Road	1.5
R2	261 Sheffield House	1.5
R3	33 Wood View	1.5
R4	10 Sheffield Road	1.5
R5	86 Sheffield Road	1.5
R6	Stonehurst, Sheffield Road	1.5
R7	Hood Hill Farm	1.5
R8*	23 Farlow Croft	1.5
R9*	11 Howbrook Close	1.5
R10	29 Fenn Road	1.5
R11*	Tankersley St Peters CofE Primary	1.5
R12	55 Hay Green Lane	1.5
R13	Birdwell Primary School	1.5
R14	1 Chapel Street	1.5
R15	15 Sheffield Road	1.5
Proposed Sensitive Receptors		**Receptor Height (m)**
PR1	Proposed Receptor	1.5
PR2	Proposed Receptor	1.5
PR3	Proposed Receptor	1.5
PR4	Proposed Receptor	1.5
PR5	Proposed Receptor	1.5
*Located within the AQMA		

The locations of the existing sensitive receptors are identified on Figure 1.

4.5 Ecological Receptors

Air quality impacts associated with the proposed re-development have the potential to impact on receptors of ecological sensitivity within the vicinity of the site. The IAQM guidance on 'Air Quality Impacts on Designated Nature Conservation Sites' (2019) document outlines the types of designated nature sites within 2 km of the proposed development which require air quality assessment. These are inclusive of;

- Sites of Special Scientific Interest (SSSIs);
- Special Areas of Conservation (SACs);
- Special Protection Areas (SPAs);
- Ramsar Sites;
- Areas of Special Scientific Interest (ASSIs);
- National Nature Reserves (NNRs);
- Local Nature Reserves (LNRs);
- Local Wildlife Sites (LWSs); and,
- Areas of Ancient Woodland (AW).

The Conservation of Habitats and Species Regulations (2017) additionally requires competent authorities to review planning applications and consents that have the potential to impact on European designated sites (e.g. Special Protection Areas).

A study was undertaken to identify any statutory designated sites of ecological or nature conservation importance within the extents of the dispersion modelling assessment. This was completed using the Multi-Agency Geographic Information for the Countryside (MAGIC) web-based interactive mapping service, which draws together information on key environmental schemes and designations.

Following a search within a 2 km radius of the site boundary, one ecological receptor was identified, as shown in Table 4.4 below. In accordance with the IAQM Guidance, several points have been included at some sites as part of the assessment.

Table 4.4 Ecological Receptors

Site ID	Site	Designation	UK NGR (m)		Distance from Site (km)	Distance from Road Centre Line (m)
			X	Y		
E1	Potter Holes Plantation	LNR	434142	399524	1.76	15
E2	Potter Holes Plantation	LNR	434323	399828	1.42	15
E3	Worsborough Country Park	LNR	434398	402843	1.48	244
E4	Worsborough Country Park	LNR	433929	403620	2.36	262
E5	Worsborough Country Park	LNR	434701	402818	1.36	17
E6	Short Wood	AW	435297	401463	0.36	266
E7	The Old Park	AW	434132	401123	0.49	25
E8	The Old Park	AW	433984	402191	0.84	29
E9	Wigfield Wood	AW	434142	399524	1.04	46
E10	Hay Green, Barrow Colliery	LWS	435225	402910	1.48	349

It should be noted that the IAQM Guidance only requires the assessment of ecological receptors which are located within 200m of the road network. Due to the distance from the modelled road network, ecological receptor E3, E4, E6, and E10 can be scoped out of this air quality assessment.

5. Assessment of Air Quality Impacts - Construction Phase

5.1 Pollutant Sources

The main emissions during construction are likely to be dust and particulate matter generated during earth moving (particularly during dry months) or from construction materials. The main potential effects of dust and particulate matter are:

- Visual - dust plume, reduced visibility, coating and soiling of surfaces leading to annoyance, loss of amenity, the need to clean surfaces;
- Physical and/or chemical contamination and corrosion of artefacts;
- Coating of vegetation and soil contamination; and,
- Health effects due to inhalation e.g. asthma or irritation of the eyes.

A number of other factors such as the amount of precipitation and other meteorological conditions will also greatly influence the amount of particulate matter generated.

Construction activities can give rise to short-term elevated dust/PM_{10} concentrations in neighbouring areas. This may arise from vehicle movements, soiling of the public highway, demolition or windblown stockpiles.

5.2 Particulate Matter (PM_{10})

The UK Air Quality Standards seek to control the health implications of respirable PM_{10}. However, the majority of particles released from construction will be greater than this in size.

Construction works on site have the potential to elevate localised PM_{10} concentrations in the area. On this basis, mitigation measures should still be taken to minimise these emissions as part of good site practice.

5.3 Dust

Particles greater than 10µm are likely to settle out relatively quickly and may cause annoyance due to their soiling capability. Although there is no formal standards or criteria for nuisance caused by deposited particles, the IAQM 'Guidance on Monitoring in the Vicinity of Demolition and Construction Sites' (October 2018) and the Environment Agency Technical Guidance Note (TGN) M17 states that dust is usually compared with a 'complaints likely' guideline of 200mg/m^2/day. Therefore, a deposition rate of 200mg/m^2/day is often presented as a threshold for serious nuisance though this is usually only applied to long term exposure as people are generally more tolerant of dust for a short or defined period. Significant nuisance is likely when the dust coverage of surfaces is visible in contrast with adjacent clean areas, especially when it happens regularly. Severe dust nuisance occurs when the dust is perceptible without a clean reference surface.

Construction activities have the potential to suspend dust, which could result in annoyance of residents surrounding the site. Measures will be taken to minimise the emissions of dust as part of good site practice.

Recommended mitigation measures proportionate to the risk associated with the development and based on best practice guidance are discussed in the following sections.

5.4 Methodology

The construction phase assessment utilises the IAQM Guidance on the Assessment of Dust from Demolition and Construction document published in February 2014.

Four construction processes are considered; these are demolition, earthworks, construction and trackout. For each of these phases, the significance of the potential dust impacts is derived following the determination of a dust emission magnitude and the distance of activities to the nearest sensitive receptor, therefore assessing worst case impacts. A full explanation of the methodology is contained in Appendix A.

5.5 Assessment Results

Based on the methodology detailed in Appendix A, the scale of the anticipated works has determined the potential dust emission magnitude for each process, as presented in the Table 5.1 below.

Table 5.1 Dust Emission Magnitude

Construction Process	Site Criteria	Dust Emission Magnitude
Demolition	No demolition required	N/A
Earthworks	Total site area >10,000 m²	Large
Construction	Total building volume 25,000 - 100,000 m³	Medium
Trackout	Assumed >50 HDV outward movements, unpaved road length >100 m	Large

The sensitivity of the surrounding area to each construction process has been determined following stage 2B of the IAQM guidance. The assessment has determined the area sensitivities as shown in the Table 5.2.

Table 5.2 Sensitivity of the Area

<table>
<tr><th rowspan="2">Source</th><th colspan="6">Area Sensitivity</th></tr>
<tr><th>Dust Soiling</th><th>Site Sensitivity Criteria</th><th>Health Effects of PM_{10}</th><th>Site Sensitivity Criteria</th><th>Ecological</th><th>Site Sensitivity Criteria</th></tr>
<tr><td>Demolition</td><td colspan="6">N/A – No demolition required</td></tr>
<tr><td>Earthworks</td><td>High</td><td rowspan="2"><100 Highly Sensitive Receptors within 50 m</td><td>Low</td><td rowspan="3">Annual Mean of <24 ug/m³ for PM_{10} 10-100 Highly Sensitive Receptors within 50 m</td><td>N/A</td><td rowspan="2"><50 m from site boundary</td></tr>
<tr><td>Construction</td><td>High</td><td>Low</td><td>N/A</td></tr>
<tr><td>Trackout</td><td>High</td><td><100 Highly Sensitive Receptors within 50 m of roads within 500 m of site exit</td><td>Low</td><td>N/A</td><td><50 m from roads within 500 m from site boundary</td></tr>
</table>

The dust emission magnitude determined in Table 5.1 has been combined with the sensitivity of the area determined in Table 5.2, to determine the risk of impacts prior to the implementation of appropriate mitigation measures. The potential impact significance of dust emissions associated with the construction phase, without mitigation, is presented overleaf.

Table 5.3 Impact Significance of Construction Activities without Mitigation

Source	Summary Risk of Impacts Prior to Mitigation		
	Dust Soiling	Health Effects of PM_{10}	Ecological
Demolition	N/A	N/A	N/A
Earthworks	High	Low	N/A
Construction	Medium	Low	N/A
Trackout	High	Low	N/A

Appropriate mitigation measures are detailed and presented in Section 8. Following the adoption of these measures, the subsequent impact significance of the construction phase is not predicted to be significant.

6. Assessment of Air Quality Impacts - Operational Phase

In the context of the proposed development, road traffic is identified as the dominant emission source that is likely to cause potential risk of exposure of air pollutants at receptors.

The operational phase assessment therefore consists of the quantified predictions of the change in NO_2, PM_{10} and $PM_{2.5}$ for the operational phase of the development due to changes in traffic movement. Predictions of air quality at the site have been undertaken for the operational phase of the development using ADMS Roads.

In accordance with the provided traffic data, the operational phase assessment has been undertaken with an assumed operational opening year of 2022. The assessment scenarios are therefore:

- 2018 Baseline = Existing baseline conditions;
- 2022 'Do Minimum' = 2022 Baseline Scenario + Committed Developments;
- 2022 'Do Something' = 2022 Baseline Scenario + Committed Developments + Proposed Development Flows.

6.1 Existing and Predicted Traffic Flows

Baseline 2019 data, projected 2022 'do minimum' and 'do something' traffic data and average vehicle speeds have been obtained for the operational phase assessment in the form of Annual Average Daily Traffic figures (AADT). This traffic data was provided by Mosodi Transport Consultants.

To correspond with the latest BMBC monitoring data and meteorological data, a TEMPro factor of 1.02 was applied to the provided 2019 baseline to calculate Baseline 2018 traffic flows.

Additional 2018 traffic data was sourced from the Department for Transport (DfT) road statistic database. To calculate the predicted 2022 opening operational year traffic flows, a TEMPro factor of 1.05 has been applied.

Emission factors for the 2018 baseline and 2022 projected 'do minimum' and 'do something' scenarios have been calculated using the Emission Factor Toolkit Version 9 (May 2019).

In addition to the proposed development, the assessment also includes an assessment of the cumulative traffic impact associated with the Hoyland Masterplan area and Rockingham Phase 2 & 3.

A 50m 20km/hr slow down phase is included on each link at every junction and roundabout within the assessment. All of the roads within the dispersion model are illustrated in Figure 8.1. Detailed traffic figures are provided in the Table 6.1.

Table 6.1 Traffic Data

Link	Speed (km/h)	2018		2022			
				Do Minimum		Do Something	
		AADT	HGV%	AADT	HGV%	AADT	HGV%
M1S	112	89003	10.1	91016	10.0	91148	10.0
A61 (west of M1)	70	24175	14.0	25253	13.6	25279	13.6
M1 N	112	92835	10.8	94966	10.7	95051	10.7
A61 Sheffield Road	45	20713	8.1	21211	8.1	21604	7.9
A61 Link East of M1 J36	64	36880	12.4	39938	11.7	40182	11.6
A6135 S of B6096	48	10600	6.7	11330	6.3	11381	6.3
Tankersley Lane	48	6559	5.2	6662	5.2	6662	5.2
B6096	48	10878	6.8	12552	6.0	12552	6.0
A6135 N of B6096	45	12988	8.7	14474	7.9	14524	7.9
A6195 S of Kestrel Way	64	22383	13.0	24388	12.3	24463	12.3
Sheffield Road	64	2429	8.5	2791	7.5	2791	7.5
A6195 W of Phase 3	80	23750	12.6	25448	12.0	25518	12.0
A6195 E of Phase 3	80	23750	12.6	25434	12.0	25504	12.0
A616 (East of Westwood Roundabout)	96	20270	11.3	21225	11.3	21234	11.3
A61 (South of Westwood Roundabout)	80	14074	3.2	14737	3.2	14746	3.2
A616 (West of Westwood Roundabout)	96	25089	10.8	26271	10.8	26280	10.8
Hay Green Lane	32	853	0	864	0	1516	0
A61 Sheffield Road (North of Hay Green Lane)	45 / 96	20713	8.1	21211	8.1	21383	8.0
Worsbrough Road	48	1075	0.8	1126	0.8	1126	0.8
Chapel Street	48	2829	2.4	2962	2.4	2962	2.4

6.2 Background Concentrations

The use of background concentrations within the modelling process ensures that pollutant sources other than traffic are represented appropriately. Background sources of pollutants include industrial, domestic and rail emissions within the vicinity of the study site. Several sources have been used to obtain representative background levels as discussed below.

The background concentrations used within the assessment have been determined with reference to the IAQM Guidance and TG (16).

The IAQM Guidance states:

> "*A matter of judgement should take into account the background and future background air quality and whether it is likely to approach or exceed the value of the AQO.*"

Additionally, TG (16) states:

> *"Typically only the process contributions from local sources are represented within and output by the dispersion model. In these circumstances, it is necessary to add an appropriate background concentration(s) to the modelled source contributions to derive the total pollutant concentrations."*

Defra Published Background Concentrations for 2018

The background concentrations shown in Table 6.2 below were referenced from the UK National Air Quality Information Archive database based on the National Grid Co-ordinates of 1 x 1 km grid squares nearest to the development site. In May 2019, Defra issued revised 2018 based background maps for nitrogen oxide (NO_x), NO_2, PM_{10} and $PM_{2.5}$. The mapped background concentrations are summarised in Table 6.2.

Table 6.2 Published Background Air Quality Levels (µg/m³)

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
Local Authority Monitoring				
DT24	13.67	18.93	10.93	7.01
DT25	17.40	24.77	12.49	7.87
DT26	17.40	24.77	12.49	7.87
DT27	17.40	24.77	12.49	7.87
DT31	14.17	19.66	11.23	7.24
DT32	14.17	19.66	11.23	7.24
Existing Sensitive Receptors				
R1	13.90	19.42	11.09	6.97
R2	17.40	24.77	12.49	7.87
R3	17.40	24.77	12.49	7.87
R4	13.67	18.93	10.93	7.01
R5	13.67	18.93	10.93	7.01
R6	13.67	18.93	10.93	7.01
R7	16.08	22.71	12.15	7.67
R8*	10.07	13.55	10.18	6.46
R9*	10.62	14.38	9.65	6.42
R10	12.22	16.72	10.41	6.77
R11*	17.40	24.77	12.49	7.87
R12	14.17	19.66	11.23	7.24
R13	14.17	19.66	11.23	7.24
R14	14.17	19.66	11.23	7.24
R15	14.17	19.66	11.23	7.24
Existing Sensitive Receptors				
PR1 – PR5	14.17	19.66	11.23	7.24
Ecological Sensitive Receptors				
E1	14.17	19.66	11.23	7.24
E2	12.22	16.72	10.41	6.77
E3	12.22	16.72	10.41	6.77

Receptor Location	2018			
	NO_2	NO_x	PM_{10}	$PM_{2.5}$
E4	12.71	17.43	10.86	6.93
E5	14.33	19.87	12.96	7.64
E6	12.71	17.43	10.86	6.93
E7	12.15	16.61	11.02	6.90
E8	14.17	19.66	11.23	7.24
E9	11.96	16.30	10.84	6.91
*Located within the AQMA				

All the Defra background concentrations detailed in Table 6.2 for 2018, show that the background levels are predicted to be below the relevant AQO within the study area.

A breakdown of the background source apportionment of NO_x concentrations at each monitoring location and receptor is shown in Table 6.3.

Table 6.3 Pollutant Source Apportionment of NO_x (µg/m³)

Receptor Location	2018						
	Total NO_x	% of NO_x from Road Sources	% of NO_x from Industrial Sources	% of NO_x from Domestic Sources	% of NO_x from Aircraft Sources	% of NO_x from Rail Sources	% of NO_x from Other Sources
Local Authority Monitoring Locations							
DT24	18.93	46.65	6.35	5.22	0.00	1.25	40.53
DT25	24.77	78.56	6.75	4.24	0.00	1.10	40.20
DT26	24.77	78.56	6.75	4.24	0.00	1.10	40.20
DT27	24.77	78.56	6.75	4.24	0.00	1.10	40.20
DT31	19.66	53.08	5.89	4.23	0.00	1.03	39.66
DT32	19.66	53.08	5.89	4.23	0.00	1.03	39.66
Modelled Receptor Locations							
R1	19.42	36.40	13.76	4.47	0.00	1.27	44.10
R2	24.77	60.04	5.16	3.24	0.00	0.84	30.72
R3	24.77	60.04	5.16	3.24	0.00	0.84	30.72
R4	18.93	46.65	6.35	5.22	0.00	1.25	40.53
R5	18.93	46.65	6.35	5.22	0.00	1.25	40.53
R6	18.93	46.65	6.35	5.22	0.00	1.25	40.53
R7	22.71	53.12	5.11	3.90	0.00	1.92	35.95
R8*	13.55	30.15	7.98	4.44	0.00	1.69	55.74
R9*	14.38	30.72	6.81	7.86	0.00	1.72	52.90
R10	16.72	41.65	7.52	3.73	0.00	1.39	45.71
R11*	24.77	60.04	5.16	3.24	0.00	0.84	30.72
R12	19.66	51.09	5.67	4.07	0.00	0.99	38.18
R13	19.66	51.09	5.67	4.07	0.00	0.99	38.18
R14	19.66	51.09	5.67	4.07	0.00	0.99	38.18
R15	19.66	51.09	5.67	4.07	0.00	0.99	38.18
Proposed Receptor Locations							

Receptor Location	2018						
	Total NO_x	% of NO_x from Road Sources	% of NO_x from Industrial Sources	% of NO_x from Domestic Sources	% of NO_x from Aircraft Sources	% of NO_x from Rail Sources	% of NO_x from Other Sources
PR1	19.66	51.09	5.67	4.07	0.00	0.99	38.18
Ecological Receptor Locations							
E1	16.72	41.65	7.52	3.73	0.00	1.39	45.71
E2	16.72	41.65	7.52	3.73	0.00	1.39	45.71
E3	17.43	47.11	5.63	3.51	0.00	1.08	42.66
E4	19.87	55.53	4.23	2.49	0.00	0.89	36.86
E5	17.43	47.11	5.63	3.51	0.00	1.08	42.66
E6	16.61	41.33	6.94	4.39	0.00	1.31	46.03
E7	19.66	51.09	5.67	4.07	0.00	0.99	38.18
E8	16.30	44.61	5.94	2.83	0.00	1.08	45.54
E9	16.61	46.48	5.34	2.72	0.00	1.04	44.43
*Located within the AQMA							

Table 6.3 above shows that the major background source of NO_x at the monitoring and sensitive receptor locations, where sources have been identified is comprised of 'other sources' but road sources make up the bulk of identified sources.

A review of the Defra background concentrations shows that the NO_2 concentrations at the monitoring and sensitive receptor locations are lower in comparison to the LA monitoring. For the ecological sensitive receptor locations, a review of the NO_X background concentrations using the Air Pollution Information System (APIS) website[1] has been undertaken. A detailed search for these conservation sites on the website has determined the background concentration. The background concentrations at the conservation sites are considered to be the most representative.

Table 6.4 shows the background concentrations utilised within the verification.

Table 6.4 Utilised Background Concentrations (µg/m³)

Receptor Location	2018		Source
	NO_2	NO_x	
Local Authority Monitoring			
DT24	13.67	18.93	Defra Published Backgrounds
DT25	17.40	24.77	
DT26	17.40	24.77	
DT27	17.40	24.77	
DT31	14.17	19.66	
DT32	14.17	19.66	
Existing Sensitive Receptors			

[1] http://www.apis.ac.uk/

Receptor Location	2018		Source
	NO_2	NO_x	
R1	13.90	19.42	Defra Published Backgrounds
R2	17.40	24.77	
R3	17.40	24.77	
R4	13.67	18.93	
R5	13.67	18.93	
R6	13.67	18.93	
R7	16.08	22.71	
R8*	10.07	13.55	
R9*	10.62	14.38	
R10	12.22	16.72	
R11*	17.40	24.77	
R12	14.17	19.66	
R13	14.17	19.66	
R14	14.17	19.66	
R15	14.17	19.66	
Proposed Sensitive Receptors			
PR1 – PR5	14.17	19.66	Defra Published Backgrounds
Ecological Sensitive Receptors			
E1	-	18.72	Apis Background Concentrations
E2	-	18.72	
E3	-	19.30	
E4	-	22.64	
E5	-	19.30	
E6	-	17.91	
E7	-	21.46	
E8	-	18.67	
E9	-	19.05	
*Located within the AQMA			

6.3 Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in Section 7 of the TG16 guidance note and uses the most recently available diffusion tube monitoring data to best represent this.

The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of NO_X at the monitoring locations. Outputs from the ADMS Roads model are provided as predicted road traffic contribution NO_X emissions. These are converted into predicted roadside contribution NO_2 exposure at the relevant receptor locations based on the updated approach to deriving NO_2 from NO_X for road traffic sources published in Local Air Quality Management TG16. The calculation was derived using the NO_X to NO_2 worksheet in the

online LAQM tools website hosted by Defra. Table 6.6 summarises the final model/monitored data correlation following the application of the model correction factor.

Table 6.6 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube location	NO_2 µg/m³		
	Monitored NO_2	Modelled NO_2	Difference (%)
DT24	30.20	30.58	1.27
DT25	34.30	37.20	8.44
DT26	40.10	40.22	0.31
DT27	39.10	38.98	-0.31
DT31	29.70	28.75	-3.21
DT32	32.80	29.54	-9.94
*Located within the AQMA			

The final model produced data at the monitoring locations to within 10% of the monitoring results at all of the receptors, as recommended by TG16 guidance.

The final verification model correlation coefficient (representing the model uncertainty) is 1.00[2]. This figure demonstrates that the model predictions were in line with the road traffic emissions at the monitoring locations.

6.4 Summary of Model Inputs

Table 6.7 Summary of ADMS Roads Model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), NO_2, Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	**Emley Moor No.2 Meteorological Station**, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**0.5m** representing a typical surface roughness for **Parkland, Open Suburbia** were used for both Site Data and Met Measurement Site Data
Latitude	Allows the location of the model area to be set	United Kingdom = **53.5**
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Small Towns= **10m** was used for both Site Data and Met Measurement Site Data
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used depended on data obtained from OS map data for the specific road link
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	No topographical information used
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used

[2] This was achieved by applying a model correction factor of 1.91 to roadside predicted NO_X concentrations before converting to NO_2

Parameter	Description	Input Value
Road Type	Allows the effect of different types of roads to be assessed.	**Urban (Not London)** and **Motorway (Not London)** settings were used for the relevant links
Road Speeds	Enables individual road speeds to be added for each road link	Based on Google Map observations
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons used within the model
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built EFT database of traffic emission factors.	The **EFT** Version **9.0 (2019)** dataset was used.
Year	Predicted EFT emissions rates depend on the year of emission.	**2018** data for verification and baseline operational phase assessment **2022** data for the operational phase assessment.
Site Plans	**Source**: The Harris Partnership	**Drawing Title**: Proposed Masterplan 12006-1-100

6.5 ADMS Modelling Results

6.5.1 Traffic Assessment

The ADMS Model has predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ at relevant receptor locations adjacent to roads likely to be affected by the development, as summarised in the following tables. Only receptors close to roads where there is predicted to be a change in emissions have been assessed.

6.5.2 Assessment Scenarios

For the operational year of 2022, assessment of the effects of emissions from the proposed traffic associated with the scheme, has been undertaken using the Emissions Factor Toolkit (EFT) 2022 emissions rates which take into account of the rate of reduction in emission from road vehicles into the future with the following factors:

- 2018 Baseline = Existing baseline conditions;
- 2022 'Do Minimum' = 2022 Baseline Scenario + Committed Developments; and,
- 2022 'Do Something' = 2022 Baseline Scenario + Committed Developments + Proposed Development Flows.

Nitrogen Dioxide

Table 6.8 presents a summary of the predicted change in NO_2 concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.8 Predicted Annual Average Concentrations of NO_2 at Receptor Locations

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2022	Do Something 2022	Development Contribution
R1	179 Upper Hoyland Road	22.40	19.83	19.85	0.02
R2	261 Sheffield House	34.70	29.45	29.57	0.12
R3	33 Wood View	42.22	34.63	34.77	0.14
R4	10 Sheffield Road	26.65	22.76	22.78	0.02
R5	86 Sheffield Road	31.02	25.97	26.00	0.03
R6	Stonehurst, Sheffield Road	23.93	20.77	20.79	0.02
R7	Hood Hill Farm	21.40	19.88	19.89	0.01
R8*	23 Farlow Croft	11.85	11.37	11.37	<0.01
R9*	11 Howbrook Close	14.24	13.32	13.33	0.01
R10	29 Fenn Road	20.49	17.74	17.75	0.01
R11*	Tankersley St Peters CofE Primary	27.97	24.76	24.77	0.01
R12	55 Hay Green Lane	17.32	16.37	16.53	0.16
R13	Birdwell Primary School	26.19	22.46	22.59	0.13
R14	1 Chapel Street	25.70	22.04	22.12	0.08
R15	15 Sheffield Road	23.02	20.26	20.30	0.04
PR1	Proposed Receptor	-	-	16.22	-
PR2	Proposed Receptor	-	-	18.68	-
PR3	Proposed Receptor	-	-	17.01	-
PR4	Proposed Receptor	-	-	19.69	-
PR5	Proposed Receptor	-	-	16.05	-
Annual Mean AQO		**40 µg/m³**			
*Located within the AQMA					

All modelled existing receptors are predicted to be below the AQO for NO_2 in both the 'do minimum' and 'do something' scenarios.

As indicated in Table 6.8, the maximum predicted increase in the annual average exposure to NO_2 at any existing receptor, due to changes in traffic movements associated with the development, is 0.16 µg/m³ at 55 Hay Green Lane (R12).

The impact description of changes in traffic flow associated with the development with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 6.9.

Table 6.9 Significance of Effects at Key Receptors (NO_2)

NO_2 Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	0.02	0.05	0%	≤75% of AQO	Negligible
R2	0.12	0.30	0%	≤75% of AQO	Negligible
R3	0.14	0.35	0%	76-94% of AQO	Negligible
R4	0.02	0.05	0%	≤75% of AQO	Negligible
R5	0.03	0.08	0%	≤75% of AQO	Negligible
R6	0.02	0.05	0%	≤75% of AQO	Negligible

NO_2 Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R7	0.01	0.03	0%	≤75% of AQO	Negligible
R8*	<0.01	0.00	0%	≤75% of AQO	Negligible
R9*	0.01	0.03	0%	≤75% of AQO	Negligible
R10	0.01	0.03	0%	≤75% of AQO	Negligible
R11*	0.01	0.03	0%	≤75% of AQO	Negligible
R12	0.16	0.40	0%	≤75% of AQO	Negligible
R13	0.13	0.33	0%	≤75% of AQO	Negligible
R14	0.08	0.20	0%	≤75% of AQO	Negligible
R15	0.04	0.10	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					
*Located within the AQMA					

The significance of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2 exposure for existing receptors, is determined to be 'negligible' at all modelled receptors. This is based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Figure 6.1 Annual Average Nitrogen Dioxide (µgm^{-3}) Contribution from the Scheme Across the Study Area.

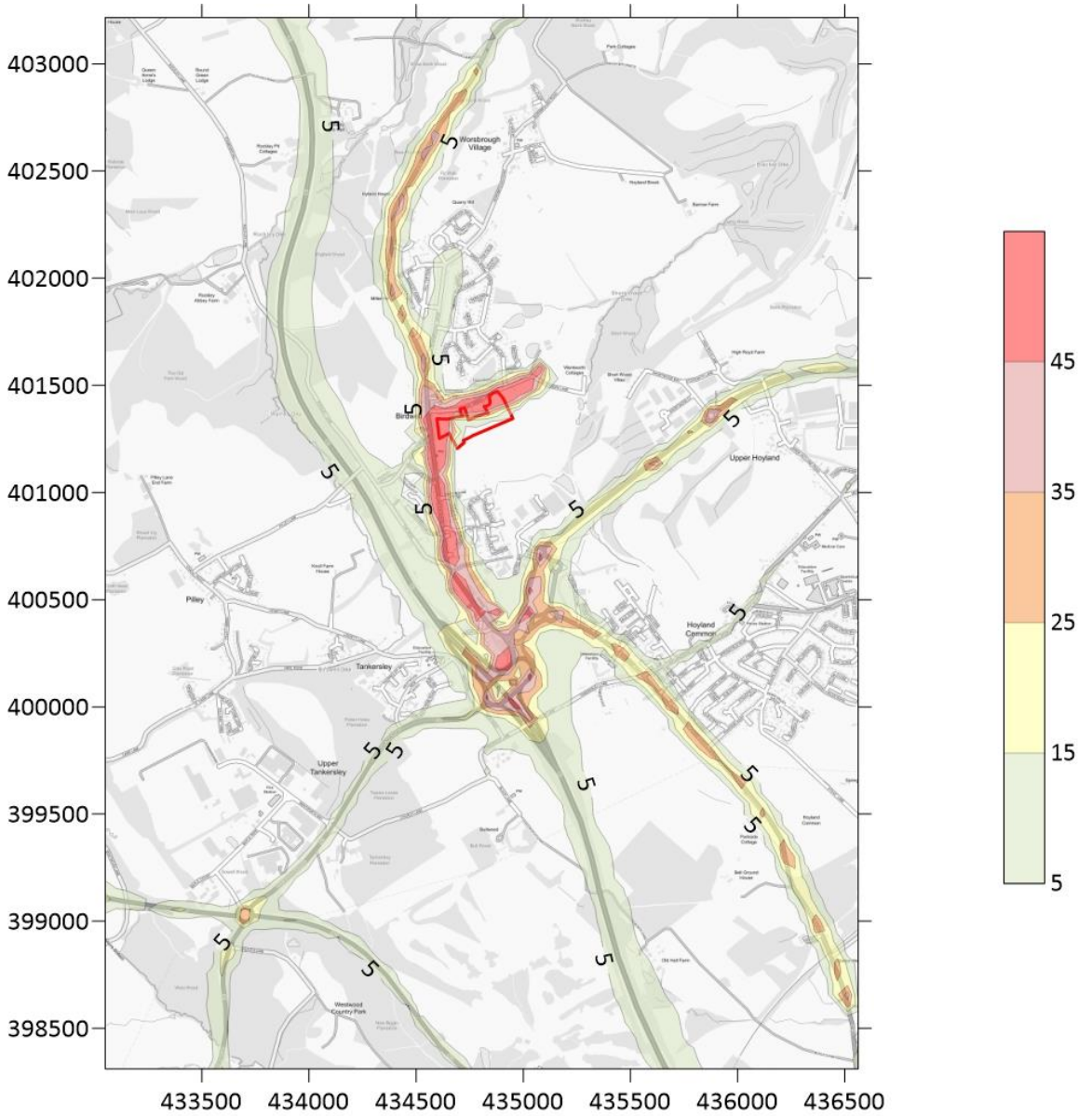


Figure 6.2 Annual Average Nitrogen Dioxide (µgm-3) Concentrations at the Proposed Development Site.

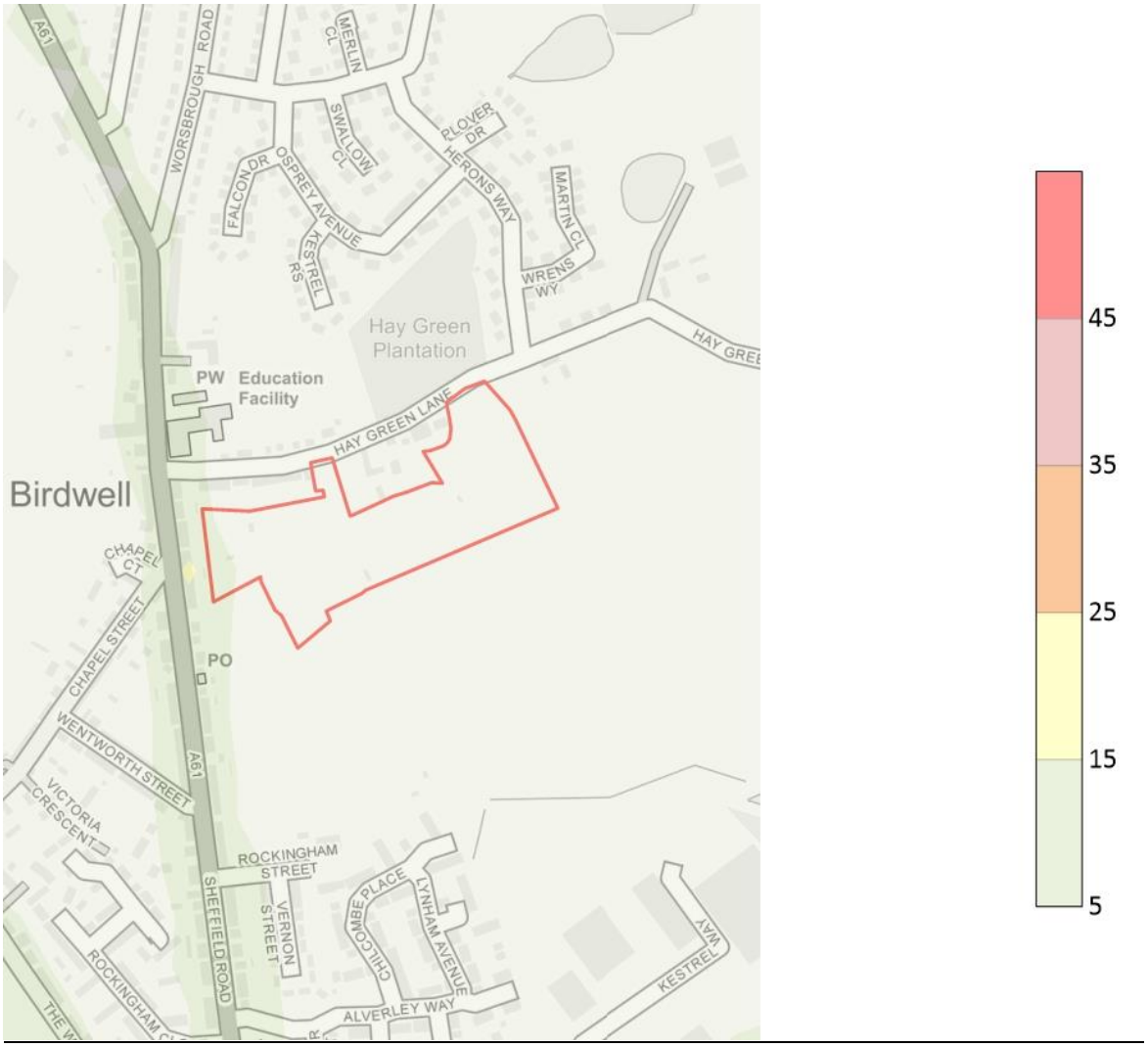
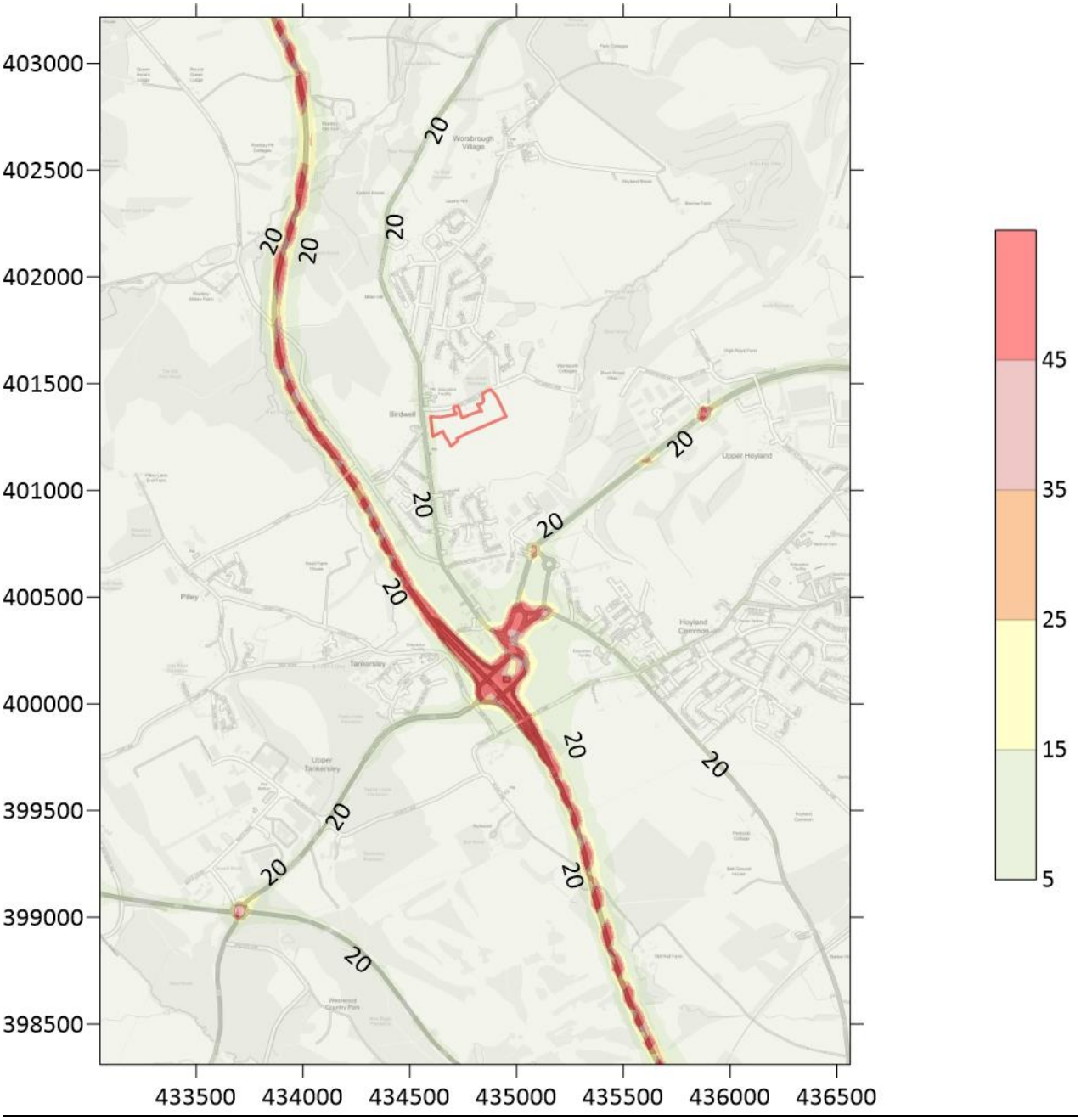


Figure 6.3 Annual Average Nitrogen Dioxide (µgm-3) Concentrations Across the Study Area.



Particulate Matter (PM_{10})

Table 6.10 presents a summary of the predicted change in annual mean PM_{10} concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.10 Predicted Annual Average Concentrations of PM_{10} at Receptor Locations

Receptor		PM_{10} (µg/m³)			
		Baseline 2018	Do Minimum 2022	Do Something 2022	Development Contribution
R1	179 Upper Hoyland Road	12.36	12.31	12.31	<0.01
R2	261 Sheffield House	15.18	15.04	15.07	0.03
R3	33 Wood View	16.16	15.97	16.01	0.04
R4	10 Sheffield Road	12.78	12.77	12.78	0.01
R5	86 Sheffield Road	13.13	13.11	13.11	<0.01
R6	Stonehurst, Sheffield Road	12.19	12.14	12.14	<0.01
R7	Hood Hill Farm	12.96	12.94	12.94	<0.01
R8*	23 Farlow Croft	10.48	10.48	10.48	<0.01
R9*	11 Howbrook Close	10.32	10.31	10.31	<0.01
R10	29 Fenn Road	11.73	11.67	11.67	<0.01
R11*	Tankersley St Peters CofE Primary	13.60	13.50	13.50	<0.01
R12	55 Hay Green Lane	11.62	11.59	11.63	0.03
R13	Birdwell Primary School	13.14	13.05	13.08	0.03
R14	1 Chapel Street	12.70	12.62	12.63	0.02
R15	15 Sheffield Road	12.60	12.54	12.55	0.01
PR1	Proposed Receptor	-	-	11.57	-
PR2	Proposed Receptor	-	-	12.06	-
PR3	Proposed Receptor	-	-	11.69	-
PR4	Proposed Receptor	-	-	12.17	-
		-	-	11.53	-
Annual Mean AQO		**40 µg/m³**			
***Located within the AQMA**					

All modelled existing receptors are predicted to be below the AQO for PM_{10} in both the 'do minimum' and 'do something' scenarios.

As indicated in Table 6.10, the maximum predicted increase in the annual average exposure to PM_{10} at any existing receptor, due to changes in traffic movements associated with the development, is 0.04 µg/m³ 33 Wood View (R3).

The impact description of changes in traffic flow associated with the development with respect to annual mean PM_{10} exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 6.11.

Table 6.11 Significance of Effects at Key Receptors (PM_{10})

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	<0.01	0.01	0%	≤75% of AQO	Negligible
R2	0.03	0.07	0%	≤75% of AQO	Negligible
R3	0.04	0.09	0%	≤75% of AQO	Negligible
R4	0.01	0.01	0%	≤75% of AQO	Negligible
R5	<0.01	0.01	0%	≤75% of AQO	Negligible
R6	<0.01	0.01	0%	≤75% of AQO	Negligible

PM_{10} Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R7	<0.01	0.01	0%	≤75% of AQO	Negligible
R8*	<0.01	0.00	0%	≤75% of AQO	Negligible
R9*	<0.01	0.00	0%	≤75% of AQO	Negligible
R10	<0.01	0.00	0%	≤75% of AQO	Negligible
R11*	<0.01	0.00	0%	≤75% of AQO	Negligible
R12	0.03	0.09	0%	≤75% of AQO	Negligible
R13	0.03	0.07	0%	≤75% of AQO	Negligible
R14	0.02	0.04	0%	≤75% of AQO	Negligible
R15	0.01	0.02	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					
*Located within the AQMA					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean PM_{10} exposure for existing receptors is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Particulate Matter ($PM_{2.5}$)

Table 6.12 presents a summary of the predicted change in annual mean $PM_{2.5}$ concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.12 Predicted Annual Average Concentrations of $PM_{2.5}$ at Receptor Locations

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2022	Do Something 2022	Development Contribution
R1	179 Upper Hoyland Road	7.74	7.66	7.66	<0.01
R2	261 Sheffield House	9.51	9.34	9.36	0.02
R3	33 Wood View	10.13	9.89	9.91	0.02
R4	10 Sheffield Road	8.14	8.07	8.07	<0.01
R5	86 Sheffield Road	8.38	8.28	8.28	<0.01
R6	Stonehurst, Sheffield Road	7.80	7.72	7.72	<0.01
R7	Hood Hill Farm	8.16	8.12	8.13	<0.01
R8*	23 Farlow Croft	6.64	6.63	6.63	<0.01
R9*	11 Howbrook Close	6.82	6.79	6.80	<0.01
R10	29 Fenn Road	7.57	7.49	7.49	<0.01
R11*	Tankersley St Peters CofE Primary	8.61	8.50	8.50	<0.01
R12	55 Hay Green Lane	7.49	7.46	7.48	0.02
R13	Birdwell Primary School	8.39	8.28	8.30	0.02
R14	1 Chapel Street	8.16	8.05	8.06	0.01
R15	15 Sheffield Road	8.07	7.99	8.00	<0.01
PR1	Proposed Receptor	-	-	7.44	-
PR2	Proposed Receptor	-	-	7.72	-
PR3	Proposed Receptor	-	-	7.51	-

Receptor		$PM_{2.5}$ (µg/m³)			
		Baseline 2018	Do Minimum 2022	Do Something 2022	Development Contribution
PR4	Proposed Receptor	-	-	7.79	-
PR5	Proposed Receptor	-	-	7.42	-
Annual Mean AQO		**40 µg/m³**			
*Located within the AQMA					

All modelled existing receptors are predicted to be below the AQO for $PM_{2.5}$ in both the 'do minimum' and 'do something' scenarios.

As indicated in Table 6.12, the maximum predicted increase in the annual average exposure to $PM_{2.5}$ at any existing receptor, due to changes in traffic movements associated with the development, is 0.02 µg/m³ at 261 Sheffield House (R2), 33 Wood View (R3), 55 Hay Green Lane (R12), and Birdwell Primary School (R13).

The impact description of changes in traffic flow associated with the development with respect to annual mean $PM_{2.5}$ exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table 6.13.

Table 6.13 Significance of Effects at Key Receptors ($PM_{2.5}$)

$PM_{2.5}$ Significance Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change Due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Significance
R1	<0.01	0.01	0%	≤75% of AQO	Negligible
R2	0.02	0.07	0%	≤75% of AQO	Negligible
R3	0.02	0.08	0%	≤75% of AQO	Negligible
R4	<0.01	0.01	0%	≤75% of AQO	Negligible
R5	<0.01	0.01	0%	≤75% of AQO	Negligible
R6	<0.01	0.01	0%	≤75% of AQO	Negligible
R7	<0.01	0.01	0%	≤75% of AQO	Negligible
R8*	<0.01	0.00	0%	≤75% of AQO	Negligible
R9*	<0.01	0.00	0%	≤75% of AQO	Negligible
R10	<0.01	0.00	0%	≤75% of AQO	Negligible
R11*	<0.01	0.00	0%	≤75% of AQO	Negligible
R12	0.02	0.08	0%	≤75% of AQO	Negligible
R13	0.02	0.07	0%	≤75% of AQO	Negligible
R14	0.01	0.04	0%	≤75% of AQO	Negligible
R15	<0.01	0.02	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					

The significance of the effects of changes in traffic as a result of the proposed development, with respect to annual mean $PM_{2.5}$ exposure, for existing receptors, is determined to be 'negligible' based on the methodology outlined in Section 3. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'.

Ecological Sensitive Receptor Locations

Background concentrations at each of the ecologically sensitive sites were determined through a review of the NO_X pollutants published on the APIS website.

The below assessment has been undertaken in accordance with *A Guide to the Assessment of Air Quality Impacts in Designated Nature Conservation Sites* (IAQM, 2019).

Nitrogen Oxide

Table 6.14 presents a summary of the predicted change in NO_X concentrations at relevant receptor locations, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 6.14 Predicted Annual Average Concentrations of NO_X at Ecological Receptor Locations

Receptor ID	Ecological Receptor	Predicted Maximum Annual Mean Concentration (µg/m³)				
		Do Minimum 2022 NO_X	Do Something 2022 NO_X	Process Contribution (PC)	PC as %age of AQO	Background
E1	Potter Holes Plantation LNR	28.74	28.75	0.01	0.04	18.72
E2	Potter Holes Plantation LNR	27.51	27.52	0.01	0.04	18.72
E5	Worsborough Country Park LNR	30.60	30.67	0.07	0.25	19.30
E7	The Old Park AW	48.14	48.17	0.03	0.10	21.46
E9	Wigfield Wood AW	41.62	41.64	0.02	0.08	18.67
Annual Mean AQO/Critical Level (CL)			30 (µg/m3)			

As indicated in Table 6.14, the maximum predicted increase in the annual average exposure to NO_X at any ecological receptor, due to changes in traffic movements associated with the development, is 0.07 µg/m³ at Worsborough Country Park (LNR) (E5).

Section 5.5.4.1 of *A Guide to the Assessment of Air Quality Impacts in Designated Nature Conservation Sites*', IAQM 2019 states:

Where the assessment indicates that changes in annual mean NOx concentrations within a designated site cannot be dismissed as imperceptible (i.e. an increase of over 0.4 µg/m³) and the NOx critical level is exceeded, then changes in nutrient nitrogen deposition should be calculated as supporting information to further assist in the evaluation of significance.

The maximum predicted increase in the annual average exposure to NO_X at the identified ecological receptor, due to changes in traffic movements associated with the development, is 0.07 µg/m³ at Worsborough Country Park LNR (E5) which is below the 0.40 µg/m³ development contribution stated within the guidance of '*A Guide to the Assessment of Air Quality Impacts in Designated Nature Conservation Sites*', IAQM 2019. As a

result, no further assessment is required and the impact at (E5) Worsborough Country Park (LNR) is considered to be negligible.

7. Mitigation

7.1 Construction Phase

The dust risk categories have been determined in Section 5 for each of the four construction activities. The assessment has determined that the potential impact significance of dust emissions associated with the construction phase of the proposed development is 'high risk' at the worst affected receptors.

Using the methodology described in Appendix A, appropriate site-specific mitigation measures associated with the determined level of risk can be found in Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition and Construction. The mitigation measures have been divided into general measures applicable to all sites and measures applicable specifically to demolition, earthworks, construction and trackout. They are categorised into 'highly recommended' and 'desirable' measures.

The mitigation measures for the proposed development are detailed in Table 7.1 and 7.2 below:

Table 7.1 Highly Recommended Construction Phase Mitigation Measures

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.
Dust Management
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document.
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 local authority when asked.
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 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.

Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
Avoid site runoff of water or mud.
Keep site fencing, barriers and scaffolding clean using wet methods.
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed or fence stockpiles to prevent wind whipping.
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.
Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
Use enclosed chutes and conveyors and covered skips.
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Avoid bonfires and burning of waste materials.

Table 7.2 Desirable Construction Phase Mitigation Measures

Communications
No Action Required.
Dust Management
No Action Required.

Following the implementation of the mitigation measures detailed in the tables above, the impact significance of the construction phase is not considered to be significant.

7.2 Operational Phase Mitigation - BMBC Air Quality and Emissions Good Practice Planning Guidance

A review of the BMBC Air Quality and Emissions Good Practice Planning Guidance (October 2018) has been undertaken. The outcome of the review has shown that the Proposed Development is categorised as 'Major' development. This means that 'Type 1' and 'Type 2' mitigation should be installed.

'Type 1' Mitigation

Type 1 mitigation includes the installations of Electric Vehicle (EV) charging points. As part of the requirements of the Air Quality Action Plan, residential properties must install one charging point per unit (dwelling with dedicated parking) or one charging point per 10 spaces (unallocated parking). The specification of the charging points should be in accordance with Appendix 4 of the BMBC Air Quality and Emissions Good Practice Planning Guidance.

'Type 2' Mitigation

Type 2 mitigation includes the implementation of a Travel Plan in accordance with Appendix 5 of the BMBC Air Quality and Emissions Good Practice Planning Guidance. The Travel Plan should include measures which reduce the number of high emission vehicles and shift towards sustainable transport measures (e.g. public transport, walking and cycling). As well as the promotion of low emissions fuels and technologies.

'Type 3' Mitigation

Type 3 mitigation includes the implementation of a Travel Plan in accordance with Appendix 5 of the BMBC Air Quality and Emissions Good Practice Planning Guidance. The Travel Plan should include measures which reduce the use of private vehicles, and supports the use of pooled low emission vehicles, and further reduction of high emission vehicles and shift towards sustainable transport measures (e.g. public transport, walking and cycling). As well as the promotion of low emissions fuels and technologies.

Defra Damage Costs Assessment

A 'damage costs' assessment has been completed. Damage costs are a simple way to value changes in air pollution. They estimate the cost of a change in emissions of different pollutants. In line with the Barnsley MBC Air Quality and Emissions Good Practice Planning Guidance, a damage cost assessment has been undertaken. Methodology and calculations can be found in Appendix C.

Additional trips	1,937 AADT
Average distance travelled	10 km
Assumed average speed of	50 kph

Table 7.3 Damage Cost Calculation

Pollutant	Annual Link Emissions (kg/annum)	Over 5 Years (kg/annum)	2018 National Damage Costs (£/tonne)	Valuation (£)
NO_x	865	4,327	£6,199	26,824
$PM_{2.5}$	37	186	£105,836	19,699
Total				**£46,523**

The mitigation measures have been approximately costed as below to determine whether the mitigation is commensurate to the damage costs presented above.

The total damage costs provide an indication as to the costs associated with the effect from the proposed development on the wider area. The calculated figure will be put towards various mitigation measures shown in Section 8 of the report; it does not represent a sum owed by the developer.

8. Conclusions

WYG has undertaken an Air Quality Assessment to support an application for a proposed employment development at land at Hay Green Lane, Birdwell.

Construction Phase

Prior to the implementation of appropriate mitigation measures, the potential impact significance of dust emissions associated with the construction phase of the proposed development has potential as 'low' at some worst affected receptors without mitigation. However, appropriate site-specific mitigation measures have been recommended based on Section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition, Earthworks, Construction and Trackout. It is anticipated that with these appropriate mitigation measures in place, the risk of adverse effects due to emissions from the construction phase will not be significant.

Operational Assessment

An operational assessment of 2022 emissions has been undertaken.

The 2022 assessment of the effect of emissions from traffic associated with the scheme, has determined that the maximum predicted increase in the annual average exposure to NO_2 at any existing receptor is likely to be 0.16 µg/m^3 at 55 Hay Green Lane (R12).

For PM_{10}, the maximum predicted increase in the annual average exposure is likely to be 0.04 µg/m^3 at 33 Wood View (R3). For $PM_{2.5}$, the maximum predicted increase in the annual average exposure is likely to be 0.02 µg/m^3 at 261 Sheffield House (R2), 33 Wood View (R3), 55 Hay Green Lane (R12), and Birdwell Primary School (R13).

The significance of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2, PM_{10} and $PM_{2.5}$ exposures, significance is determined to be 'negligible' at all identified receptor locations.

At any proposed sensitive receptors, there is not predicted to be any exceedances of the NO_2, PM_{10} or $PM_{2.5}$ pollutant concentrations and therefore, mitigation is not required at the proposed development.

Habitat Assessment

The maximum predicted increase in the annual average exposure to NO_X at the identified ecological receptor, due to changes in traffic movements associated with the development, is 0.07 µg/m^3 at Potter Holes Plantation LNR which below the 0.40 µg/m^3 development contribution stated within the guidance of '*A Guide to the Assessment of Air Quality Impacts in Designated Nature Conservation Sites* ', IAQM 2019. As a result,

no further assessment is required and the impact at (E5) Worsborough Country Park (LNR) is considered to be negligible.

Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'. In conclusion, the development is not considered to be contrary to any of the national and local planning policies.

Figures

Figure 8.1 Air Quality Assessment Area

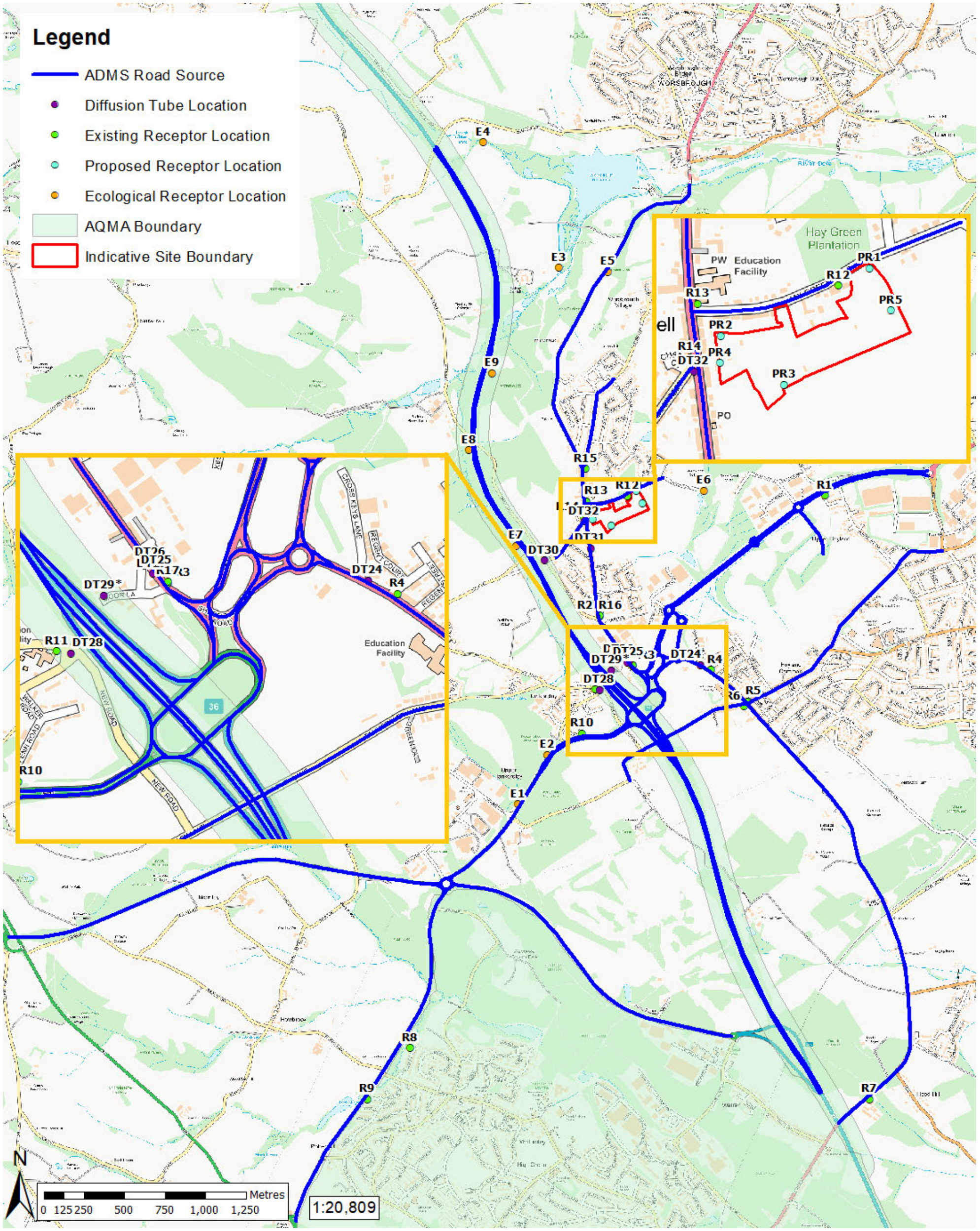
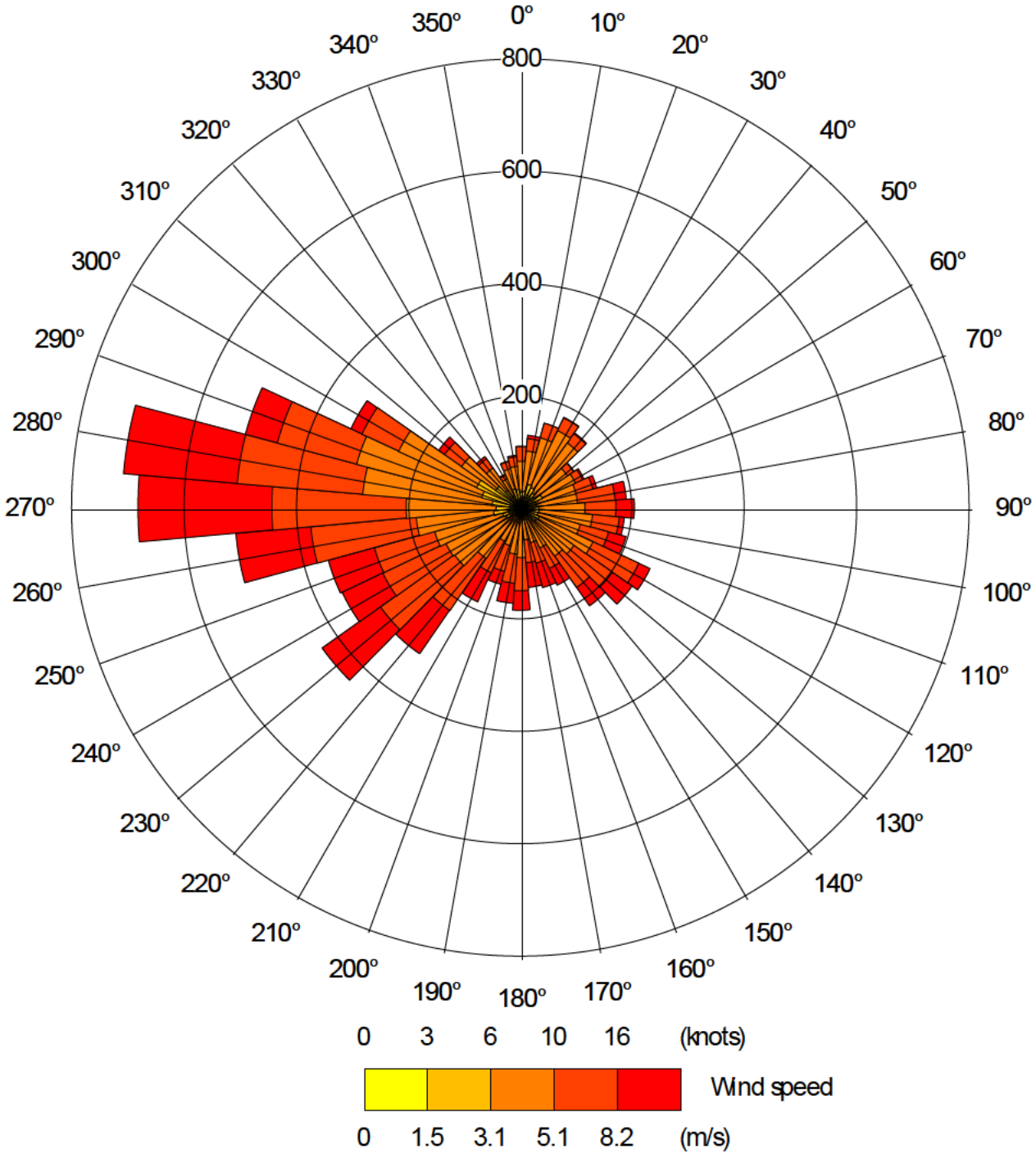


Figure 8.2 Emley Moor No.2 2018 Meteorological Station Wind Rose



Appendix A Construction Phase Assessment Methodology

The following information sets out the adopted approach to the construction phase impact assessment in accordance with the aforementioned IAQM guidance[3].

Step 1 – Screen the Requirement for a more Detailed Assessment

An assessment is required if there are sensitive receptors within 350m of the site boundary, within 50m of the route(s) used by construction vehicles on the surrounding road network, or within 500m from the site entrance. A detailed assessment is also required if there is an ecological receptor within 50m of the site boundary.

Step 2A – Define the Potential Dust Emission Magnitude

Demolition

The dust emission magnitude for the demolition phase has been determined based on the below criteria:

- *Large*: Total building volume >50 000m^3, potentially dusty construction (e.g. concrete), on-site crushing and screening, demolition activities >20m above ground level;
- *Medium*: Total building volume 20 000m^3 – 50 000m^3, potentially dusty construction material, demolition activities 10-20m above ground level; and,
- *Small*: Total building volume <20 000m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks

The dust emission magnitude for the planned earthworks has been determined based on the below criteria:

- *Large:* Total site area >10 000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), > 10 heavy earth moving vehicles active at any one time, formation of bunds >8m in height, total material moved >100 000 tonnes;
- *Medium*: Total site area 2 500m^2 – 10 000m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4m-8m in height, total material moved 20 000 tonnes – 100 000 tonnes; and
- *Small:* Total site area <2 500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10 000 tonnes, earthworks during wetter months.

Construction

The dust emission magnitude for the construction phase has been determined based on the below criteria:

- *Large:* Total building volume >100 000m^3, on site concrete batching; sandblasting
- *Medium:* Total building volume 25 000m^3 – 100 000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and,
- *Small:* Total building volume <25 000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

Trackout

The dust emission magnitude for trackout has been determined based on the below criteria:

- *Large:* >50 HGV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- *Medium:* 10-50 HGV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and,
- *Small:* <10 HGV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

[3] Institute of Air Quality Management 2014. *Guidance on the Assessment of dust from demolition and construction.*

Step 2B - Defining the Sensitivity of the Area

Sensitivities of People to Dust Soiling Effects

- *High:*
  - Users can reasonably expect an enjoyment of a high level of amenity;
  - The appearance, aesthetics or value of their property would be diminished by soiling; and the people or property would reasonably expect to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land; and,
  - Indicative examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.
- *Medium:*
  - Users can reasonably expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home;
  - The appearance, aesthetics or value of their property could be diminished by soiling;
  - The 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; and,
  - Indicative examples include parks and places of work.
- *Low:*
  - The enjoyment of amenity would not reasonably be expected;
  - Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling;
  - There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land; and,
  - Indicative examples include playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table A1– Sensitivity of the Area to Dust Soiling Effects on People and Property

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

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Sensitivities of People to the Health Effects of PM_{10}

- *High:*
  - Locations where members of the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day);
  - Indicative examples include residential properties. Hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.
- *Medium:*
  - Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day); and,
  - Indicative examples include office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.
- *Low:*
  - Locations where human exposure is transient; and,
  - Indicative examples include public footpaths, playing fields, parks and shopping streets.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table A2 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28 - 32 µg/m³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24 – 28 µg/m³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Sensitivities of Receptors to Ecological Effects

- *High:*
  - Locations with an international or national designation and the designated features may be affected by dust soiling;
  - Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain; and,
  - Indicative examples include a Special Area of Conservation (SAC) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
- *Medium:*
  - Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown;
  - Locations with a national designation where the features may be affected by dust deposition; and,
  - Indicative example is a Site of Special Scientific Interest (SSSI) with dust sensitive features.
- *Low:*
  - Locations with a local designation where the features may be affected by dust deposition; and,
  - Indicative example is a local Nature Reserve with dust sensitive features.

The sensitivity of the area should be derived for each of the four activities: demolition, construction, earthworks and trackout, using the following table:

Table A3 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from Source (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Note - The likely routes the construction traffic will use should also be included to enable the presence of trackout receptors to be included in the assessment. As a general guidance, without site-specific mitigation, trackout may occur along the public highway up to 500 m from large sites (as defined in step 2A), 200 m from medium sites and 50 m from small sites, as measured from the site exit.

Step 2C - Defining the Risk of Impacts

The risk of impacts with no mitigation is determined by combining the dust emission magnitude determined in Step 2A and the sensitivity of the area determined in Step 2B.

The following tables provide a method of assigning the level of risk for each activity.

Demolition

Table A4 - Risk of Dust Impacts, Demolition

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

Earthworks

Table A5 - Risk of Dust Impacts, Earthworks

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

Construction

Table A6 - Risk of Dust Impacts, Construction

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

Trackout

Table A7 - Risk of Dust Impacts, Trackout

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

Step 3 – Site Specific Mitigation

The dust risk categories for each of the four activities determined in Step 2C should be used to define the appropriate, site-specific mitigation measures to be adopted.

These mitigation measures are contained within section 8.2 of the IAQM Guidance on the Assessment of Dust from Demolition and Construction.

Appendix B Alternative (CURED) Future Emissions Scenario Results

Scenario Context

As an additional sensitivity test, an assessment using emissions for 2025, generated from the Calculator Using Realistic Emissions for Diesels (CURED) Version 3A toolkit (23rd January 2018) has been undertaken.

The CURED emissions projections have been developed by Air Quality Consultants (AQC), on the basis that the Defra published EFT fleet emission projections may be over-precautionary in terms of NO_x emissions. The CURED emissions projections incorporate a larger proportion of diesel car, Euro IV, V and VI Heavy Duty Vehicle emissions than the Defra published EFT.

The three assessment scenarios are defined below:

- 2018 Baseline = Existing baseline conditions;
- 2022 'Do Minimum' Theoretical Scenario = Baseline Conditions + Committed Development Flows; and,
- 2022 'Do Something' Theoretical Scenario = Baseline Conditions + Committed Development Flows + Proposed Development Flows.

Model Verification

Table B1 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube location	NO_2 µg/m³		
	Monitored NO_2	Modelled NO_2	Difference (%)
DT24	30.20	30.59	1.29
DT25	34.30	37.16	8.34
DT26	40.10	40.22	0.31
DT27	39.10	38.94	-0.40
DT31	29.70	28.79	-3.05
DT32	32.80	29.61	-9.74
*Located in the AQMA			

The final model produced data at the monitoring locations to within 10% of the monitoring results, which is recommended by TG16 guidance.

The final verification model correlation coefficient (representing the model uncertainty) is 1.00[4]. This figure demonstrates that the model predictions were in line with the road traffic emissions at the monitoring locations.

[4] This was achieved by applying a model correction factor of 2.12 to roadside predicted NO_X concentrations before converting to NO_2

Table B2 CURED Scenario NO_2 Results at Receptor Locations

Receptor		NO_2 (µg/m³)			
		Baseline 2018	Do Minimum 2022	Do Something 2022	Development Contribution
R1	179 Upper Hoyland Road	23.25	20.96	20.98	0.02
R2	261 Sheffield House	36.32	31.72	31.86	0.14
R3	33 Wood View	44.54	37.76	37.93	0.17
R4	10 Sheffield Road	27.98	24.49	24.52	0.03
R5	86 Sheffield Road	32.78	28.31	28.34	0.03
R6	Stonehurst, Sheffield Road	24.97	22.17	22.18	0.01
R7	Hood Hill Farm	21.91	20.64	20.65	0.01
R8*	23 Farlow Croft	12.02	11.63	11.64	0.01
R9*	11 Howbrook Close	14.59	13.87	13.87	<0.01
R10	29 Fenn Road	21.33	18.80	18.81	0.01
R11*	Tankersley St Peters CofE Primary	28.86	26.15	26.16	0.01
R12	55 Hay Green Lane	17.62	16.81	17.01	0.20
R13	Birdwell Primary School	27.38	24.07	24.23	0.16
R14	1 Chapel Street	26.86	23.56	23.66	0.10
R15	15 Sheffield Road	23.90	21.46	21.50	0.04
PR1	Proposed Receptor	-	-	16.63	-
PR2	Proposed Receptor	-	-	19.56	-
PR3	Proposed Receptor	-	-	17.57	-
PR4	Proposed Receptor	-	-	20.77	-
PR5	Proposed Receptor	-	-	16.42	-
Annual Mean AQO		**40 µg/m³**			
*Located in the AQMA					

All modelled existing receptors are predicted to be below the AQO for NO_2 in both the 'do minimum' and 'do something' scenarios.

As indicated in Table B2, the maximum predicted increase in the annual average exposure to NO_2 at any existing receptor, due to changes in traffic movements associated with the development, is 0.20 µg/m³ at 55 Hay Green Lane (R12).

The impact description of changes in traffic flow associated with the development with respect to annual mean NO_2 exposure has been assessed with reference to the criteria in Section 3. The outcomes of the assessment are summarised in Table B3.

Table B3 Impact Description of Effects at Key Receptors (NO_2)

Impact Description of NO_2 Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R1	23.25	0.05	0%	≤75% of AQO	Negligible
R2	36.32	0.35	0%	76-94% of AQO	Negligible
R3	44.54	0.43	0%	95-102% of AQO	Negligible
R4	27.98	0.08	0%	≤75% of AQO	Negligible
R5	32.78	0.08	0%	≤75% of AQO	Negligible
R6	24.97	0.03	0%	≤75% of AQO	Negligible

Impact Description of NO_2 Effects at Key Receptors					
Receptor	Change Due to Development (DS-DM) (µg/m³)	Change due to Development (% of AQO)	% Change in Concentration Relative to AQO	% Annual Mean Concentration in Assessment Year	Impact Description
R7	21.91	0.03	0%	≤75% of AQO	Negligible
R8*	12.02	0.03	0%	≤75% of AQO	Negligible
R9*	14.59	0.00	0%	≤75% of AQO	Negligible
R10	21.33	0.03	0%	≤75% of AQO	Negligible
R11*	28.86	0.03	0%	≤75% of AQO	Negligible
R12	17.62	0.50	1%	≤75% of AQO	Negligible
R13	27.38	0.40	0%	≤75% of AQO	Negligible
R14	26.86	0.25	0%	≤75% of AQO	Negligible
R15	23.90	0.10	0%	≤75% of AQO	Negligible
*0% means a change of <0.5% as per explanatory note 2 of table 6.3 of the EPUK IAQM Guidance.					
*Located in the AQMA					

The impact description of the effects of changes in traffic flow as a result of the proposed development, with respect to NO_2 exposure for existing receptors, is determined to be 'negligible' at all identified receptors. This is based on the methodology outlined in Section 3.

Appendix C Defra Damage Cost Assessment Methodology

A 'damage costs' assessment has been completed. Damage costs are a simple way to value changes in air pollution. They estimate the cost of a change in emissions of different pollutants. Barnsley Metropolitan Borough Council have published the BMBC Technical Planning guidance, which lays out the appropriate damage cost emission calculations.

"Road Transport Emission Increase =

∑[Estimated trip rate for 5 years X Emission rate per 10 km per vehicle type X Damage Costs]"

Using the Emissions Factor Toolkit (EFT), annual link emissions were calculated using the following criteria, in line with IAQM and EPUK guidance:

Additional trips	652 AADT
Average distance travelled	10 km
Assumed average speed of	50 kph

Using a 2018 baseline year, total annual link emissions in EFT output were calculated to be:

NOx	865	kg/annum
PM2.5	37	kg/annum

To calculate the link emissions over a five-year period, the annual link emissions were multiplied by five:

NOx	4,327	kg/annum
PM2.5	186	kg/annum

National Damage Cost Values were used to calculate the total damage cost for the proposed development. Five year emissions were converted to Tonnes and multiplied by national damage cost for 2018.

NOx	4,327 / 1,000 = 4.3 t
	4.3 t x £6,199 = £26,824
PM2.5	186 / 1,000 = 0.2 t
	0.2 t x £105,836 = £19,699

Total Damage Cost is calculated to be £46,523. Calculations can be seen summarised in Table C1.

Table C1 Damage Cost Calculation

Pollutant	Annual Link Emissions (kg/annum)	5 Years Annual Link Emissions (kg/annum)	5 Years Annual Link Emissions (t/annum)	2018 National Damage Costs (£/tonne)	Valuation (£)
NO_x	865	4,327	4.3	6,199	26,824
$PM_{2.5}$	37	186	0.2	105,836	19,699
	Total				**£46,523**

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