Pipestone Ltd

Proposed Residential Development
Land West Of Wakefield Road
Mapplewell, Barnsley

Air Quality Assessment

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1.0 Introduction

Pipestone Ltd commissioned WYG Planning and Environment (WYG) to prepare an Air Quality Assessment for a planning application for a proposed residential development on land west of Wakefield Road, Mapplewell, Barnsley.

1.1 Site Location and Context

The approximate United Kingdom (UK) National Grid Reference (NGR) for the proposed development site is 433600, 410100. Reference should be made to Figure 1 for an indication of the proposed development site boundary and surrounding area. The proposal is for a residential development with up to 300 residential dwellings.

1.2 Overview and Scope of Air Quality Assessment

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

- Baseline evaluation of air quality within the vicinity of the proposed development;
- Assessment of potential air quality impacts associated with the proposed development site during the construction phase;
- Assessment of the suitability of the site for residential purposes; and,
- Assessment of potential air quality impacts associated with the proposed development during the operational phase.

The results 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 using a qualitative risk assessment method based on the Institute of Air Quality Management's 'Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance' document.

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 (PM_{10}) as a result of the development, at key local receptor locations. The changes have been referenced to EU air quality limit values and UK air quality objectives and the magnitude and significance of the changes have been referenced to non statutory guidance issued by Environmental Protection UK.

2.0 Extant Policy, Legislation and Relevant Agencies

2.1 Documents Consulted

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

2.1.1 Legislation and Best Practice Guidance

- The Air Quality Standards Regulations, 2010;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009;
- Development Control: Planning for Air Quality (2010 Update) Updated guidance from Environmental Protection UK on dealing with air quality concerns within the development control process, April 2010;
- National Planning Policy Framework, Department for Communities and Local Government, March 2012;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007;
- The Control of Dust and Emissions from Construction and Demolition – Best Practice Guide, Greater London Authority and London Councils, 2006; and,
- Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance, Institute of Air Quality Management, January 2012

2.1.2 Websites Consulted

- The UK National Air Quality Archive (www.airquality.co.uk);
- EMAPSITE (www.emapsite.com); and,
- Barnsley Metropolitan Borough Council website (http://www.barnsley.gov.uk/)
- MAGIC (http://magic.defra.gov.uk/)

2.1.3 Site Specific Reference Documents

- Barnsley Local Development Framework Core Strategy - Adopted September 2011
- 2012 Air Quality Updating and Screening Assessment, for Barnsley Metropolitan Council;

2.2 Air Quality Legislative Framework

2.2.1 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 99/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for NO_2 and NO_x, sulphur dioxide, lead and particulate matter;
- **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.

2.2.2 UK Legislation

The Air Quality Standards Regulations 2010, 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 United Kingdom (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 2007 No. 64 Regulation 14 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 air 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 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 1 along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 1 Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Applies	Objective	Concentration Measured as[10]	Date to be Achieved by and Maintained thereafter	European Obligations	Date to be achieved and maintained thereafter	New or existing
PM_{10}	UK	50µg/m^3 by end of 2004 (max 35 exceedances a year)	24-hour mean	1st January 2005	50µg/m^3 by end of 2004 (max 35 exceedances a year)	1st January 2005	Retain Existing
	UK	40µg/m^3 by end of 2004	Annual mean	1st January 2005	40µg/m^3	1st January 2005	
Nitrogen Dioxide	UK	200µg/m^3 not to be exceeded more than 18 times a year	1 Hour Mean	31st December 2005	200µg/m^3 not to be exceeded more than 18 times a year	1st January 2010	Retain Existing
	UK	40µg/m^3	Annual Mean	31st December 2005	40µg/m^3	1st January 2010	

Within the context of this assessment, the annual mean objectives are those against which residential receptors will be assessed and the short term objectives apply to all receptor locations, both residential and non residential.

2.2.3 Local Air Quality Management

Under the Environment Act 1995 all local authorities 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 ambient pollutant concentrations against AQOs, the process of which is set out in the Department of Environment's Local Air Quality Management Policy Guidance LAQM TG (09). If it is predicted that levels at receptor locations 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 pollutants levels in pursuit of the Objective levels.

2.3 Planning and Policy Guidance

2.3.1 National Policy

The National Planning Policy Framework (NPPF) 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 broadly retains the principles of PPS 23: Planning and Pollution Control and states that:

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

2.3.2 Local Policy

Barnsley Metropolitan Borough Council (BMBC) formally adopted the 'Local Development Framework Core Strategy' (CS) in September 2011, which outlines the Council's broad planning strategy for the future. The following have been identified as being relevant to the proposed development from an air quality perspective:

> ***'CSP 28 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 implementing measures to ensure the current road system is used efficiently.'*
>
> ***'CSP 40 Pollution Control and Protection***
>
> *Development will be expected to demonstrate that it is not likely to result, directly or indirectly,*
> *in an increase in air, surface water and groundwater, noise, smell, dust, vibration, light or other pollution which would unacceptably affect or cause a nuisance to the natural and built environment or to people.*
> *We will not allow development of new housing or other environmentally sensitive development where existing air pollution, noise, smell, dust, vibration, light or other pollution levels are unacceptable and there is no reasonable prospect that these can be mitigated against.*
> *Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.'*

3.0 Assessment Methodology

The potential environmental effects of the proposed development are identified, in so far as current knowledge of the site and development allows. The significance of potential environmental effects is assessed according to their scale (magnitude) and the sensitivity of the receptors.

3.1 Predicting Magnitude of Impact

Magnitude (scale of change) is determined by considering the predicted deviation from baseline conditions; quantifiable assessment of magnitude has been undertaken where possible.

Impacts of the proposed development on air quality have been assessed with reference to the baseline conditions and environmental assessment criteria. The rationale for determining the magnitude of an impact is shown in Table 2. The rationale has been derived in part from the magnitude matrix described in Table 4 of the EPUK non statutory guidance 'Development Control: Planning for Air Quality (2010 Update)'.

Table 2 Methodology for Assessing Magnitude of Impacts on Air Quality

Magnitude of Impact(1)	Description	Description
Large	Impact resulting in a considerable change in baseline environmental conditions (i) with severe undesirable/desirable consequences on the receiving environment.	• Air quality varies between the do minimum and do something by more than 10% of the air quality objective. • Substantial risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Medium	Impact resulting in a discernable change in baseline environmental conditions (i) with undesirable/desirable conditions	• Air quality varies between the do minimum and do something by 5 - 10% of the air quality objective. • Moderate risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Small	Impact resulting in a discernable change in baseline environmental conditions with undesirable/desirable conditions that can be tolerated.	• Air quality varies between the do minimum and do something by 1 - 5% of the air quality objective. • Slight risk that emissions will generate statutory nuisance complaints, resulting in formal action (Construction).
Imperceptible(2)	No discernable change in baseline environmental conditions.	• Air quality varies between the do minimum and do something by less than 1% of the air quality objective. • Little or no cause for nuisance complaints to be made (Construction).

NOTE (1) An impacts magnitude can be either positive or negative, except for negligible.
(2) If the assessor is certain that a receptor or attribute of a feature will suffer no impact whatsoever then the term 'No Impact' can be used in the place of 'Negligible Impact'. However, it is not usually possible to determine 'No Impact' in many cases with 100% certainty so the term 'Negligible' should be used in these cases.

The stated methodology has been developed by WYG and was based on the example assessment criteria for air quality provided in the Environmental Protection UK guidance document Development Control: Planning for Air Quality for road vehicle exhaust emission impacts.

3.2 Sensitivity of Receptor

Receptors can demonstrate different sensitivities to changes in their environment. For the purpose of this assessment sensitivity is determined as Very High, High, Medium or Low as detailed in Table 3. The factors considered when determining the sensitivity of a receptor are summarised below in Table 3.

Table 3 Methodology for Assessing Sensitivity of Receptor

Sensitivity	Description
Very High	• Do Minimum pollutant concentration already exceeding the relevant AQO. • Receptors of very high sensitivity to dust and odour, such as: hospitals and clinics, retirement homes, painting and furnishing, hi-tech industries and food processing (Construction). • Densely populated areas – more than 100 dwellings within 20m of the development site (Construction)
High	• Do Minimum pollutant concentration already 90 - 100% of the relevant AQO. • Receptors of high sensitivity to dust and odour, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices (Construction). • Densely populated areas – 10-100 dwellings within 20m of the development site (Construction)
Medium	• Do Minimum pollutant concentration between 75-90% of the relevant AQO. • Receptors of medium sensitivity to dust and odour, such as: farms, outdoor storage, light and heavy industry (Construction). • Suburban or edge of town areas (Construction)
Low	• Do Minimum pollutant concentration less than 75% of the relevant AQO • All other dust/odour sensitive receptors not identified above (Construction). • Rural/Industrial areas (Construction).

3.3 Assessment of Impact Significance

Table 4 shows how the interaction of magnitude and sensitivity results in the significance of an environmental effect. If the scale of the impact magnitude is negative then the resulting effect is adverse. If the scale of the impact magnitude is positive then the resulting effect is beneficial.

Table 4 Impact Significance Matrix

Sensitivity of Receptor	Magnitude of Impact			
	Large	Medium	Small	Imperceptible
Very High	Substantial	Moderate	Slight	Negligible
High	Moderate	Moderate	Slight	Negligible
Medium	Slight	Slight	Negligible	Negligible
Low	Slight	Negligible	Negligible	Negligible

4.0 Baseline Conditions

This section provides a review of the existing air quality in the vicinity of the proposed development in order to provide a benchmark against which to assess potential air quality impacts.

4.1 Air Quality Review and Assessment

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. The assessments have indicated that concentrations of NO_2 are above the relevant AQOs at a number of locations of relevant public exposure within the Council. As such, the 2012 USA currently declares five AQMAs[1]:

- **M1 AQMA:** Encompasses areas 100 metres either side of the M1.
- **A628 AQMA:** Encompasses areas off Dodworth Road
- **A628 AQMA:** Encompasses areas off Barnsley Road
- **A61 AQMA:** Encompasses areas just surrounding the Wakefield / Burton Road junction
- **A61 AQMA:** Encompasses areas just off Harborough Hill Road
- **A633 AQMA:** Encompasses areas surrounding Rotherham / Burton Road

The closest AQMA is the Wakefield / Burton Road Junction which is approximately over 2.0 km from the proposed development site. It is not anticipated that the traffic generated by the proposed development will be greater than 5% of the existing flows along Wakefield Road. As such the impact associated with the development within the AQMA is considered to be negligible, therefore the impacts of the proposed development within the AQMA were not considered further.

4.2 Air Quality Monitoring

Monitoring of air quality within BMBC is undertaken through non-automatic monitoring and automatic monitoring methods. These have been reviewed in order to provide an indication of existing air quality in the surrounding area of the proposed development site. The closest location, Gawber, is over 2.5 km away from the proposed site and not considered representative of the airborne pollutants concentrations.

[1] Search in www.airquality.co.uk

In 2011 the Council undertook non-automatic monitoring for nitrogen dioxide using passive diffusion tubes. The closest NO_2 diffusion tube monitoring results are presented in Table 5.

Table 5 Monitored Annual Mean Nitrogen Dioxide Concentrations (Non-Automatic)

Site		UK NGR (m)		Annual Mean Nitrogen Dioxide Concentrations ($\mu g/m^3$)				
		X	Y	2007	2008	2009	2010	2011
1	Tankersley School	434652	400231	32.30	34.20	27.80	34.50	24.10
32	Wakefield Road / Wensley Road	434512	409256	29.60	31.00	27.70	29.10	24.90
33	Wakefield Road / Brunswick Close	433933	408660	31.40	33.50	33.40	31.90	30.50

As Table 5 illustrates, the closest nitrogen dioxide diffusion tube monitoring sites to the proposed development site did not exceed the National Air Quality Objective of 40µg/m^3 in 2011. Between 2008 and 2011 where data was available, no exceedances were recorded. Only tube location 32 lies within the main study area as such it was utilised within the verification process.

4.3 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 meteorological data used in the assessment is derived from Robin Hood airport. This is the nearest meteorological station 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 Robin Hood airport Meteorological Station site.

4.4 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 nitrogen dioxide and particulate matter.

The assessment has therefore modelled all roads within the immediate vicinity of the application site which are considered likely to experience significant changes in traffic flow as a result of the proposed development. Full details of the traffic data input into the ADMS Roads 3 model can be found in Appendix A, with Figure 1 providing a visual illustration of the modelled road sources.

It should be noted that the 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.

4.5 Sensitive Receptors

Receptors that are considered as part of the air quality assessment are primarily those existing receptors that are situated to the north, south and west of the proposed development site, along routes predicted to experience changes in traffic flow as a result of the scheme.

The receptor locations are summarised in Table 6 below and the spatial locations of all of the receptors are illustrated in Figure 1.

Table 6 Modelled Sensitive Receptors

Discrete Sensitive Receptor		UK NGR (m)	
		X	Y
R1	407 Wakefield Road	434166.5	409602.7
R2	397 Wakefield Road	434187.9	409592.2
R3	418 Kirkstall Road	434100.1	409584.7
R4	396 Kirkstall Road	434225.2	409505.6
R5	2 Bar Lane	434027.9	409623.7
R6	20 Bar Lane	433936.7	409646.7
R7	9 Bar Lane	433931.0	409684.3
R8	1 Wakefield Road	434053.0	409687.4
R9	Eastfield Arms, Public House, Wakefield Road	433994.3	409708.7
R10*	26 Eastfield Crescent*	433961.3	409790.7
R11	78 Paddock Road	433674.0	410286.7
R12	2 Parkview Road	433602.7	410351.2
R13	62 Paddock Road	433591.6	410319.3
R14	23 Paddock Road	433503.4	410377.5
R15	62 Eastfield Crescent	433881.0	409956.8
R16	76 Eastfield Crescent	433840.2	409906.7
R17	18 Cloudberry Way	433678.2	409861.4
R18	20 Waythorne Close	433479.3	409967.3
R19	66 Paddock Road	433630.4	410299.6
R20	16 Park View Road	433502.5	410493.1
R21	The Old Police Station, Wakefield Road	433491.1	410535.7
R22	12 Wakefield Road	433408.9	410617.6

Discrete Sensitive Receptor		UK NGR (m)	
		X	Y
R23	26 Wakefield Road	433395.4	410698.3
R24	Lee Lane Farm	434765.4	411282.6
R25	2 Shaw Lane	433437.9	410554.2
R26	7 Shaw Lane	433327.3	410533.6
R27	2 Paddock Close	433438.3	410517.1
R28	17 Paddock Road	433339.0	410479.2
R29	Proposed Property Adjacent to Site Access	433763.8	410143.8
R30	Proposed Property Adjacent to Site Access	433740.6	410129.2
R31	Proposed Property Adjacent to Site Access Link B	433683.9	410107.4
R32	Proposed Property Adjacent to Site Access Link A	433797.7	410068.3
R33	Proposed Property Adjacent to Site Access Link A	433821.0	410046.7
R34	Proposed Property Adjacent to Site Access Link A	433826.0	409986.8

NOTE *Non-Residential receptors marked with asterisk.

The potential effects of the proposed development on ecological receptors have also been considered. A desktop assessment of 'Designated' ecological receptors (as defined within the Design Manual for Roads and Bridges guidance on air quality assessments) has been undertaken as well as a review of other potentially sensitive ecological receptors such as Local Nature Reserves and Ancient Woodland. Following a desktop review of protected areas within 1km radius, the following were identified:

- Notton Wood Local Nature Reserve (LNR)

Given the distance between the proposed development site and the LNR, it is not anticipated that the proposed development will have a significant effect within the LNR, as such ecological receptors were not considered further within this assessment.

5.0 Assessment of Air Quality Impacts - Construction Phase

5.1 Pollutant Sources

Other than negligible emissions from construction vehicles and equipment, 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. In respect of fires on site it should be noted that suitable management strategies will be in place to prevent burning of any material during the construction phase. The main potential effects of particulates / dust 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 wind blown stockpiles.

5.2 Particulate Matter (PM_{10})

The UK Air Quality Standards seek to control the health implications of respirable particulate matter PM_{10} (less than 10 micrometers in diameter). 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. Research indicates that 70% of dust emissions typically settle within 200m of their source and only 10% remain in the air at 400m away. There are no formal standards or criteria for nuisance caused by deposited particles, however, 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 should 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

WYG have adapted Guidance from the IAQM 'Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance' document published in January 2012. Whilst the sensitivity of receptors is determined using the criteria contained in Table 3, in order to determine the significance of effects the construction phase assessment utilises a risk based approach, rather than defining the magnitude of change, as applied in the operational phase assessment.

In total 4 processes are considered, namely 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 class 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 C.

5.5 Assessment Results

Based on the methodology detailed in Appendix C and prior to the implementation of appropriate mitigation measures, the potential impact significance of dust emissions associated with the construction phase of the proposed development is presented in Table 7 below. The assessment is based on the nearest sensitive receptors to each source activity.

Table 7 Impact Significance of Construction Activities without Mitigation

Source	Impact Significance	
	Dust Soiling	PM_{10}
Demolition	Negligible	Negligible
Earthworks	Slight adverse	Slight adverse
Construction	Slight adverse	Slight adverse
Trackout	Slight adverse	Slight adverse

Appropriate Mitigation Measures are presented in section 8 based on the risk classification of the proposed site. Following the adoption of these measures, the subsequent expected impact significance of the construction phase based on IAQM guidance is summarised in Table 8 below.

Table 8 Impact Significance of Construction Activities with Mitigation

Source	Impact Significance	
	Dust Soiling	PM_{10}
Demolition	Negligible	Negligible
Earthworks	Negligible	Negligible
Construction	Negligible	Negligible
Trackout	Negligible	Negligible

6.0 Assessment of Air Quality Impacts - Operational Phase

In the context of the proposed development, transportation 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 quantified predictions of the changes in nitrogen dioxide and particulate matter exposure as a result of the operational phase of the development, due to changes in traffic movement.

In accordance with the traffic data provided to WYG, the operational phase assessment has been undertaken with an assumed operational year of 2017. The assessment scenarios are therefore:

- 2017 'Do Minimum' = Baseline + Committed Development
- 2017 'Do Something' = Committed Development + Proposed Residential Development

6.1 Existing and Predicted Traffic Flows

Projected 2017 'do minimum' and 'do something' traffic data has been provided by Bryan G Hall Ltd for the operational phase assessment in the form of AM and PM Peak turn-counts. These were scaled to represent Annual Average Daily Traffic figures (AADT) using adjustment factors of 10.5 for AM and PM flows.

For the purposes of the air quality assessment only roads predicted to experience significant changes in flows have been included in the air quality model. These represent the primary access routes to the proposed development site. Where unavailable, traffic speeds have been estimated based on site observations and national speed limits. All of the roads within the dispersion model are illustrated in Figure 1.

Emission factors for the projected 2017 'do minimum' and 'do something' scenarios have been calculated using Defra's EFT version 5.1.3 (Updated August 2012). It should be noted that at the time of assessment the latest available EFT version was 5.1.3.

CERC have been advised by the LAQM Helpdesk that 'there are no major changes in core emissions between 5.1.3 and 5.2c, just very minor tweaks'. As such it is not considered necessary to update the model to include the EFTv5.2c emission factors.

Road junctions have been modelled with the assumption of a 50m slow-down phase, prior to the junction line. This slow-down phase has been modelled at a speed of 20km/h. Detailed traffic figures are provided in Table 18, Appendix A.

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.

Background concentrations as used within the prediction calculations 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 April 2012 Defra issued revised 2010 background maps for NO_x, NO_2, PM_{10} and $PM_{2.5}$ which incorporate updates to the input data used for modelling. The updated mapped background concentrations are summarised in Table 9 below.

Table 9 Predicted Background Concentrations

UK NGR		2010 Predicted Background Concentration (µg/m^3)		
X	Y	NO_2	NO_x	PM_{10}
434500	409500	16.32	23.21	15.56
433500	409500	16.05	22.80	15.35
433500	410500	17.45	25.12	15.50
UK NGR		**2017 Predicted Background Concentration (µg/m^3)**		
X	**Y**	**NO_2**	**NO_x**	**PM_{10}**
434500	409500	12.19	16.61	14.53
433500	409500	12.07	16.46	14.31
433500	410500	13.15	18.09	14.42

Table 9 indicates that there were no background exceedances of the relevant AQOs within the vicinity of the proposed development during 2010 and 2017. As a worst-case, mapped background concentrations for 2010 have been used throughout the assessment.

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 Annex 3 of the LAQM TG (09) 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 nitrogen oxides (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 paragraphs 2.22 to 2.27 of Local Air Quality Management LAQM TG(09). The calculation was derived using the NO_X to NO_2 worksheet in the online LAQM tools website hosted by DEFRA.

A model correction of 5.4901 was applied to roadside predicted NO_X concentrations before converting to NO_2. This figure demonstrates that the model was under predicting the road traffic emissions at the monitoring locations, probably due to the effects of congestion and stop-start driving behaviour in the study area and the effects of increased tailpipe emissions as traffic accelerates away from the roundabouts and junctions. Table 10 below summarises the final model / monitored data correlation following the application of the relevant adjustment factor.

Table 10 Comparison of Roadside Modelling & Monitoring Results for NO_2

Tube location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
32	29.10	29.10	0.00

The final model produced data at the monitoring location within 25% of the monitoring results, as recommended within LAQM TG (09).

The model is therefore considered to be verified and suitably representative of local emissions and exposures. Reference should be made to Figure 3 for a visual illustration of the model correlation coefficient.

6.4 Summary of Model Inputs

Table 11 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), nitrogen dioxide (NO_2), Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	**Robin Hood Airport 2010**, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**1.5m** representing a typical surface roughness for large urban areas
Latitude	Allows the location of the model area to be set	United Kingdom = **52º**
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Mixed Urban/Industrial = **30m.**
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

Parameter	Description	Input Value
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	Time varied emissions were not used.
Road Type	Allows the effect of different types of roads to be assessed.	**Urban Road** (not London) settings were used
Road Speeds	Enables individual road speeds to be added for each road link	Based on national speed limits and 20km/h for slowdown sections
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 Defra toolkit of traffic emission factors.	The **EFT Version 5.1.3** dataset was used.
Year	Predicted DfT emissions rates depend on the year of emission.	**2010** data for the base year model validation. **2017** data for the operational phase assessment

6.5 ADMS Modelling Results

6.5.1 Traffic Assessment

The ADMS Model has predicted concentrations of NO_2 and PM_{10} at relevant receptor locations adjacent to roads likely to be effected by the development. The model outputs are based on fully verified model results from the ADMS Roads model. The following tables summarise the atmospheric dispersion model predictions of air quality at the relevant receptor locations. Only receptors close to roads where there is predicted to be a change in emissions have been assessed.

Nitrogen Dioxide

Table 12 presents a summary of the predicted change in annual average nitrogen dioxide concentrations at relevant receptor locations in the projected operational year of 2017, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 12 Predicted 2017 Annual Average Concentrations of NO_2 at Modelled Receptor Locations (µg/m^3)

Receptor		Annual Mean Nitrogen Dioxide (µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R1	407 Wakefield Road	34.08	34.77	0.69
R2	397 Wakefield Road	32.98	33.64	0.66
R3	418 Kirkstall Road	22.60	22.98	0.38
R4	396 Kirkstall Road	20.15	20.43	0.28
R5	2 Bar Lane	23.51	24.26	0.75
R6	20 Bar Lane	20.02	20.76	0.74
R7	9 Bar Lane	23.71	24.76	1.05

Receptor		Annual Mean Nitrogen Dioxide (µg/m³)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R8	1 Wakefield Road	33.23	34.06	0.83
R9	Eastfield Arms, Public House, Wakefield Road	20.28	20.79	0.51
R10*	26 Eastfield Crescent*	19.31	19.69	0.38
R11	78 Paddock Road	17.32	17.61	0.29
R12	2 Parkview Road	16.51	16.68	0.17
R13	62 Paddock Road	15.47	15.62	0.15
R14	23 Paddock Road	15.19	15.28	0.09
R15	62 Eastfield Crescent	19.66	20.27	0.61
R16	76 Eastfield Crescent	14.83	15.36	0.53
R17	18 Cloudberry Way	14.42	14.68	0.26
R18	20 Waythorne Close	14.09	14.28	0.19
R19	66 Paddock Road	15.46	15.65	0.19
R20	16 Park View Road	17.55	17.72	0.17
R21	The Old Police Station, Wakefield Road	22.92	23.22	0.30
R22	12 Wakefield Road	16.25	16.40	0.15
R23	26 Wakefield Road	16.09	16.25	0.16
R24	Lee Lane Farm	14.30	14.31	0.01
R25	2 Shaw Lane	20.86	20.99	0.13
R26	7 Shaw Lane	16.43	16.48	0.05
R27	2 Paddock Close	20.40	20.50	0.10
R28	17 Paddock Road	18.44	18.51	0.07
R29	Proposed Property Adjacent to Site Access	-	17.92	-
R30	Proposed Property Adjacent to Site Access	-	16.74	-
R31	Proposed Property Adjacent to Site Access Link B	-	15.45	-
R32	Proposed Property Adjacent to Site Access Link A	-	17.75	-
R33	Proposed Property Adjacent to Site Access Link A	-	18.73	-
R34	Proposed Property Adjacent to Site Access Link A	-	16.79	-
Annual Mean Air Quality Objective not to be exceeded (residential)		**40 µg/m³**		
Annual Mean Air Quality Objective not to be exceeded (non-residential)		**60 µg/m³**		

NOTE *Non-residential receptors

As indicated in Table 12, the maximum predicted increase in the annual average exposure to nitrogen dioxide at any existing receptor, due to changes in traffic movements associated with the development, is 1.05µg/m^3 at Bar Lane (R7).

All locations are predicted to meet the national AQO for NO_2 in 2017.

The significance 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 3.0. The outcomes of the assessment are summarised in Table 13.

Table 13 Significance Effects at Key Receptors in 2017 (Nitrogen Dioxide)

Receptor		Change (% of AQO)	Magnitude	Sensitivity	Significance
R1	407 Wakefield Road	1.72	Small	Medium	Negligible
R2	397 Wakefield Road	1.65	Small	Medium	Negligible
R3	418 Kirkstall Road	0.95	Imperceptible	Low	Negligible
R4	396 Kirkstall Road	0.70	Imperceptible	Low	Negligible
R5	2 Bar Lane	1.87	Small	Low	Negligible
R6	20 Bar Lane	1.85	Small	Low	Negligible
R7	9 Bar Lane	2.62	Small	Low	Negligible
R8	1 Wakefield Road	2.07	Small	Medium	Negligible
R9	Eastfield Arms, Public House, Wakefield Road	1.27	Small	Low	Negligible
R10*	26 Eastfield Crescent*	0.95	Imperceptible	Low	Negligible
R11	78 Paddock Road	0.72	Imperceptible	Low	Negligible
R12	2 Parkview Road	0.42	Imperceptible	Low	Negligible
R13	62 Paddock Road	0.37	Imperceptible	Low	Negligible
R14	23 Paddock Road	0.22	Imperceptible	Low	Negligible
R15	62 Eastfield Crescent	1.52	Small	Low	Negligible
R16	76 Eastfield Crescent	1.32	Small	Low	Negligible
R17	18 Cloudberry Way	0.65	Imperceptible	Low	Negligible
R18	20 Waythorne Close	0.47	Imperceptible	Low	Negligible
R19	66 Paddock Road	0.47	Imperceptible	Low	Negligible
R20	16 Park View Road	0.42	Imperceptible	Low	Negligible
R21	The Old Police Station, Wakefield Road	0.75	Imperceptible	Low	Negligible
R22	12 Wakefield Road	0.37	Imperceptible	Low	Negligible
R23	26 Wakefield Road	0.40	Imperceptible	Low	Negligible
R24	Lee Lane Farm	0.02	Imperceptible	Low	Negligible
R25	2 Shaw Lane	0.32	Imperceptible	Low	Negligible
R26	7 Shaw Lane	0.12	Imperceptible	Low	Negligible
R27	2 Paddock Close	0.25	Imperceptible	Low	Negligible
R28	17 Paddock Road	0.17	Imperceptible	Low	Negligible

The magnitude of the effects of changes in traffic flow as a result the proposed development, with respect to NO_2 exposure, is determined to range from 'small' to 'imperceptible'. The significance 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

Annual Mean

Table 14 presents a summary of the predicted change in annual mean PM_{10} concentrations at relevant receptor locations in the projected opening year of 2017, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 14 Predicted 2017 Annual Average Concentrations of PM_{10} at Modelled Receptor Locations (µg/m^3)

Receptor		Annual Mean Particulate Matter(µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R1	407 Wakefield Road	18.37	18.54	0.18
R2	397 Wakefield Road	18.16	18.33	0.16
R3	418 Kirkstall Road	15.97	16.05	0.08
R4	396 Kirkstall Road	15.66	15.72	0.05
R5	2 Bar Lane	16.13	16.28	0.16
R6	20 Bar Lane	15.73	15.90	0.16
R7	9 Bar Lane	16.43	16.68	0.25
R8	1 Wakefield Road	17.80	18.00	0.20
R9	Eastfield Arms, Public House, Wakefield Road	15.82	15.93	0.12
R10*	26 Eastfield Crescent*	15.83	15.92	0.09
R11	78 Paddock Road	15.65	15.72	0.07
R12	2 Parkview Road	15.40	15.45	0.04
R13	62 Paddock Road	15.18	15.21	0.03
R14	23 Paddock Road	15.11	15.13	0.02
R15	62 Eastfield Crescent	16.00	16.14	0.14
R16	76 Eastfield Crescent	14.86	14.96	0.10
R17	18 Cloudberry Way	14.73	14.79	0.05
R18	20 Waythorne Close	14.67	14.71	0.04
R19	66 Paddock Road	15.20	15.24	0.04
R20	16 Park View Road	15.62	15.67	0.04
R21	The Old Police Station, Wakefield Road	16.75	16.83	0.08
R22	12 Wakefield Road	15.35	15.39	0.03
R23	26 Wakefield Road	15.37	15.40	0.04
R24	Lee Lane Farm	14.91	14.91	0.00
R25	2 Shaw Lane	16.07	16.10	0.03
R26	7 Shaw Lane	15.30	15.32	0.02
R27	2 Paddock Close	15.96	15.99	0.03
R28	17 Paddock Road	15.67	15.68	0.02
R29	Proposed Property Adjacent to Site Access	-	15.73	-

Receptor		Annual Mean Particulate Matter(µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R30	Proposed Property Adjacent to Site Access	-	15.44	-
R31	Proposed Property Adjacent to Site Access Link B	-	15.15	-
R32	Proposed Property Adjacent to Site Access Link A	-	15.68	-
R33	Proposed Property Adjacent to Site Access Link A	-	15.91	-
R34	Proposed Property Adjacent to Site Access Link A	-	15.26	-

As indicated in Table 14, the maximum predicted increase in the annual average exposure to particulate matter at any existing receptor, due to changes in traffic movements associated with the development, is 0.25µg/m^3 at 9 Bar Lane (R7).

No modelled receptors are predicted to experience PM_{10} concentrations in exceedance of the Annual Mean Air Quality Objective.

The significance 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 3.0. The outcomes of the assessment are summarised in Table 15.

Table 15 Significance Effects at Key Receptors in 2017 (Annual Mean Particulate Matter)

Receptor		Change (% of AQO)	Magnitude	Sensitivity	Significance
R1	407 Wakefield Road	0.44	Imperceptible	Low	Negligible
R2	397 Wakefield Road	0.41	Imperceptible	Low	Negligible
R3	418 Kirkstall Road	0.21	Imperceptible	Low	Negligible
R4	396 Kirkstall Road	0.14	Imperceptible	Low	Negligible
R5	2 Bar Lane	0.40	Imperceptible	Low	Negligible
R6	20 Bar Lane	0.41	Imperceptible	Low	Negligible
R7	9 Bar Lane	0.62	Imperceptible	Low	Negligible
R8	1 Wakefield Road	0.49	Imperceptible	Low	Negligible
R9	Eastfield Arms, Public House, Wakefield Road	0.29	Imperceptible	Low	Negligible
R10*	26 Eastfield Crescent*	0.23	Imperceptible	Low	Negligible
R11	78 Paddock Road	0.16	Imperceptible	Low	Negligible
R12	2 Parkview Road	0.11	Imperceptible	Low	Negligible
R13	62 Paddock Road	0.08	Imperceptible	Low	Negligible
R14	23 Paddock Road	0.05	Imperceptible	Low	Negligible
R15	62 Eastfield Crescent	0.34	Imperceptible	Low	Negligible
R16	76 Eastfield Crescent	0.25	Imperceptible	Low	Negligible
R17	18 Cloudberry Way	0.13	Imperceptible	Low	Negligible
R18	20 Waythorne Close	0.10	Imperceptible	Low	Negligible
R19	66 Paddock Road	0.11	Imperceptible	Low	Negligible
R20	16 Park View Road	0.11	Imperceptible	Low	Negligible

Receptor		Change (% of AQO)	Magnitude	Sensitivity	Significance
R21	The Old Police Station, Wakefield Road	0.19	Imperceptible	Low	Negligible
R22	12 Wakefield Road	0.08	Imperceptible	Low	Negligible
R23	26 Wakefield Road	0.10	Imperceptible	Low	Negligible
R24	Lee Lane Farm	0.00	Imperceptible	Low	Negligible
R25	2 Shaw Lane	0.07	Imperceptible	Low	Negligible
R26	7 Shaw Lane	0.04	Imperceptible	Low	Negligible
R27	2 Paddock Close	0.07	Imperceptible	Low	Negligible
R28	17 Paddock Road	0.04	Imperceptible	Low	Negligible

The magnitude of the effects in 2017 of changes in traffic as a result the proposed development, with respect to annual mean PM_{10} exposure, is determined to be 'imperceptible'. The significance has been 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'.

Short term (24-hour Mean)

Following consultation with BMBC[2] an assessment of the 24-hour mean PM_{10} concentrations at relevant receptor locations was carried out.

For the short term averaging period the UK DEFRA methodology has been followed.

The 90.41%-ile 24-hour Development Contribution PM_{10} + 2 x (annual mean background PM_{10}) was utilised to predict short term PM_{10} concentrations at existing receptor locations.

Table 16 presents a summary of the predicted change in 24-hour mean PM_{10} concentrations at relevant receptor locations in the projected opening year of 2017, due to changes in traffic flow associated with the development, based on modelled 'do minimum' and 'do something' scenarios.

Table 16 Predicted 2017 90.41%ile 24-hour Mean Concentrations of PM_{10} at Modelled Receptor Locations (µg/m^3)

Receptor		90.41%-ile 24-hour Mean Particulate Matter(µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R1	407 Wakefield Road	36.13	36.42	0.29
R2	397 Wakefield Road	35.76	36.03	0.27
R3	418 Kirkstall Road	32.35	32.51	0.16
R4	396 Kirkstall Road	31.64	31.77	0.12
R5	2 Bar Lane	32.56	32.89	0.33

[2] Email from Chris Shields Technical Officer (Pollution Control), (Dated 14/08/2013)

Receptor		90.41%-ile 24-hour Mean Particulate Matter(µg/m^3)		
		2017 Do Minimum	2017 Do Something	Development Contribution
R6	20 Bar Lane	31.76	32.09	0.33
R7	9 Bar Lane	32.59	33.09	0.50
R8	1 Wakefield Road	34.78	35.15	0.37
R9	Eastfield Arms, Public House, Wakefield Road	31.68	31.86	0.18
R10*	26 Eastfield Crescent*	31.87	32.03	0.17
R11	78 Paddock Road	31.61	31.74	0.13
R12	2 Parkview Road	30.82	30.89	0.07
R13	62 Paddock Road	30.40	30.45	0.05
R14	23 Paddock Road	30.08	30.13	0.04
R15	62 Eastfield Crescent	32.37	32.58	0.22
R16	76 Eastfield Crescent	29.73	29.84	0.11
R17	18 Cloudberry Way	29.37	29.47	0.09
R18	20 Waythorne Close	29.25	29.33	0.08
R19	66 Paddock Road	30.51	30.58	0.07
R20	16 Park View Road	31.38	31.46	0.08
R21	The Old Police Station, Wakefield Road	33.51	33.68	0.17
R22	12 Wakefield Road	30.91	30.99	0.09
R23	26 Wakefield Road	31.04	31.14	0.10
R24	Lee Lane Farm	29.90	29.91	0.00
R25	2 Shaw Lane	32.26	32.33	0.07
R26	7 Shaw Lane	30.79	30.82	0.03
R27	2 Paddock Close	31.75	31.79	0.03
R28	17 Paddock Road	31.03	31.04	0.01
R29	Proposed Property Adjacent to Site Access	-	31.59	-
R30	Proposed Property Adjacent to Site Access	-	30.94	-
R31	Proposed Property Adjacent to Site Access Link B	-	30.27	-
R32	Proposed Property Adjacent to Site Access Link A	-	31.26	-
R33	Proposed Property Adjacent to Site Access Link A	-	31.70	-
R34	Proposed Property Adjacent to Site Access Link A	-	30.61	-

As indicated in Table 16, the maximum predicted increase in the annual average exposure to particulate matter at any existing receptor, due to changes in traffic movements associated with the development, is 0.50µg/m^3 at 9 Bar Lane (R7).

No exceedances of the 24-hour mean objective are predicted at any of the modelled sensitive receptor locations.

The significance of changes in traffic flow associated with the development with respect to 24-hour mean PM_{10} exposure has been assessed with reference to the criteria in section 3.0. The outcomes of the assessment are summarised in Table 17.

Table 17 Significance Effects at Key Receptors in 2017 (24-hour Mean Particulate Matter)

Receptor		Change (% of AQO)	Magnitude	Sensitivity	Significance
R1	407 Wakefield Road	0.57	Imperceptible	Low	Negligible
R2	397 Wakefield Road	0.55	Imperceptible	Low	Negligible
R3	418 Kirkstall Road	0.31	Imperceptible	Low	Negligible
R4	396 Kirkstall Road	0.25	Imperceptible	Low	Negligible
R5	2 Bar Lane	0.66	Imperceptible	Low	Negligible
R6	20 Bar Lane	0.66	Imperceptible	Low	Negligible
R7	9 Bar Lane	1.00	Small	Low	Negligible
R8	1 Wakefield Road	0.75	Imperceptible	Low	Negligible
R9	Eastfield Arms, Public House, Wakefield Road	0.37	Imperceptible	Low	Negligible
R10*	26 Eastfield Crescent*	0.34	Imperceptible	Low	Negligible
R11	78 Paddock Road	0.25	Imperceptible	Low	Negligible
R12	2 Parkview Road	0.14	Imperceptible	Low	Negligible
R13	62 Paddock Road	0.10	Imperceptible	Low	Negligible
R14	23 Paddock Road	0.09	Imperceptible	Low	Negligible
R15	62 Eastfield Crescent	0.43	Imperceptible	Low	Negligible
R16	76 Eastfield Crescent	0.22	Imperceptible	Low	Negligible
R17	18 Cloudberry Way	0.18	Imperceptible	Low	Negligible
R18	20 Waythorne Close	0.15	Imperceptible	Low	Negligible
R19	66 Paddock Road	0.13	Imperceptible	Low	Negligible
R20	16 Park View Road	0.17	Imperceptible	Low	Negligible
R21	The Old Police Station, Wakefield Road	0.33	Imperceptible	Low	Negligible
R22	12 Wakefield Road	0.17	Imperceptible	Low	Negligible
R23	26 Wakefield Road	0.20	Imperceptible	Low	Negligible
R24	Lee Lane Farm	0.01	Imperceptible	Low	Negligible
R25	2 Shaw Lane	0.15	Imperceptible	Low	Negligible
R26	7 Shaw Lane	0.06	Imperceptible	Low	Negligible
R27	2 Paddock Close	0.07	Imperceptible	Low	Negligible
R28	17 Paddock Road	0.02	Imperceptible	Low	Negligible

The magnitude of the effects in 2017 of changes in traffic as a result the proposed development, with respect to 24-hour mean PM_{10} exposure, is determined to be 'small' to 'imperceptible'. The significance has been 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'.

7.0 Mitigation

7.1 Mitigation of Construction Impacts

With a 'Medium risk' assessment rating as detailed in Table 22, the following mitigation measures are recommended to be adopted and should become part of the approved Construction Environmental Management Plan.

7.1.1 Site Planning

- Erect solid barriers to site boundary.
- No bonfires.
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors.
- All site personnel to be fully trained.
- Trained and responsible manager on site during working times to maintain logbook and carry out site inspections.
- Hard surface site haul routes.

7.1.2 Construction traffic

- All vehicles to switch off engines – no idling vehicles.
- Effective vehicle cleaning and specific fixed wheel washing on leaving site and damping down of haul routes.
- All loads entering and leaving site to be covered.
- No site runoff of water or mud.
- On-road vehicles to comply to set emission standards.
- All non road mobile machinery (NRMM) to use ultra low sulphur tax-exempt diesel (ULSD) where available and be fitted with appropriate exhaust after-treatment from the approved list.
- Minimise movement of construction traffic around site.
- Hard surfacing and effective cleaning of haul routes and appropriate speed limit around site.

7.1.3 Demolition Works

- Use water as dust suppressant.
- Cutting equipment to use water as suppressant or suitable local extract ventilation.
- Use enclosed chutes and covered skips.
- Wrap building(s) to be demolished.

7.1.4 Site Activities

- Minimise dust generating activities.
- Use water as dust suppressant where applicable.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Re-vegetate earthworks and exposed areas.
- If applicable, ensure concrete crusher or concrete batcher has permit to operate.

7.2 Operational Phase

7.2.1 Traffic

Although an assessment of road traffic exhaust emissions has not predicted any exceedances of the AQO, implementing traffic management measures will result in fewer vehicle trips and therefore a reduction in associated vehicle emissions. This is likely to result in reductions of the mean roadside concentrations of traffic-related pollutant concentrations.

The following mitigation measures aim to increase the number of residents travelling to and from the site on foot, by cycle and/or by public transport. As such the number of trips to and from the site made by private car, and especially the single occupancy private car, will be reduced. The following measures are considered best practice but should not be regarded as an exhaustive list of potential mitigation options:

- Minimise reliance upon motor vehicle use through a Framework Travel Plan;
- Promote alternative transport options;
- Inclusion of integrated cycle paths into surrounding environments; and,
- Inclusion of pedestrian walkways into surrounding environments.

Further details related to operational phase mitigation measures a presented in the Residential Travel Plan document.

8.0 Summary and Conclusions

WYG undertook an Air Quality Assessment (AQA) for a proposed residential development at land west of Wakefield Road, Mapplewell, Barnsley. The AQA was undertaken in accordance with the methodology and parameters previously described within this report. Predicted pollutant concentrations were compared with the relevant AQOs for both nitrogen dioxide and particulate matter.

The significance of the effects of potential emissions from the construction phase has been assessed as 'negligible', following the adoption of appropriate mitigation measures, as recommended in section 7.0.

The maximum predicted increase in annual mean exposure to NO_2 at all modelled receptors, as a result of the impacts of changes in traffic flow, is predicted to be 1.05µg/m^3 at 9 Bar Lane (R7).

The magnitude of the effects of the proposed development, with respect to NO_2 exposure, is determined to be 'small' to 'imperceptible' and the significance has been determined to be 'negligible'.

The maximum predicted increase in annual mean exposure to PM_{10} at all modelled receptors, as a result of the impacts of changes in traffic flow, is predicted to be 0.25µg/m^3 at 9 Bar Lane (R7).

The maximum predicted increase in 24-hour mean exposure to PM_{10} at all modelled receptors, as a result of the impacts of changes in traffic flow, is predicted to be 0.50µg/m^3 at 9 Bar Lane (R7).

No modelled receptors are predicted to experience PM_{10} concentrations in exceedance of the relevant Air Quality Objective.

The magnitude of the effects of the proposed development, with respect to annual mean PM_{10} exposure, is determined to be 'imperceptible' and the significance has been determined to be 'negligible'.

The magnitude of the effects of the proposed development, with respect to 24-hour mean PM_{10} exposure, is determined to be 'small' to 'imperceptible'. The significance has been determined to be 'negligible'.

None of the modelled proposed receptor locations are predicted to experience pollutant concentrations in exceedances of the relevant AQOs, as such the proposed development site is considered to be suitable residential use.

Following the adoption of the recommended mitigation measures, the development is not considered to be contrary to any of the national, regional or local planning policies.

Units and Abbreviations Used

AQMA	Air Quality Management Area
BMBC	Barnsley Metropolitan Borough Council
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
LA	Local Authority
LAPC	Local Authority Pollution Control
LAQM	Local Air Quality Management
$\mu g/m^3$	Concentration (in micrograms per cubic metre)
UK NGR	UK National Grid Reference
NO_2	Nitrogen dioxide
NO	Nitric oxide
NO_X	Total oxides of nitrogen
PM_{10}	Particulate matter with a mean hydraulic diameter less then 10µm
WYG	WYG Environment Planning Transport
%ile	Percentile

Figures

Figure 1 Air Quality Assessment Area

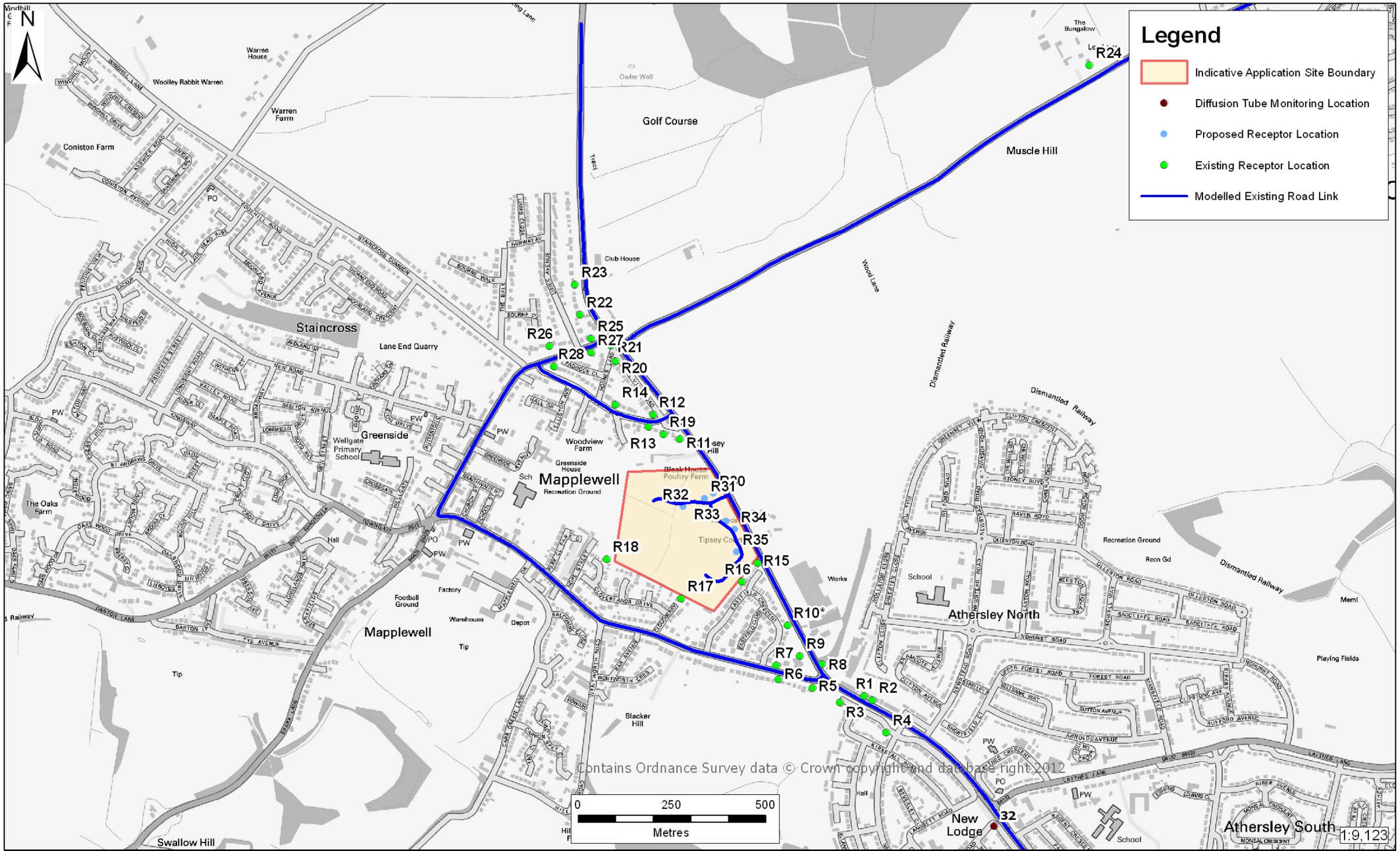


Figure 1 - Air Quality Assessment Area	WYG Planning & Environment part of the WYG group
Proposed Residential Development Land West of Wakefield Road, Mapplewell, Barnsley Air Quality Assessment	
Client: Pipestone Limited	Project No: A079811

Figure 2 Robin Hood Airport Windrose 2010

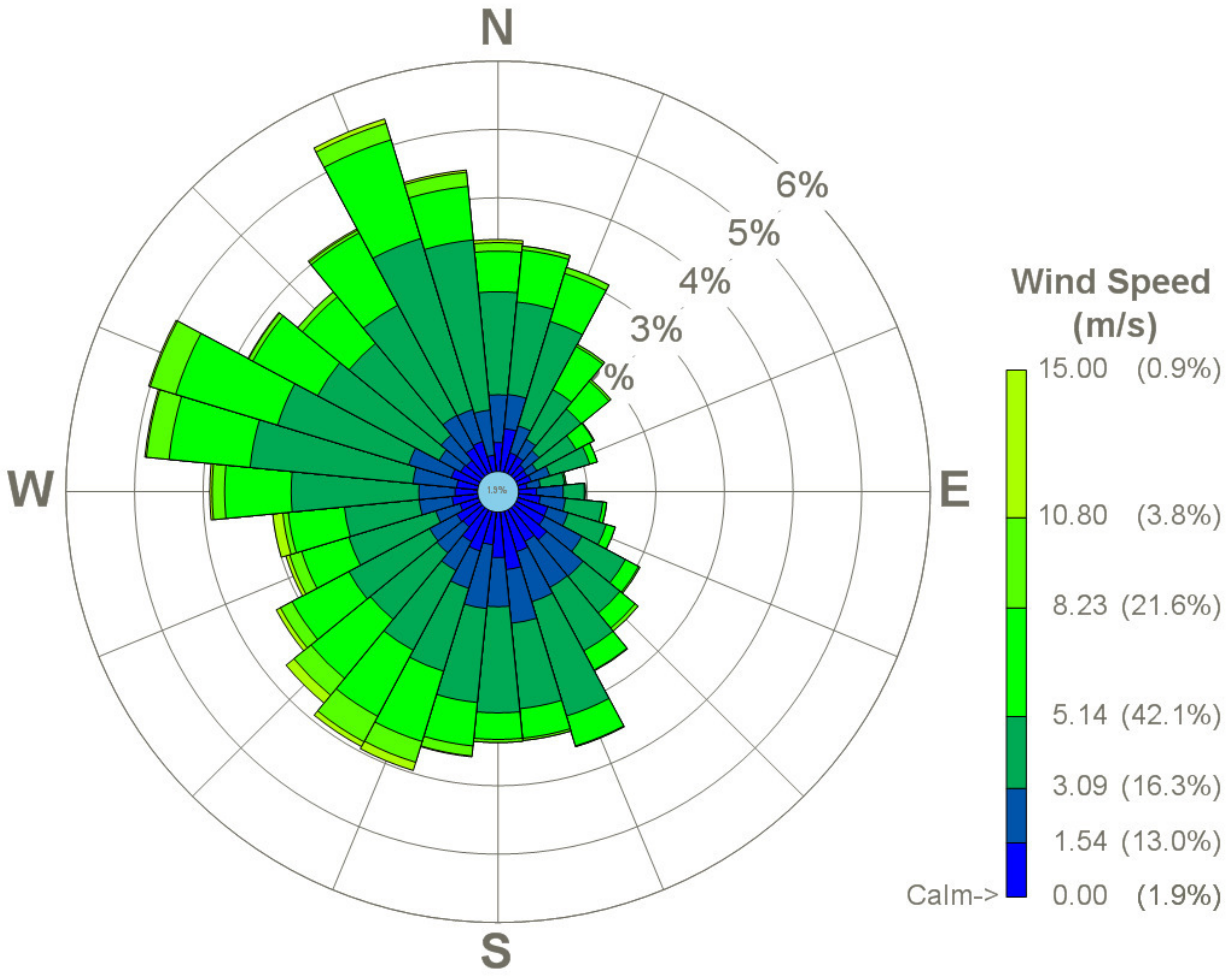
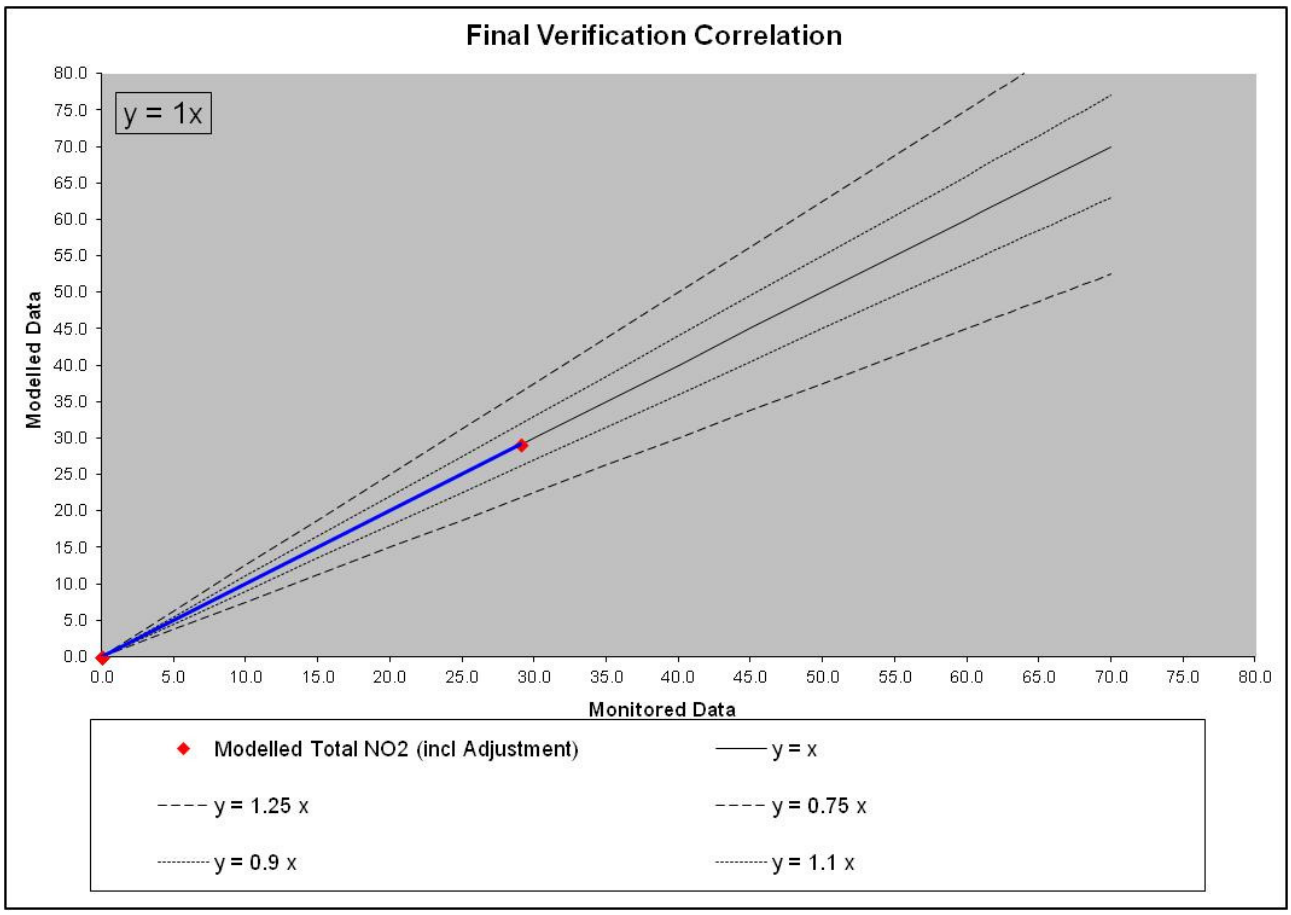


Figure 3 Model Correlation Coefficient



Appendices

Appendix A - Traffic Data

Table 18 Traffic Data

Road Name	Traffic Speed km/h	Do Minimum 2017		Do Something 2017	
		AADT	HGV %	AADT	HGV %
Wakefield Road (North)	48	7067	3.94	7492	3.72
Shaw Lane	30	6253	3.00	6253	3.00
Lee Lane	30	4127	3.00	4127	3.00
Wakefield Road between Lee Lane and Paddock Lane	48	8274	3.95	8699	3.76
Paddock Lane	30	1050	2.00	1050	2.00
Wakefield Road between Site Access and Paddock Lane	48	9035	3.95	9461	3.78
Site Access	20	0	0.00	2037	0.00
Wakefield Road between Site Access and Bar Lane	48	9035	3.95	9461	3.78
Bar Lane	30	8589	3.95	9812	3.46
Wakefield Road (South)	30	16874	3.95	17672	3.77

Appendix B - 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].

Assessment Step 1 – Screen the Requirement for a more Detailed Assessment

There are sensitive receptors within 100m of the site boundary and within 100m of routes used by construction vehicles on the public highway, as such, further assessment of potential construction impacts has been undertaken.

Assessment Step 2 – Risk of Dust Impacts

A) Demolition

Dust emission class 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.

B) Earthworks

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

- **LARGE**: Total site are >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.

[3] Institute of Air Quality Management. 2012. *Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance.*

C) Construction

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

- **LARGE**: Total building volume >100 000m^3, piling on site concrete batching; sandblasting
- **MEDIUM**: Total building volume 25 000m^3 – 100 000m^3, potentially dusty construction material (e.g. concrete), piling, 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).

D) Trackout

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

- **LARGE**: >100 HGV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- **MEDIUM**: 25-100 HGV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- **SMALL**: <25 HGV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50m.

Assessment Stage 3 - Defining the Risk Classification

Based on the distance of the sensitive receptors from the proposed construction activities and based on the above emission classes, the risk effects of the proposed development scenario are deduced from the below tables.

Table 19 Risk Category from Demolition Activities

Source	Dust Emission Class		
	Large	Medium	Small
<20	High Risk Site	High Risk Site	Medium Risk Site
20-100	High Risk Site	Medium Risk Site	Low Risk Site
100-200	Medium Risk Site	Low Risk Site	Low Risk Site
200-350	Medium Risk Site	Low Risk Site	Negligible

Table 20 Risk Category from Earthworks and Construction Activities

Source	Dust Emission Class		
	Large	Medium	Small
<20	High Risk Site	High Risk Site	Medium Risk Site
20-50	High Risk Site	Medium Risk Site	Low Risk Site
50-100	Medium Risk Site	Medium Risk Site	Low Risk Site
100-200	Medium Risk Site	Low Risk Site	Negligible
200-350	Low Risk Site	Low Risk Site	Negligible

Table 21 Risk Category from Trackout Activities

Source	Dust Emission Class		
	Large	Medium	Small
<20	High Risk Site	High Risk Site	Medium Risk Site
20-50	Medium Risk Site	Medium Risk Site	Low Risk Site
50-100	Low Risk Site	Low Risk Site	Negligible

Based on the distance of the sensitive receptors from the proposed construction activities the unmitigated risk effects of the proposed development scenario are summarised in the following table.

Table 22 Summary of Risk Effects Prior to the Implementation of Mitigation Measures

Source	Summary Risk Effects with No Mitigation		
	Dust Soiling	PM_{10}	Ecological
Demolition	Low Risk Site	Low Risk Site	Negligible
Earthworks	Medium Risk Site	Medium Risk Site	Negligible
Construction	Medium Risk Site	Medium Risk Site	Negligible
Trackout	Medium Risk Site	Medium Risk Site	Negligible

Assessment Stage 4 - Defining the Impact Significance

Based on the sensitivity of the surrounding area and the risk effects associated with construction activities the significance effects prior and following the implementation of mitigation measures are summarised in the below tables.

Table 23 Significance Effects Prior to the Implementation of Mitigation Measures

Significance of Effects for Each Activity without Mitigation			
Sensitivity of Surrounding area	Risk of site giving rise to dust effects		
	Large	Medium	Small
Very High	Substantial adverse	Moderate adverse	Moderate adverse
High	Moderate adverse	Moderate adverse	Slight adverse
Medium	Moderate adverse	Slight adverse	Negligible
Low	Slight adverse	Negligible	Negligible

Table 24 Significance Effects Following the Implementation of Mitigation Measures

Significance of Effects for Each Activity with Mitigation			
Sensitivity of Surrounding area	Risk of site giving rise to dust effects		
	Large	Medium	Small
Very High	Slight adverse	Slight adverse	Negligible
High	Slight adverse	Negligible	Negligible
Medium	Negligible	Negligible	Negligible
Low	Negligible	Negligible	Negligible

Based on the risk classification of the proposed construction site, appropriate mitigation measures can be identified and subsequently incorporated into the Construction Site Environmental Management Plan. The below tables summarise the significance of effects for each activity prior to and following the implementation of appropriate mitigation.

Table 25 Significance Effects Prior to the Implementation of Mitigation Measures

Source	Summary Risk Effects with No Mitigation		
	Dust Soiling	PM_{10}	Ecological
Demolition	Medium	Medium	None
Earthworks	Medium	Medium	None
Construction	Medium	Medium	None
Trackout	Medium	Medium	None

Table 26 Significance Effects Following the Implementation of Mitigation Measures

Source	Summary Risk Effects with No Mitigation		
	Dust Soiling	PM_{10}	Ecological
Demolition	Negligible	Negligible	None
Earthworks	Negligible	Negligible	None
Construction	Negligible	Negligible	None
Trackout	Negligible	Negligible	None