Air Quality Assessment

Woodley Arms, Waldeck Street, Reading

Report Ref: AQ0457

Date: July 2019

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1 INTRODUCTION

1.1 Scope

GEM Air Quality Ltd has been commissioned to undertake a detailed air quality assessment based on the potential impacts of existing and future traffic levels on a proposed residential development located at the Woodley Arms along Waldeck Street in Reading.

The pollutants modelled as part of this assessment are nitrogen oxides (NOx) and particulate matter (PM_{10}). The impacts of vehicle emissions have been assessed using the techniques detailed within Volume 11, Section 3 of the Design Manual for Roads and Bridges (DMRB)[1] and the Local Air Quality Management Technical Guidance (LAQM.TG16)[2]. The impact of road traffic emissions will be assessed using the ADMS-Roads air dispersion model. This model has been devised by Cambridge Environmental Research Consultants (CERC) and is described as a "*comprehensive tool for investigating air pollution problems due to small networks of roads*".

It should be noted that the short-term impacts of NO_2 and PM_{10} emissions have not been modelled as dispersion models are inevitably poor at predicting short-term peaks in pollutant concentrations, which are highly variable from year to year, and from site to site. Notwithstanding this, general assumptions have been made about short term concentrations based on the modelled annual mean concentrations.

In addition to this, the assessment has also assessed the potential impact on local air quality from demolition and construction activities at the site.

[1] Design Manual for Roads and Bridges, Vol 11, Section 3, Part 1 – HA207/07, Highways Agency, May 2007

[2] Part IV of the Environment Act 1995, Local Air Quality Management Technical Guidance (TG16), Defra, April 2016

2 POLLUTANTS & LEGISLATION

2.1 Pollutant Overview

In most urban areas of the UK, traffic generated pollutants have become the most common pollutants. These are nitrogen dioxide (NO_2), fine particulates (PM_{10}), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO_2). This air quality assessment focuses on NO_2 and PM_{10}, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO_2 and PM_{10}.

Table 1 – Overview of NO_2 and PM_{10}

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM_{10})	Tiny particulates of solid or liquid nature suspended in the air	Road transport; Power generation plants; Production processes e.g. windblown dust	Soil erosion; Volcanoes; Forest fires; Sea salt crystals	Asthma; Lung cancer; Cardiovascular problems
Nitrogen Dioxide (NO_2)	Reddish-brown coloured gas with a distinct odour	Road transport; Power generation plants; Fossil fuels – extraction & distribution; Petroleum refining	No natural sources, although nitric oxide (NO) can form in soils	Pulmonary edema; Various environmental impacts e.g. acid rain

2.2 Air Quality Strategy

The UK Government and the devolved administrations published the latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland on 17 July 2007[3]. The Strategy provides an over-arching strategic framework for air quality management in the UK.

With regards to this assessment, the Air Quality Strategy contains national air quality standards and objectives established by the Government to protect human health. The objectives for nitrogen dioxide and particulates (PM_{10} and $PM_{2.5}$) have been set, along with seven other pollutants (benzene, 1,3-butadiene, carbon monoxide, lead, PAHs, sulphur dioxide and ozone). Those which are limit values required by EU Daughter Directives on Air Quality have been transposed into UK law through the Air Quality Standards Regulations 2010 which came into force on 11th June 2010. Table 2 provides the UK Air Quality Objectives for NO_2 and PM.

[3] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Department for Environment, Food and Rural Affairs in partnership with the Scottish Executive, Welsh Assembly Government and Department of the Environment Northern Ireland, July 2007

Table 2 – UK Air Quality Objectives for Nitrogen Dioxide and Particulate Matter

Pollutant	Objective	Concentration measured as
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean
	40µg/m^3	Annual mean
Particles ($PM_{2.5}$)	25µg/m^3 (except Scotland)	Annual Mean
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1 hour mean
	40µg/m^3	Annual mean

Objectives for $PM_{2.5}$ were also introduced by the UK Government and the Devolved Administrations in 2010. However, these are not included in Regulations as the Air Quality Strategy has adopted an "exposure reduction" approach for $PM_{2.5}$ in order to seek a more efficient way of achieving further reductions in the health effects of air pollution by providing a driver to improve air quality everywhere in the UK rather than just in a small number of localised hotspot areas.

As defined in Table 4, background $PM_{2.5}$ concentrations are well below the limit value of 25.0 µg/m^3. As such, no further consideration has been given to $PM_{2.5}$ within this assessment.

2.3 Clean Air Strategy

The Clean Air Strategy[4] was published in January 2019 and sets out the comprehensive action that is required from across all parts of government and society to tackle all sources of air pollution. New legislation will create a stronger and more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

[4] Clean Air Strategy 2019, Department for Environment, Food and Rural Affairs, January 2019

2.4 Local Air Quality Management (LAQM)

At the core of LAQM delivery are three pollutant objectives; these are: nitrogen dioxide (NO_2), particulate matter (PM_{10}) and sulphur dioxide (SO_2). All current Air Quality Management Areas (AQMAs) across the UK are declared for one or more of these pollutants, with NO_2 accounting for the majority. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

2.4.1 Reading Borough Council

The Council has declared an AQMA that encompasses Reading town centre and areas along the major radial road routes into Reading (including J11 of the M4). The AQMA has been declared for NO_2 from road traffic sources. As such, the proposed development is within this AQMA.

3 PLANNING POLICY & GUIDANCE

3.1 National Planning Policy & Guidance

3.1.1 National Planning Policy Framework

On a national level, air quality can be a material consideration in planning decisions. The updated National Planning Policy Framework (NPPF) for England, released in February 2019, is considered a key part of the Governments reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

Paragraph 103 within the NPPF states that the "*The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.*".

It goes on to state in paragraph 181 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 and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan*".

3.1.2 Land-Use Planning & Development Control

In January 2017, Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) produced guidance to ensure that air quality is adequately considered in the land-use planning and development control processes[5].

The guidance document is particularly applicable to assessing the effect of changes in exposure of members of the public resulting from residential and mixed-use developments, especially those within urban areas where air quality is poorer. It is also relevant to other

[5] Land-Use Planning & Development Control: Planning for Air Quality. Guidance from Environmental Protection UK and the Institute of Air Quality Management for the consideration of air quality within the land-use planning and development control processes. EPUK & IAQM. January 2017

forms of development where a proposal could affect local air quality and for which no other guidance exists.

3.2 Local Planning Policy & Guidance

3.2.1 Reading Borough Council

Policy EN15 "Air Quality" within the Councils Draft Local Plan relates specifically to air quality and states the following:

"*Development should have regard to the need to improve air quality and reduce the effects of poor air quality.*

i. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:
- *Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly worsen air quality;*
- *Whether the development is within, or accessed via, an Air Quality Management Area; and*
- *Whether it can be demonstrated that a local worsening in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.*

ii. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application. If there are significant detrimental effects that cannot be mitigated, the application should be refused.

iii. *Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring*".

4 Assessment Methodology

4.1 Construction Phase

The Institute of Air Quality Management (IAQM) has published guidance on the assessment of dust from construction and demolition[6]. Based on this guidance, the main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentrations or airborne particles and nitrogen dioxide due to exhaust emissions from diesel powered vehicles and equipment on site.

In relation to the most likely impacts, the guidance states the following:

"*The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from activities on the site. Dust soiling will arise from the deposition of particulate matter in all size fractions.*

Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed".

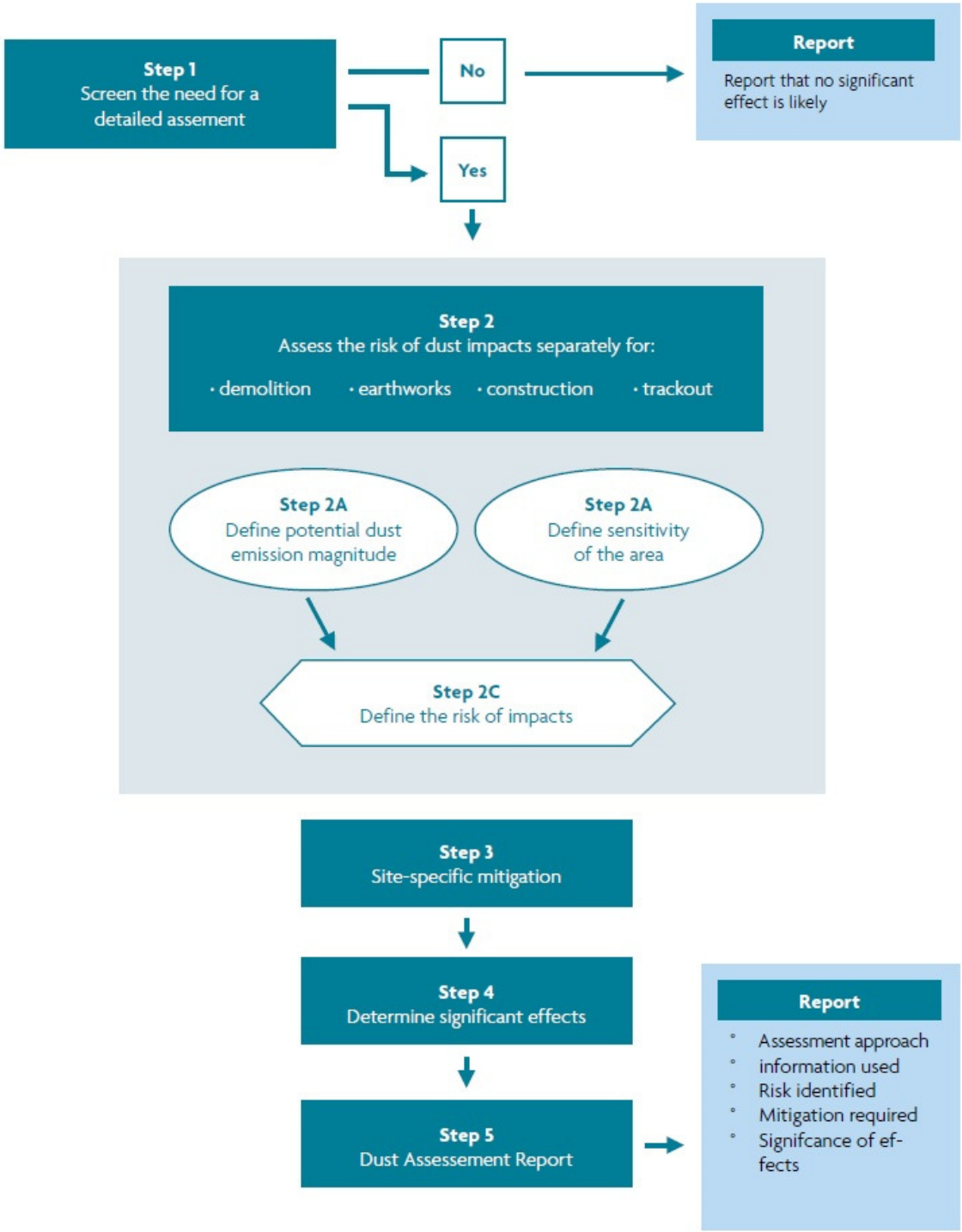
The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- Demolition;
- Earthworks;
- Construction; and
- Track out.

With regards to the proposed development the potential for dust emissions is assessed for each activity that is likely to take place. The assessment procedure assumes no mitigation measures are applied. The conditions with no mitigation thus form the baseline or "do-nothing" situation for a construction site. The assessment procedure uses the steps provided in the guidance and summarised in Figure 1.

[6] Holman et al (2014). IAQM Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London. www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf

Figure 1 – Dust Assessment Procedure



4.2 Operational Phase (Traffic Emissions)

4.2.1 Modelled Scenarios

Two scenarios have been modelled as part of this assessment. These are as follows:

- **Scenario 1 (2017)** – existing levels of air quality / model verification; and
- **Scenario 2 (2022)** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure.

The current baseline year (2017) has been modelled as this corresponds with the latest air quality monitoring undertaken by the Council. A future year has been chosen (2022) representing the baseline year plus 5 years and will provide an assessment of the future impact of traffic emissions on the proposed development once completed and fully occupied.

4.2.2 ADMS-Roads

Modelling the impact of traffic emissions on the proposed development will be undertaken using the latest version of the ADMS-Roads model[7]. ADMS-Roads is significantly more advanced than that of most other air dispersion models in that it incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

4.2.3 Emission Factors

Defra and the Devolved Administrations have provided an updated Emission Factors Toolkit (Version 9.0) which incorporates updated NOx emissions factors and vehicle fleet information[8]. These emission factors have been integrated into the latest ADMS-Roads modelling software. However, in order to undertake a worst-case assessment emission factors for 2017 have been used for all modelled years.

4.2.4 Traffic Data

Baseline traffic flows along the A327 Southampton Street are available from the Department for Transport (DfT)[9]. Baseline data has been projected to 2022. Projection of traffic data has been undertaken using growth factors specific to Reading Borough Council, obtained from TEMPro[10]. The projected flow rates are provided in Table 3. It is assumed that the percentage HDV and speed will remain unchanged in future years. The A327 Silver Street has been modelled for the purposes of model verification.

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7 Model Version: 4.1.1, Interface Version: 4.1.1 (18/01/2018)
8 https://laqm.defra.gov.uk/documents/EFT2019_v9.0.xlsb
9 http://www.dft.gov.uk/traffic-counts/
10 TEMPro (Trip End Model Presentation Program) version 7, Department for Transport

For the modelled speeds, the figures provided above have been used. However, where a link approaches a junction a speed of 20 kph has been modelled in order to represent queuing traffic at a junction.

Table 3 – Annual Average Daily Traffic Flows, Percentage HDV and Speeds for Modelled Roads, 2017 and 2022

Link Name	AADT 2017	AADT 2022	HDV (%)	Speed (kph)
A327 Silver Street	6,871	7,227	3.4%	48
A327 Southampton Street	17,759	18,679	3.3%	48

4.2.5 Street Canyons

A street canyon may be defined as a relatively narrow street with buildings on both sides, where the height of the buildings is generally greater than the width of the road. Street canyons may result in elevated pollutant concentrations from road traffic emissions due to a reduced likelihood of the pollutants becoming dispersed in the atmosphere. Street canyons have been modelled as part of this assessment along the A327 Silver Street.

4.3 Background Concentrations

Background NOx, NO_2 and PM_{10} concentrations have been obtained from Defra[11]. These 1 km x 1 km grid resolution maps are derived from a base year of 2015 (for NOx, NO_2, PM_{10} and $PM_{2.5}$ only), which are then projected to future years (2017). Background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ derived from Defra are provided in Table 4.

Table 4 – Background NOx, NO_2 and PM Concentrations

Pollutant	X	Y	2017
NO_2	471500	172500	20.7
NOx			30.2
PM_{10}			15.0
$PM_{2.5}$			9.6

In order to undertake a worst-case assessment, the background concentrations presented above have been assumed for all future modelled scenarios.

[11] http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2015

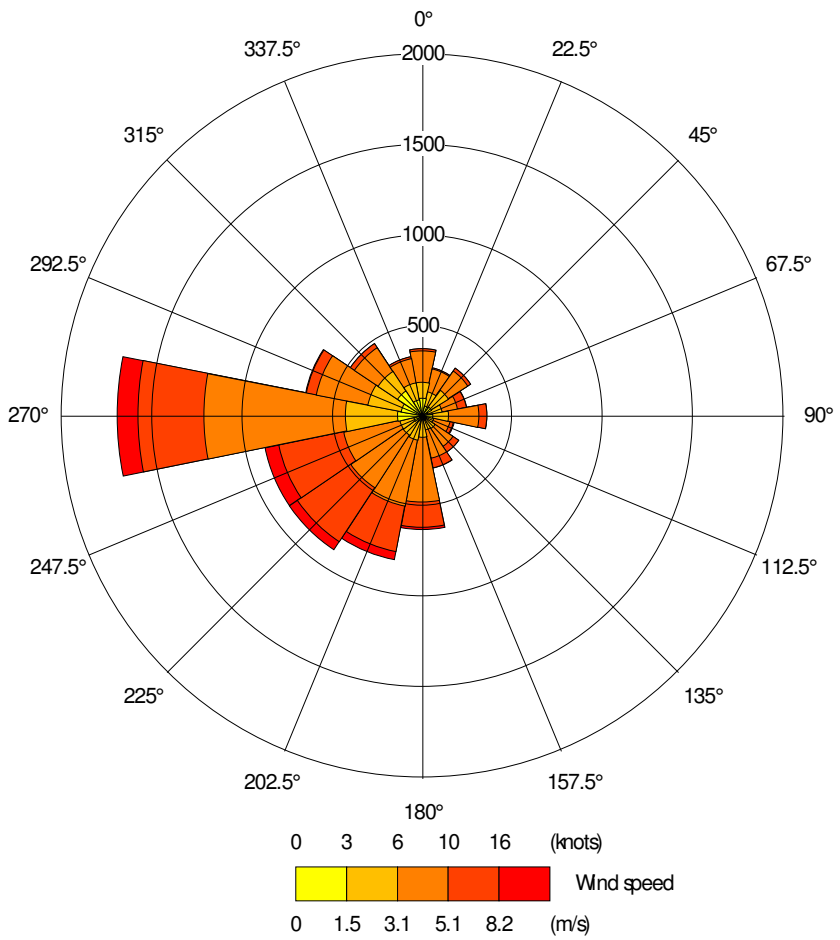
4.4 Surface Roughness

A surface roughness of 1.0 metre has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for cities. This value has been used across the modelled domain.

4.5 Meteorological Data

Hourly sequential meteorological data from Heathrow meteorological station has been used. Wind speed and direction data from Heathrow meteorological station has been plotted as a wind rose in Figure 2.

Figure 2 – Wind Speed and Direction Data, Heathrow (2017)



4.6 Model Output

4.6.1 NOx/NO_2 Relationship

Following recent evidence that shows the proportion of primary NO_2 in vehicle exhaust has increased[12]. As such, a new NOx to NO_2 calculator has been devised[13]. This new calculator has been used to determine NO_2 concentrations for this assessment, based on predicted NOx concentrations using ADMS-Roads. Converted NO_2 concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NOx concentrations are adjusted before conversion to NO_2.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short-term impacts of NO_2 and PM_{10}. Research undertaken in 2003[14] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3.

For PM_{10}, a relationship between the annual mean and the number of 24-hour mean exceedences has been devised and is as follows:

- No. 24-hour mean exceedences = -18.5 + 0.00145 x annual mean^3 + (206/annual mean)

This relationship has been applied to the modelled annual mean concentrations in order to estimate the number of 24-hourly exceedences.

[12] Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007
[13] https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v7.1.xlsm
[14] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

4.6.3 Model Verification

The Council undertakes monitoring of NO_2 at a roadside site located along Silver Street. This is the closest monitoring site to the proposed development and monitored concentrations from this site have been used for the purposes of model verification during the baseline year (2017). The location of the verification site is provided in Table 5.

Table 5 – Modelled Verification Locations

ID	Location	X	Y	Height (m)
DT10	10-20 Hieatt Close	471919	172684	2.5

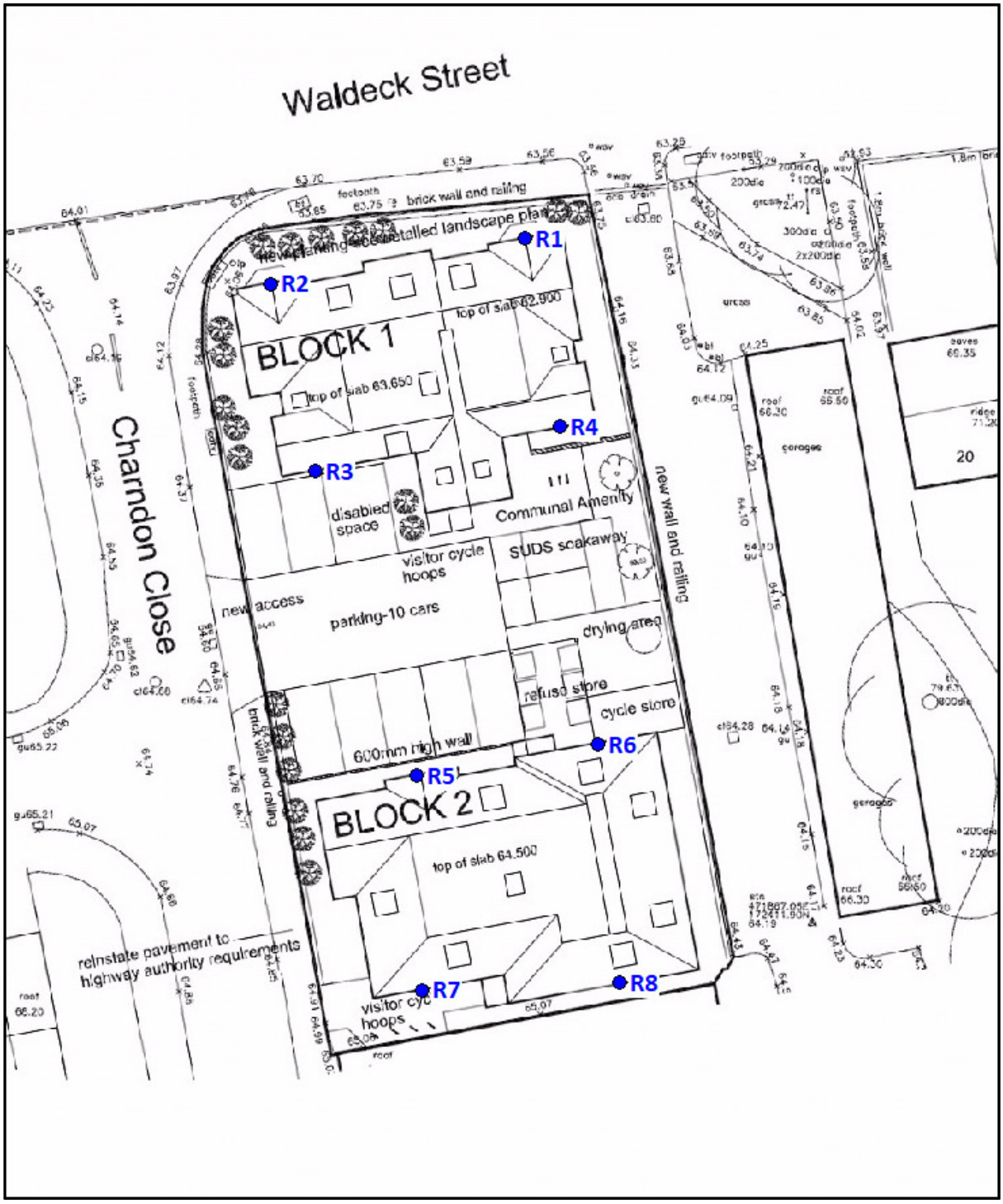
4.6.4 Receptor Locations

In order to assess the potential impact of the traffic emissions from the local road network, a number of receptors have been identified representing the different facades of the proposed development. The location of these receptors, together with their height above ground level is provided in Table 6 and represented in Figure 3.

Table 6 – Modelled Receptor Locations

AQA ID	X	Y	Height (m)	Description
R1	471851	172447	1.5, 4.5 & 7.5	Proposed Ground to First Floor
R2	471838	172445		
R2	471841	172435		
R3	471853	172437		
R4	471846	172419		
R5	471855	172421		
R6	471846	172408		
R7	471857	172409		

Figure 3 – Modelled Receptor Locations



4.7 Significance Criteria

4.7.1 Construction Phase

The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk. A development is allocated to a risk category based on two factors:

- the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (see Table 7); and
- the sensitivity of the area to dust impacts, which is defined as low, medium or high sensitivity.

These two factors are combined to determine the risk of dust impacts with no mitigation applied (see Table 8). The risk category assigned to the development can be different for each of the four potential activities (demolition, earthworks, construction and trackout).

Table 7 – Dust Emission Magnitude

Activity	Dust Emission Class		
	Large	Medium	Small
Demolition	Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level	Total building volume 20,000 – 50 000m^3, potentially dusty construction material, demolition activities 10-20 m above ground level	Total building volume <20,000 m^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	Total site area >10,000 m^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 >8 m in height, total material moved >100,000 tonnes	Total site area 2,500 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes	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	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting	Total building volume 25,000 m3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Track out	>50 HDV (>3.5t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m	10 – 50 HDV (>3.5t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100 m;	<10 HDV (>3.5t) trips in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Table 8 – Risk of Dust Impacts

Construction Activity	Sensitivity of Area	Dust Emission Magnitude		
		Large	Medium	Small
Demolition	High	High Risk	Medium Risk	Medium Risk
	Medium	High Risk	Medium Risk	Low Risk
	Low	Medium Risk	Low Risk	Negligible
Earthworks	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Construction	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Track out	High	High Risk	Low Risk	Low Risk
	Medium	Medium Risk	Low Risk	Negligible
	Low	Low Risk	Low Risk	Negligible

4.7.2 Operational Phase

The significance of emissions will be determined by comparing the predicted results to the Air Pollution Exposure Criteria (APEC) detailed in the *Air Quality and Planning Guidance* written by the London Air Pollution Planning and the Local Environment (APPLE) working group[15]. The Air Pollution Exposure Criteria is considered appropriate to describe the significance of the impacts predicted, together with an indication as to the level of mitigation required in order for the development to be approved. The APEC table is provided below.

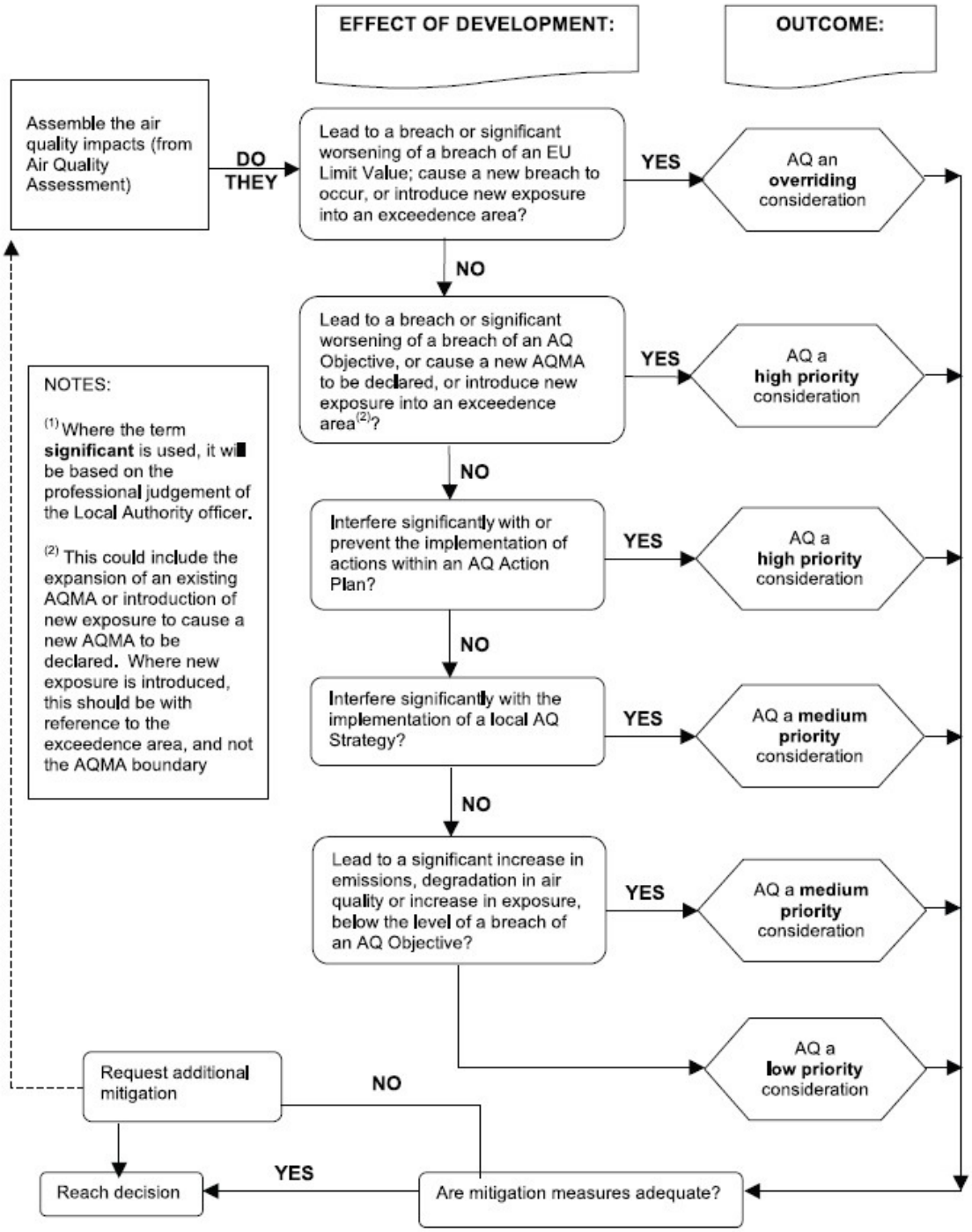
Table 9 – Air Pollution Exposure Criteria (APEC)

APEC Category	NO_2	PM_{10}	Recommendations
A	>5% below national annual mean objective	>5% below national annual mean objective >1-day less than national 24-hour objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national annual mean objective	Between 5% above or below national annual mean objective Between 1-day above or below national 24-hour objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered
C	>5% above national annual mean objective	>5% above national annual mean objective >1-day more than national 24-hour objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated

Furthermore, the guidance released by Environmental Protection UK also provides steps for a Local Authority to follow in order to assess the significance of air quality impacts of a development proposal. This procedure, shown in Figure 3, has also been applied to the modelled results.

[15] Air Quality and Planning Guidance, written by the London Air Pollution Planning and the Local Environment (APPLE) working group, January 2007

Figure 4 – Assessing the Significance of Air Quality Impacts of a Development Proposal



5 Air Quality Assessment

5.1 Impact from Construction Activities

The assessment of construction activities has focused on demolition, earthworks, construction and track out activities at the site. Using the criteria provided in Table 8 the dust emission magnitude for each activity is as follows:

- Demolition = Small;
- Earthworks = Small;
- Construction = Small; and
- Track out = Small.

Based on the IAQM guidance the sensitivity of the surrounding area is summarised in Table 10.

Table 10 – Sensitivity of the Surrounding Area

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

The dust emission magnitudes and sensitivity of the surrounding area are combined to determine the risk of dust impacts with no mitigation applied. These are summarised in Table 11.

Table 11 – Summary of Dust Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Low Risk	Low Risk	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible

It should also be noted that the likelihood of an adverse impact occurring is correlated to wind speed and wind direction. As such, unfavourable wind speeds and wind directions must occur at the same time as a dust generating activity in order to generate an adverse impact. The overall impacts also assume that the dust generating activities are occurring over the entirety of the site meaning that as an activity moves further away from a potential receptor the magnitude and significance of the impact will be further reduced.

5.2 Impact of Vehicle Emissions

5.2.1 Model Verification

Using the guidance provided within the Local Air Quality Management Technical Guidance TG(16), the modelled output has been verified against the monitoring data obtained from the sites listed in Table 5. The following tables provide a summary of the model verification process for NOx/NO_2 and PM_{10} concentrations.

Table 12 – Comparison of Modelled and Monitored NO_2 Concentrations (µg/m^3), 2017

Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/ monitored] x100
DT10	24.3	32.0	-24.0%

As described in the Technical Guidance (LAQM.TG16), in order to provide more confidence in the model predictions and the decisions based on these, the majority of results should be within ±25% (ideally ±10%) of the monitored concentrations. In order to improve the confidence in modelled concentrations across the modelled domain the model output has been adjusted. This is described further in the next section.

5.2.2 Model Adjustment

In order to undertake model adjustment, it is first necessary to derive the monitored and modelled road contributions of NOx (excluding background). The modelled road contribution NOx is taken directly from the ADMS-Roads output before it has been converted to NO_2 using the NOx to NO_2 calculator described in Section 4.6.1. The NOx to NO_2 calculator can also be used to derive monitored road contributions of NOx from NO_2 diffusion tube results. A summary of these calculations is provided in Table 13.

Table 13 – Monitored NOx and NO_2 concentrations, 2017

Location	Monitored Total NO_2	Defra Background NO_2	Monitored road contribution NO_2 (total – background)	Monitored road contribution NOx (total – background)	Modelled road contribution NOx (excludes background)	Ratio of monitored road contribution NOx / modelled road contribution NOx
DT10	32.0	20.7	11.3	23.2	7.1	3.3

Once the monitored and modelled road contributions of NOx (excluding background) have been derived the contributions of NOx are compared and a ratio derived. In this case the ratio is 3.3 and this factor has been used to adjust the modelled road contribution of NOx. This is shown in Table 14.

Table 14 – Adjustment of Modelled NOx Contributions, 2017

Location	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NOx	Modelled total NO_2 (based on empirical NOx/NO_2 relationship)	Monitored total NO_2	% Difference [(modelled – monitored) / monitored] x 100
DT10	3.3	23.5	32.2	32.0	0.5%

Following adjustment of the modelled NOx concentrations by a factor of 3.3 the total NO_2 concentration at the model verification location has been calculated using the method described in Section 4.6.1. The revised NO_2 concentration, shown in Table 10, indicates a more acceptable model performance when compared against the monitored NO_2 concentrations. As such, an adjustment factor of 3.3 has been applied to all modelled NOx concentrations across the model domain before conversion to NO_2.

5.2.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO_2 in 2017 and 2022 are provided in Table 15. As mentioned in Section 4.6.1, NO_2 concentrations have been calculated from the predicted NOx concentrations using the latest NOx-NO_2 conversion spreadsheet available from the Air Quality Archive.

Table 15 – Predicted NO_2 Concentrations, Annual Mean (µg/m^3)

Receptor ID	2017			2022		
	GF	1st	2nd	GF	1st	2nd
R1	22.3	22.2	22.0	22.4	22.3	22.0
R2	22.0	21.9	21.8	22.1	22.0	21.8
R3	22.0	21.9	21.7	22.1	22.0	21.8
R4	22.2	22.1	21.9	22.3	22.2	22.0
R5	21.9	21.8	21.7	22.0	21.9	21.8
R6	22.1	22.0	21.8	22.2	22.1	21.9
R7	21.8	21.8	21.6	21.9	21.8	21.7
R8	22.0	21.9	21.8	22.1	22.0	21.8
Objective	**40.0**					

The ADMS predictions for annual mean NO_2 concentrations in 2017 and 2022 indicate that the annual mean objective (40 µg/m^3) would be achieved at all modelled receptors.

Nitrogen dioxide also has an hourly objective of 200 µg/m^3 not to be exceeded more than 18 times in one year. However, the hourly mean concentration has not been calculated directly by ADMS Roads. This is as a result of an evaluation of continuous monitoring data from across the UK that revealed that the relationship between the annual mean and hourly mean NO_2 concentrations was very weak. Nonetheless, research undertaken in 2003[16] has indicated that the hourly NO_2 objective is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60 µg/m^3. Given that predicted NO_2 concentrations in 2017 and 2022 are below 60 µg/m^3 the likelihood of the short-term objective being exceeded is considered low.

[16] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

5.2.4 Particulate Matter

Predicted annual mean concentrations for PM_{10} in 2017 and 2022 are provided in Table 16.

Table 16 – Predicted PM_{10} Concentrations, Annual Mean (µg/m³)

Receptor ID	2017			2022		
	GF	1st	2nd	GF	1st	2nd
R1	15.1	15.1	15.1	15.1	15.1	15.1
R2	15.1	15.1	15.1	15.1	15.1	15.1
R3	15.1	15.1	15.1	15.1	15.1	15.1
R4	15.1	15.1	15.1	15.1	15.1	15.1
R5	15.1	15.1	15.1	15.1	15.1	15.1
R6	15.1	15.1	15.1	15.1	15.1	15.1
R7	15.1	15.1	15.1	15.1	15.1	15.1
R8	15.1	15.1	15.1	15.1	15.1	15.1
Objective	**40.0**					

The ADMS predictions for annual mean PM_{10} concentrations in 2017 and 2022 indicate that the annual mean objective (40 µg/m³) would be achieved at all the modelled receptor locations. In addition, the maximum number of days when PM_{10} concentrations are more than 50 µg/m³ is 0, less than the 35 exceedences allowed in the regulations.

6 Conclusions And Recommendations

6.1 Impact from Construction Activities

A qualitative assessment of dust levels associated with the proposed development has been carried out. The impact of dust soiling and PM_{10} can be reduced to negligible through appropriate mitigation measures, which are listed in Table 17 and are applicable to a low risk site. Implementation of these Best Practice Measures will help reduce the impact of the construction activities.

With these mitigation measures enforced, the likelihood of nuisance dust episodes occurring at those receptors adjacent to the development are considered low. Notwithstanding this, the developer should take into account the potential impact of air quality and dust on occupational exposure standards (in order to minimise worker exposure) and breaches of air quality objectives that may occur outside the site boundary. Monitoring is not recommended at this stage, however, continuous visual assessment of the site should be undertaken and a complaints log maintained in order determine the origin of a particular dust nuisance. Keeping an accurate and up to date complaints log will isolate particular site activities to a nuisance dust episode and help prevent it from reoccurring in the future.

6.1.1 Building Mitigation

Based on the results and discussion above there is no need to consider building mitigation.

6.2 Overall Conclusion

Based on the outcome of this assessment the current proposals are considered acceptable in terms of the potential air quality impacts across the development.

Table 17 – Mitigation of Construction Activities

Construction Activity	Mitigation Measures
Communications	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.
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Make a complaints log available to the local authority when asked.
	Record any exceptional incidents that cause dust and air quality pollutant emissions, either on or off the site, and the action taken to resolve the situation is recorded in the log book.
Monitoring	Carry out regular site inspections to monitor compliance with air quality and dust control procedures, record inspection results, and make an inspection log available to the local authority when asked.
	Increase the frequency of site inspections by those accountable for dust and air quality pollutant emissions issues when activities with a high potential to produce dust and emissions and dust are being carried out, and during prolonged dry or windy conditions.
Preparing and maintaining the site	Plan site layout: machinery and dust causing activities should be located away from receptors.
	Erect solid screens or barriers around dust activities or the site boundary that are, at least, as high as any stockpiles on site.
	Avoid site runoff of water or mud.
Operating vehicle/machinery	Ensure all non-road mobile machinery (NRMM) comply with standards.
	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 possible.
Operations	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 mitigation (using recycled water where possible).
	Use enclosed chutes, 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.
Waste Management	Reuse and recycle waste to reduce dust from waste materials
	Avoid bonfires and burning of waste materials.