Air Quality Assessment

35-39 Friar Street, Reading

Report Ref: AQ2058

March 2022

Union House | 111 New Union Street | Coventry | CV1 2NT | T: 0800 689 4329 | E: info@gemairquality.co.uk | www.gemairquality.co.uk

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Client Details:

Shaviram Merchants Ltd
First Floor Offices
Farley Court
Allsop Place
NW1 5LG

Produced By:

GEM Air Quality Ltd
Union House
111 New Union Street
Coventry
CV1 2NT

Tel: 0800 689 4329
Email: info@gemairquality.co.uk
www.gemairquality.co.uk

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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 the proposed residential led mixed-use development located at 35-39 Friar Street in Reading, Berkshire. 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 2021

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 (Amendment) Regulations 2016, which came into force on 31st December 2016. Table 2 provides the UK Air Quality Objectives for NO_2 and PM_{10}.

[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	Obligation
Particles (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24 hour mean	All local authorities
	50µg/m^3 not to be exceeded more than 7 times a year	24 hour mean	Scotland only
	40µg/m^3	Annual mean	All local authorities
	10µg/m^3	Annual mean	Scotland only
Particles ($PM_{2.5}$)	25µg/m^3	Annual Mean	England only (encouraged in Wales)
	10µg/m^3	Annual Mean	Scotland only
Nitrogen Dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1 hour mean	All local authorities
	40µg/m^3	Annual mean	All local authorities

Objectives for $PM_{2.5}$ were also introduced by the UK Government and the Devolved Administrations. However, these are not included in Regulations as the Air Quality Strategy has adopted an "exposure reduction" approach for $PM_{2.5}$ 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.

In addition to this, modelling of $PM_{2.5}$ is highly erroneous. As reported by the Air Quality Expert Group (AQEG)[4] "*the main traffic sources of $PM_{2.5}$ are exhaust emissions from diesel vehicles (cars, light goods vehicles and heavy goods vehicles), together with tyre wear, brake wear and road surface abrasion from all vehicles. There are significant uncertainties attached to some of these emissions estimates and particularly to the estimates of $PM_{2.5}$ from non-exhaust traffic sources*". There is also great uncertainty related to the monitoring of $PM_{2.5}$.

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[5] 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

[4] Fine Particulate Matter ($PM_{2.5}$) in the United Kingdom, AQEG
[5] Clean Air Strategy 2019, Department for Environment, Food and Rural Affairs, January 2019

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.

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 Air Quality Management Area that encompasses Reading Town Centre, areas along the major radial road routes into Reading (including J11 of the M4) and along the railway lines where they pass through built-up areas. The AQMA has been declared for NO_2 from road transport. As such, the proposed development is located 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 July 2021, 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 105 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 186 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 National Planning Practice Guidance (PPG)

The NPPF is supported by the National Planning Practice Guidance (PPG), which includes guiding principles on how planning can take account of the impacts of new development on air quality (updated November 2019). The PPG states that "*Defra carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with EU Limit Values*" and "*It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit*". The role of the local authorities is covered by the LAQM regime, with the PPG stating that local authority Air Quality Action Plans "*identify measures that will be introduced in pursuit of the objectives*". The PPG makes clear that "*Odour and dust can also be a planning concern, for example, because of the effect on local amenity*".

The PPG also states that "*Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity*".

The PPG sets out the information that may be required in an air quality assessment, making clear that "*Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific".* It also provides guidance on options for mitigating air quality impacts, as well as examples of the types of measures to be considered. It makes clear that *"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact*".

3.1.3 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[6]. 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 forms of development where a proposal could affect local air quality and for which no other guidance exists.

[6] 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

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[7]. 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".

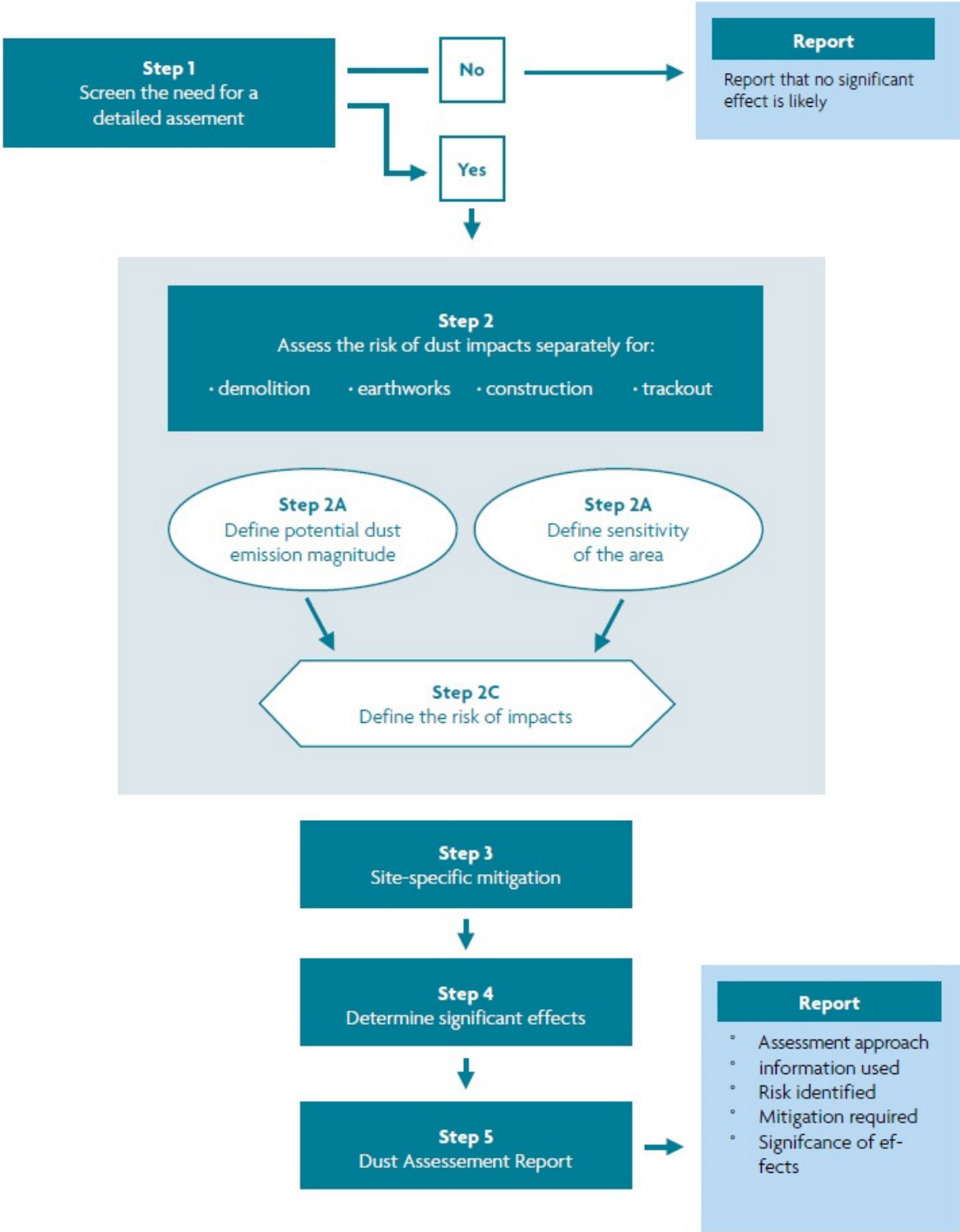
The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- 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.

[7] 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:

1. Existing levels of air quality / model verification (2019); and
2. Future impact of traffic emissions on the proposed development i.e. introduction of new exposure (2027).

Air quality monitoring data recorded throughout 2020 and 2021 is not considered suitable for model verification due to the impact of the COVID-19 pandemic on local traffic movements. As such, scenario 1 has utilised a baseline year of 2019 to reflect the most recent, pre-pandemic air quality monitoring data available from the Council.

A future year has been chosen (2027) representing an additional 5 years from the date this report was written. This 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[8]. 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 11.0) which incorporates updated NOx emissions factors and vehicle fleet information[9]. These emission factors have been integrated into the latest ADMS-Roads modelling software.

The Institute for Air Quality Management (IAQM) released a position statement in July 2018 relating to uncertainties in vehicle NOx emissions within air quality assessments. It states the following:

"It has been known since around 2011 that nitrogen oxides (NOx) emissions from diesel vehicles have not declined as expected despite the introduction of increasingly more stringent European Union (EU) emission limits since the early 1990s. This, together with an increase in numbers of diesel cars and the use of emission control devices that increase the proportion of

[8] Model Version: 5.0.1.3. Interface Version 5.0.1.7065 (31/01/2022)
[9] https://laqm.defra.gov.uk/wp-content/uploads/2021/11/EFT2021_v11.0.xlsb

the nitrogen dioxide (NO_2) in the exhaust NOx, has resulted in annual mean concentrations of NO_2 remaining high, particularly at roadside locations".

In accordance with this position statement emission factors for 2019 have been used for all modelled years as the 2019 emissions have been verified against local monitoring data. This assumes no improvement in vehicle emissions beyond 2019 and will provide a worst-case assessment in terms of the modelled impacts in 2027.

However, the IAQM position statement has now been withdrawn and the following statement has been published by the IAQM:

"*There is a growing body of evidence to suggest that the latest COPERT vehicle emission factors, which feed into the EFT (v9 and onwards), reflect the real-world NOx emissions more accurately.*

It is judged that an exclusively vehicle emissions-based sensitivity test is no longer necessary.

On this basis, the EFT may be used for future year modelling with greater confidence when considering the per vehicle emission, provided that the assessment is verified against measurements made in the year 2016 or later".

On this basis, the results presented are considered worst case and predicted concentrations across the proposed development in 2027 are expected to be lower than presented within this report.

4.2.4 Traffic Data

Baseline traffic flows along Friar Street have been derived from an air quality assessment undertaken by Waterman in January 2020 for a proposed development located along Station Hill. The modelled traffic data is provided in Table 3.

For the modelled speeds, the figures provided in Table 3 have been used. However, where a link approaches a junction a speed of 20 kph has been modelled to represent queuing traffic at a junction.

Table 3 – Annual Average Daily Traffic Flows, Percentage HDV and Speeds for Modelled Roads, 2019 and 2027

Link Name	AADT 2019	AADT 2027	HDV (%)	Speed (kph)
Friar Street	4,562	4,726	34.9%	26
Station Road	4,155	4,304	9.8%	17

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 Friar Street with a height of 15 metres, which is .

4.3 Background Concentrations

Background NOx, NO_2 and PM_{10} concentrations have been obtained from Defra[10]. These 1 km x 1 km grid resolution maps are derived from a base year of 2018 (for NOx, NO_2, PM_{10} and $PM_{2.5}$ only), which are then projected to future years (2019). Background concentrations of NOx, NO_2, PM_{10} and $PM_{2.5}$ derived from Defra are provided in Table 4. Furthermore, the assessment has assumed no improvement in future background concentrations.

Table 4 – Background NO_2 and PM Concentrations

Pollutant	X	Y	2019
NO_2	471500	173500	34.4
PM_{10}			18.8
$PM_{2.5}$			13.5

4.4 Surface Roughness

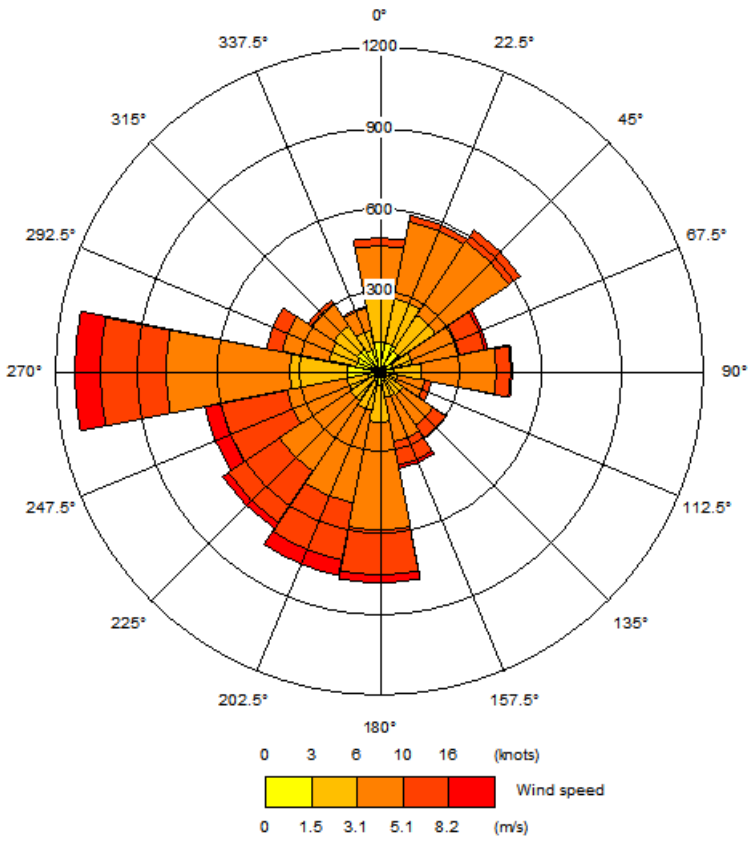
A surface roughness of 1.0 metre has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for cities. This value has been used across the modelled domain.

4.5 Meteorological Data

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

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

Figure 2 – Wind Speed and Direction Data, Heathrow Airport



4.6 Model Output

4.6.1 NOx/NO_2 Relationship

The most NOx to NO_2 calculator[11] 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 against local monitoring data 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[12] 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. A concentration of 60 µg/m^3 has therefore been used to screen the likelihood of exceedance of the hourly mean NO_2 objective.

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 to estimate the number of 24-hourly exceedences.

4.6.3 Model Verification

Monitored concentrations from the following sites have been used for the purposes of model verification during the baseline year (2019). These are the closest roadside monitoring sites to the proposed development.

Table 5 – Modelled Verification Locations

ID	Location	X	Y	Height (m)
V1	Friar Street (Nandos)	471437	173589	2.3
V2	21A Friars Walk, Friars Street	471373	173584	2.3
V3	Sainsburys 52-55 Friar Street	471320	173577	2.3

[11] https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v8.1.xlsm
[12] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

4.6.4 Receptor Locations

To assess the potential impact of the traffic emissions from the local road network, several 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. The basement and ground commercial units have not been modelled as they do not represent relevant exposure to the annual mean air quality objective.

Table 6 – Modelled Receptor Locations

AQA ID	X	Y	Height (m)	Description
1	471402	173591	4.5, 7.5, 10.5, 13.5 & 16.5	Proposed First to Fifth Floors
2	471394	173590		
3	471382	173590		
4	471379	173594		
5	471378	173603		
6	471375	173621		
7	471392	173646		
8	471400	173630		
9	471395	173614		
10	471403	173607		

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 (see Table 3).

These two factors are combined to determine the risk of dust impacts with no mitigation applied (see Table 10). 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 – Sensitivity of the Area to Dust Soiling Effects on People and Property

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

Table 9 – Sensitivity of the Area to Human Health Impacts

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

Table 10 – 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[13]. 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.

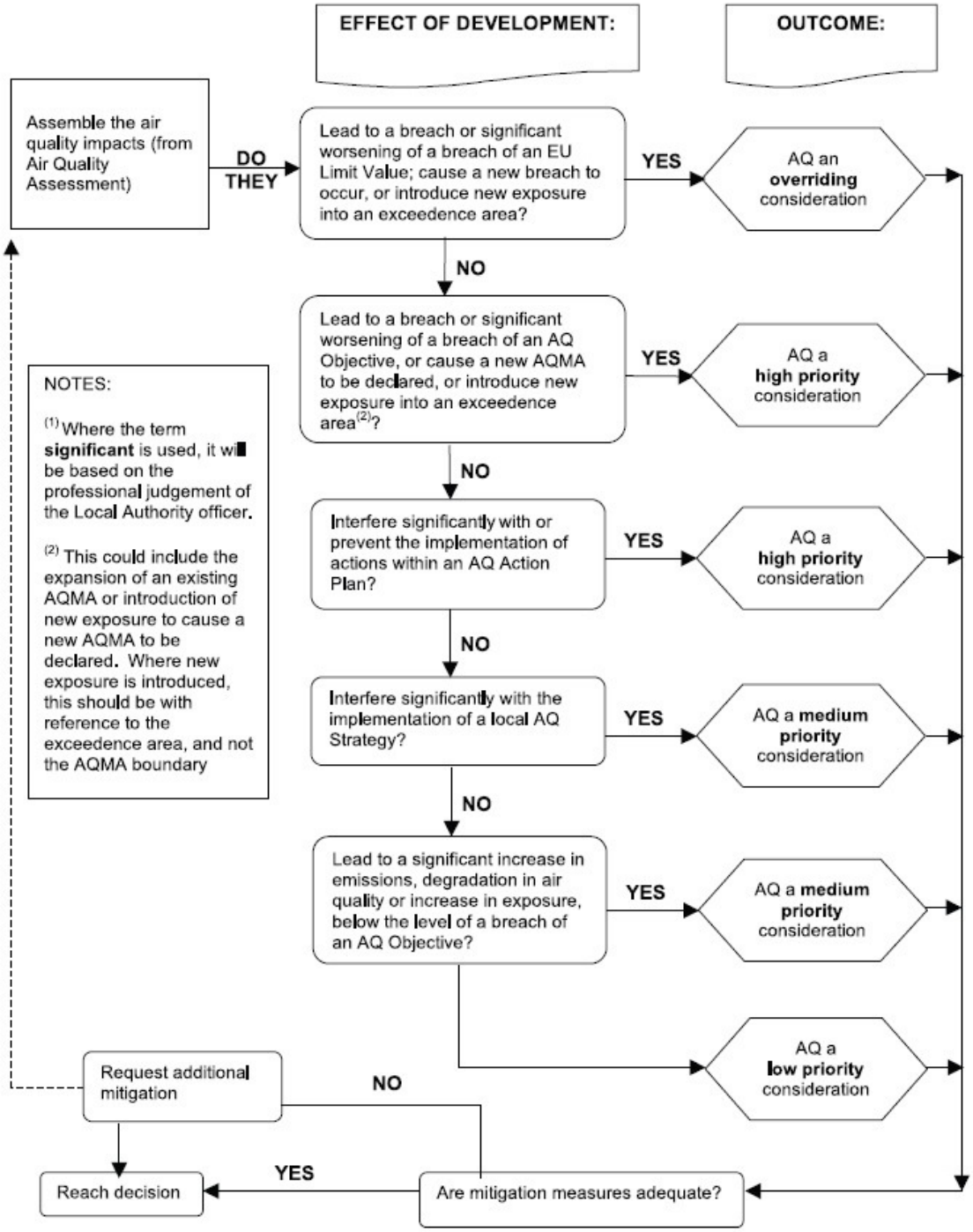
Table 11 – Air Pollution Exposure Criteria (APEC)

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 4, has also been applied to the modelled results.

[13] 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 7 the dust emission magnitude for each activity is as follows:

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

The sensitivity of the surrounding area to dust soiling and human health (Table 12) is then defined based on the criteria in Tables 8 and 9, which includes the number of highly sensitive receptors that fall within a certain distance of the proposed construction phase (see Figure 5).

Table 12 – Sensitivity of the Surrounding Area

Potential Impact	Comments	Sensitivity
Dust Soiling	There is more than one medium sensitivity receptors e.g. places of work, within 20 metres of the proposed development	Medium
Human Health	There are more than 10 medium sensitivity receptors e.g. places of work, within 20 metres of the proposed development	High

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 13.

Table 13 – Summary of Dust Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Track out
Dust Soiling	Medium Risk	Low Risk	Medium Risk	Low Risk
Human Health	Medium Risk	Low Risk	Medium Risk	Low Risk

Figure 5 – Distance from the Proposed Development

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 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 14 – Comparison of Modelled and Monitored NO_2 Concentrations (µg/m^3), 2019

Verification Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/ monitored] x100
V1	40.7	41.0	-0.7%
V2	39.8	39.0	2.0%
V3	39.9	40.0	-0.4%

As described in the Technical Guidance (LAQM.TG16), 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. Given that the modelled concentrations are within these limits no model adjustment is considered necessary.

5.2.2 Nitrogen Dioxide

Predicted annual mean concentrations for NO_2 in 2019 and 2027 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	2019					2027				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
1	39.3	38.9	38.7	38.6	34.5	39.6	39.2	38.9	38.8	34.5
2	39.4	38.9	38.7	38.6	34.5	39.7	39.2	38.9	38.8	34.5
3	39.1	38.8	38.6	38.5	34.5	39.3	39.0	38.8	38.7	34.5
4	35.6	35.0	34.7	34.6	34.5	35.6	35.0	34.7	34.6	34.5
5	35.3	35.0	34.7	34.6	34.5	35.3	35.0	34.7	34.6	34.5
6	34.9	34.8	34.7	34.6	34.5	35.0	34.8	34.7	34.6	34.5
7	34.8	34.7	34.6	34.6	34.5	34.8	34.7	34.7	34.6	34.5
8	34.9	34.8	34.7	34.6	34.5	34.9	34.8	34.7	34.6	34.5
9	35.1	34.9	34.7	34.6	34.5	35.1	34.9	34.7	34.6	34.5
10	35.3	35.0	34.7	34.6	34.5	35.3	35.0	34.8	34.6	34.5
Objective	40.0									

The ADMS predictions for annual mean NO_2 concentrations in 2019 and 2027 indicate that the annual mean objective (40 µg/m^3) is approached (in blue) along the southern, street facing façade up to and including the fourth floor (within the modelled street canyon). Predicted concentrations at the remaining receptors are below the relevant objectives.

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[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. Given that predicted NO_2 concentrations in 2019 and 2027 are below 60 µg/m^3 the likelihood of the short-term objective being exceeded is considered low.

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

5.2.3 Particulate Matter

Predicted annual mean concentrations for PM_{10} in 2019 and 2027 are provided in Table 16.

Table 16 – Predicted PM_{10} Concentrations, Annual Mean (µg/m^3)

Receptor ID	2019					2027				
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th
1	19.4	19.4	19.4	19.3	18.8	19.5	19.4	19.4	19.4	18.8
2	19.5	19.4	19.4	19.3	18.8	19.5	19.4	19.4	19.4	18.8
3	19.4	19.4	19.3	19.3	18.8	19.4	19.4	19.4	19.4	18.8
4	19.0	18.9	18.8	18.8	18.8	19.0	18.9	18.8	18.8	18.8
5	18.9	18.9	18.8	18.8	18.8	18.9	18.9	18.8	18.8	18.8
6	18.9	18.9	18.8	18.8	18.8	18.9	18.9	18.8	18.8	18.8
7	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8
8	18.9	18.9	18.8	18.8	18.8	18.9	18.9	18.8	18.8	18.8
9	18.9	18.9	18.8	18.8	18.8	18.9	18.9	18.8	18.8	18.8
10	18.9	18.9	18.8	18.8	18.8	18.9	18.9	18.8	18.8	18.8
Objective	**40.0**									

The ADMS predictions for annual mean PM_{10} concentrations in 2019 and 2027 indicate that the annual mean objective (40 µg/m^3) 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/m^3 is 3, 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 to medium risk site. Implementation of these Best Practice Measures will help reduce the impact of the construction activities to an acceptable level.

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 consider the potential impact of air quality and dust on occupational exposure standards (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.

Table 17 – Mitigation of Construction Activities

Construction Activity	Mitigation Measures
Communications	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
	Display the head or regional office contact information.
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
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.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period
	Avoid site runoff of water or mud.
	Keep site fencing, barriers and scaffolding clean using wet methods
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
	Cover, seed or fence stockpiles to prevent wind whipping
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.
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials
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.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods
Waste Management	Reuse and recycle waste to reduce dust from waste materials
	Avoid bonfires and burning of waste materials.

6.2 Impact of Vehicle Emissions

The predicted concentrations of PM_{10} in all modelled years are below the relevant objectives. Predicted concentrations at all the modelled receptors fall within APEC Category A, which states that there are "no air quality [PM_{10}] grounds for refusal, however, mitigation of any emissions should be considered". Overall, using the flow chart presented in Figure 4, air quality is a low priority consideration at the modelled locations in each of the modelled years.

The predicted concentrations of NO_2 approach the relevant objective along the southern, street facing façade of the proposed development up to and including the fourth floor. The predicted concentrations at these receptors fall within APEC Category B, meaning mitigation measures will need to be adopted to protect the future occupants from poor air quality. These are outlined in the following section. Predicted NO_2 concentrations at all the remaining receptors are below the relevant air quality objectives.

6.2.1 Building Mitigation

Based on the outcome of this assessment mitigation measures would be required to mitigate the impact of poor air quality on the future occupants of the proposed development along the southern, street facing façade up to and including the fourth floor.

The Institute of Air Quality Management (IAQM) issued a position statement in relation to the mitigation of development air quality impacts[15]. Based on this statement, the IAQM recommends that the following basic hierarchy be used for mitigating the operational air quality impacts associated with the particular development:

1) Preference should be given to **preventing or avoiding** exposure/impacts to the pollutant in the first place by eliminating or isolating potential sources or by replacing sources or activities with alternatives;

2) **Reduction and minimisation** of exposure/impacts should next be considered, once all options for prevention/avoidance have been implemented so far as is reasonably practicable (both technically and economically). To achieve this reduction/ minimisation, preference should be given first to:

    a. mitigation measures that act on the source; before

    b. mitigation measures that act on the pathway; which in turn should take preference over

    c. mitigation measures at or close to the point of receptor exposure all subject to the efficacy, cost and practicability of the available solutions. In each case, measures that are designed or engineered to operate passively are preferred

[15] Position Statement – Mitigation of Development Air Quality Impacts, IAQM, January 2015

to active measures that require continual intervention, management or a change in people's behaviours.

3) **Off-setting** a new development's air quality impact by proportionately contributing to air quality improvements elsewhere (including those identified in air quality action plans and low emission strategies) should only be considered once the solutions for preventing/avoiding, and then for reducing/minimising, impacts have been exhausted.

Based on this hierarchy, Option 2 could be applied to the proposed development. Using Option 2, some form of mitigation would need to be implemented along the southern, street facing façade up to and including the fourth floor so that the future occupants are not reliant solely on opening windows or doors to provide ventilation. This would require an additional form of ventilation; whereby clean air is drawn in naturally or mechanically and maintained thereafter. A mechanical ventilation system that draws air in from the rear of the building may be considered acceptable by the Council as predicted concentrations are below the air quality objectives with greater distance from Friar Street and outside the street canyon.

Alternatively, air could be drawn in and filtered[16]. Such filtration systems would "scrub" the incoming air stream of NO_2, reducing the concentrations of NO_2 to well below the air quality objective within the building. Such systems are becoming more common, particularly at city centre locations where traffic emissions make it difficult to find locations where clean air can be drawn into the property. A filtered ventilation system would also allow the inlets to be placed anywhere regardless of the predicted NO_2 concentrations, although they should ideally be placed as far away from emission sources as possible to reduce the burden on the filters. If such a filtration system is installed the Council will require details relating to the mechanical ventilation and air filtration systems, as well as the ongoing maintenance and cleaning of these systems.

[16] Such devices include the AAC Swiftpack® with Nitrosorb® media for NO_2 and NOx removal, or the City Breathe: Indoor Air Quality Filtration System