



AIR QUALITY ASSESSMENT

AT: Land to the West of Rodney Street, Manchester

CLIENT: Wates Construction Ltd

DATE: June 2022

STROMA PROJECT REF: PRO-068835

Please find below the link to the online feedback form:

<http://www.stroma.com/built-environment/feedback-sheffield/>

Executive Summary

The proposed development consists of 118 residential apartments and 10 townhouses with associated parking and landscaping. The potential air quality impacts associated from the construction and operation of the proposed residential development are described within the following report. A small part of the development area is located within an Air Quality Management Area (AQMA), it is situated adjacent to the Greater Manchester Combined Authority AQMA.

The UK air quality objectives state that the annual means of NO_2 and PM_{10} should not exceed $40\mu\text{g m}^{-3}$ and $\text{PM}_{2.5}$ should not exceed $25\mu\text{g m}^{-3}$. Using atmospheric dispersion modelling, concentrations of NO_2 , and PM_{10} have been predicted to be below the respective Air Quality Objectives and as such it is unlikely there will be any issues regarding air quality due to the development. $\text{PM}_{2.5}$ is sufficiently low and as such has not been modelled for beyond the background value for 2019.

In terms of the construction phase, the site is deemed to be a low-medium risk site with the only 'medium' risk being potential dust soiling from the earthworks activities. Potential mitigation measures have been included in Table 16.

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1 INTRODUCTION

1.1 Scope

Stroma Built Environment Ltd has been commissioned to undertake an air quality exposure assessment based on the potential impacts of existing and future traffic levels on a proposed development on land to the west of Rodney Street. The pollutants modelled as part of this assessment are nitrogen oxides (NO_x) and particulate matter (PM₁₀).

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 NO₂ and PM₁₀ 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.

An assessment on the potential impact on local air quality from demolition and construction activities at the site has been undertaken.

1.2 Site Description

The proposed development site on land to the west of Rodney Street is approximately 1.25 km to the north of Manchester Piccadilly Station. The development comprises of the erection of two residential apartment buildings (Use Class C3), one of 8 storeys (68 apartments) and one of 5 storeys (50 apartments), to form a total of 118 residential apartments; and the erection of 10, 3 storey townhouses (Use Class C3); together with car and cycle parking provision, hard and soft landscaping including public realm, access, substation and other associated works. A location plan can be found in Figure 1.

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, February 2018

Figure 1 – Site Location Plan



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 (NO₂), fine particulates (PM₁₀), carbon monoxide (CO), 1,3-butadiene and benzene, as well as carbon dioxide (CO₂). This air quality assessment focuses on NO₂ and PM₁₀, as these pollutants are least likely to meet their Air Quality Strategy objectives near roads. Table 1 provides an overview of NO₂ and PM₁₀.

Table 1 – Overview of NO₂ and PM₁₀

Pollutant	Properties	Anthropogenic Sources	Natural Sources	Potential Effects
Particles (PM₁₀)	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 (NO₂)	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 2007³. 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 (PM₁₀ 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 and amended in The Air Quality Standards (Amendment) Regulations 2016. Table 2 provides the UK Air Quality Objectives for NO₂ and PM₁₀.

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

Pollutant	Objective	Concentration measured as
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
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

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 µg/m³. As such, no further consideration has been given to PM_{2.5} within this assessment.

2.3 Local Air Quality Management (LAQM)

At the core of LAQM delivery are three pollutant objectives; these are: nitrogen dioxide (NO₂), particulate matter (PM₁₀) and sulphur dioxide (SO₂). All current Air Quality Management Areas (AQMAS) across the UK are declared for one or more of these pollutants, with NO₂ 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.

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

2.3.1 Manchester City Council

The Council has declared four Air Quality Management Areas (AQMAs) for exceedances of Nitrogen Dioxide and Particulate Matter. The development site itself slightly overlaps one of the declared AQMAs- it is adjacent to a section of the Greater Manchester Combined Authority AQMA on Oldham Road (A62).

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 National Planning Policy Framework (NPPF)⁴ for England, revised and released on 20th 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. The NPPF replaces the Planning Policy Statement 23 (PPS23) Planning and Pollution Control⁵.

Paragraph 174 within the NPPF states that “planning policies and decisions should contribute to and enhance the natural and local environment” and that developments “should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans”

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 Planning Practise Guidance (PPG)

As defined within section 2, the UK Government has legally binding limits for concentrations of outdoor air pollutants. Development of any size can influence air quality through the construction and in use phases. The PPG for air quality outlines the considerations for developments in relation to air quality and the scenarios to be considered where appropriate. Furthermore the PPG outlines that any assessment needs to be “proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions”. Once these considerations and assessments have been undertaken, mitigation which is specific to the locality should be agreed between the planning authority and developer “to ensure new development is appropriate for its location and unacceptable risks are prevented”.

⁴ National Planning Policy Framework, Secretary of State for Ministry of Housing, Communities and Local Government, February 2019

⁵ Planning Policy Statement 23: Planning and Pollution Control, Office of the Deputy Prime Minister (ODPM), November 2004

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 processes⁶.

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 demolition⁷. 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 PM₁₀ concentrations, as a result of dust generating activities on site; and
- An increase in concentrations of 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 PM₁₀ 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”.

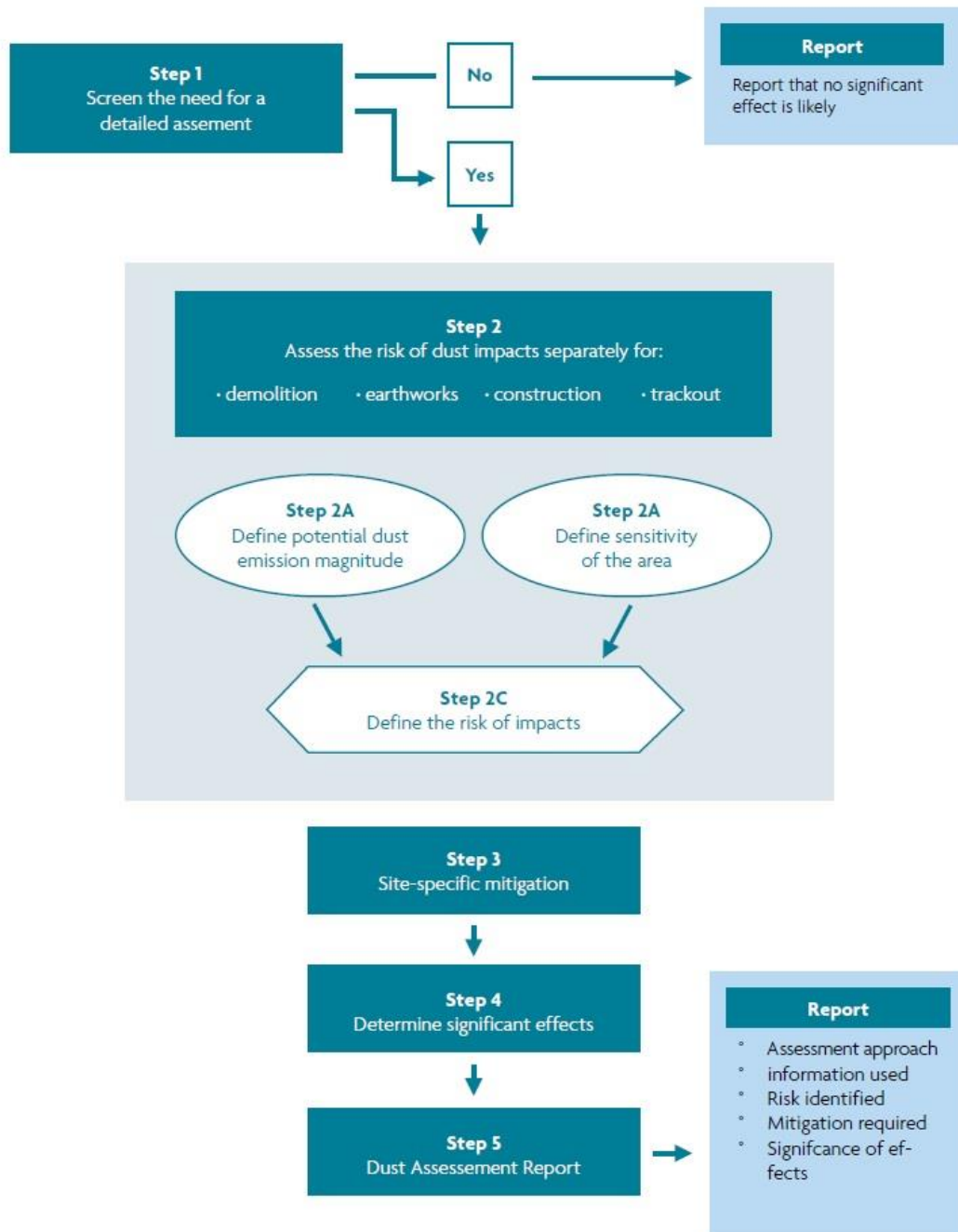
The guidance continues by providing an assessment procedure. This includes sub-dividing construction activities into four types to reflect their different potential impacts. These are as follows:

- 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 2.

⁷ Holman et al (2016). 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 2 – Dust Assessment Procedure



4.2 Operational Phase (Traffic Emissions)

4.2.1 Modelled Scenarios

A modelled baseline year of 2019 has been used to represent current air quality conditions alongside the future year, 2025, being chosen representing the first full year with the proposed development in place. The following scenarios have been adopted as part of the assessment:

- **Scenario 1** - impact of existing emissions on the proposed development (2019).
- **Scenario 2** – future impact of traffic emissions on the proposed development i.e. introduction of new exposure (2025).

Predicted concentrations will be compared to the Air Quality Strategy objectives. Background pollutant concentrations and vehicle emission rates for all modelled years are based on the latest data issued by Defra. These background concentrations and emission factors are discussed further in the following sections.

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 model⁸. 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 NO_x emissions factors and vehicle fleet information⁹. 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 2019 have been used for all modelled years.

4.2.4 Traffic Data

Projection of traffic data has been undertaken using growth factors specific to Manchester City Council, obtained from TEMPro. The projected flow rates are provided in Table 3. It is assumed that the percentage HDV and speed will remain unchanged in future years. For the modelled speeds, the figures provided above have been used. However, where a link approaches a junction a speed of 20 kmph has been modelled in order to represent queuing traffic at a junction. This is the approach recommended by the Local Air Quality Management Technical Guidance (LAQM.TG16) for modelling queuing traffic at junctions by way of reducing the modelled vehicle speeds.

⁸ Model Version: 4.1.1.0. Interface Version 4.1.1 (18/01/2018)

⁹ https://laqm.defra.gov.uk/documents/EFT2019_v11.0.xlsb

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

Link Name	AADT 2019	AADT 2025	HDV (%)	Speed (kmph)
Oldham Road	19,577	20,945	5.9	48

4.3 Background Concentrations

Background NO_x, NO₂ and PM₁₀ concentrations have been obtained from Defra¹⁰. These 1 km x 1 km grid resolution maps are derived from a base year of 2018 (for NO_x, NO₂, PM₁₀ and PM_{2.5} only), which are then projected to future years up to 2030. Background concentrations of NO₂, PM₁₀ and PM_{2.5} derived from Defra are provided in Table 4.

Table 4 – Background NO_x, NO₂, PM₁₀ and PM_{2.5} Concentrations

Location	Pollutant	X	Y	2019
Proposed Development	NO ₂	385500	398500	23.4
	NO _x			35.2
	PM ₁₀			12.6
	PM _{2.5}			8.3

4.4 Surface Roughness

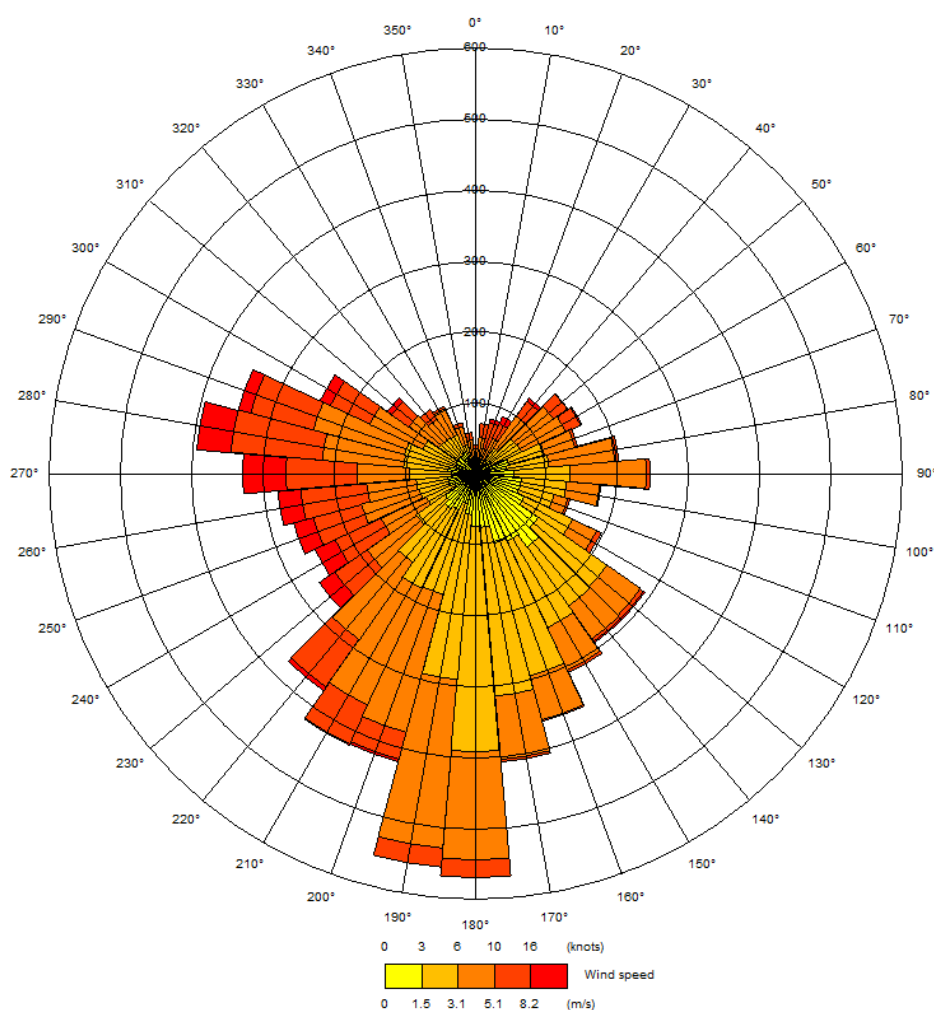
A surface roughness of 0.5 metre has been used in the model. This value is provided by ADMS-Roads as a typical roughness length for open parkland and suburbia. This value has been used across the modelled domain.

4.5 Meteorological Data

Hourly sequential meteorological data from the Manchester Airport meteorological station has been used. Wind speed and direction data from the Manchester Airport meteorological station has been plotted as a wind rose in Figure 3.

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

Figure 3 – Wind Speed and Direction Data, Manchester Airport (2019)



4.6 Model Output

4.6.1 NO_x/NO₂ Relationship

Recent evidence shows that the proportion of primary NO₂ in vehicle exhaust has increased¹¹. As such, a new NO_x to NO₂ calculator has been devised¹². This new calculator has been used to determine NO₂ concentrations for this assessment, based on predicted NO_x concentrations using ADMS-Roads. Converted NO₂ concentrations are initially compared to local monitoring data in order to verify the model output. If the model performance is considered unacceptable then the NO_x concentrations are adjusted before conversion to NO₂.

4.6.2 Predicted Short Term Concentrations

As discussed in the introduction, it has not been possible to model the short-term impacts of NO₂ and PM₁₀. Research undertaken in 2003¹³ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³.

¹¹ Trends in Primary Nitrogen Dioxide in the UK, Air Quality Expert Group, 2007

¹² https://laqm.defra.gov.uk/documents/NOx_to_NO2_Calculator_v8.1.xlsm

¹³ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marnier, 2003

For PM₁₀, a relationship between the annual mean and the number of 24-hour mean exceedances has been devised and is as follows:

- No. 24-hour mean exceedances = $-18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

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

4.6.3 Receptor Locations

In order to assess the potential impact of the proposed development, selected proposed buildings have been modelled.

The location of these model points, together with their height above ground level is provided in Table 5 and represented in Figure 4.

Table 5 – Modelled Receptor Locations

Air Quality Assessment ID	X	Y	Height (m)
1	385269	398982	1.5
2	385278	398986	1.5
3	385311	398988	1.5
4	385299	398980	1.5
5	385276	398968	1.5
6	385290	398950	1.5
7	385307	398962	1.5
8	385324	398957	1.5
9	385307	398944	1.5
10	385299	398912	1.5
11	385310	398919	1.5
12	385325	398928	1.5
13	385337	398935	1.5

Figure 4 – Modelled receptor points



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 6); 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 7). The risk category assigned to the development can be different for each of the four potential activities (demolition, earthworks, construction and trackout).

Table 6 – 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 m ³ – 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 7 – 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

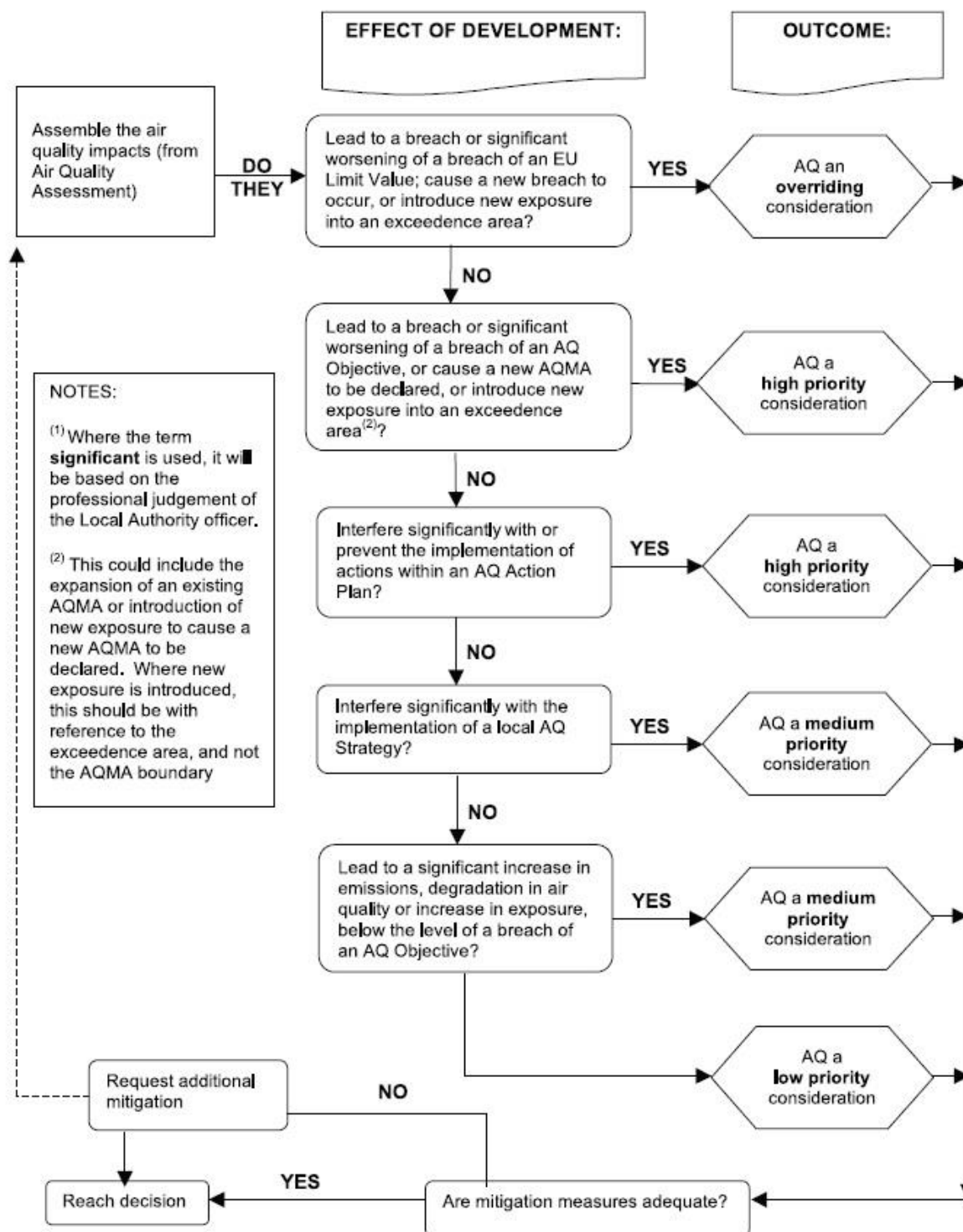
by the London Air Pollution Planning and the Local Environment (APPLE) working group¹⁴. The Air Pollution Exposure Criteria is considered appropriate to describe the significance of the impacts predicted, together with an indication as to the level of mitigation required in order for the development to be approved. The APEC table 8 is provided below.

Table 8 – Modelled Air Pollution Exposure Criteria (APEC)

APEC Category	NO₂	PM₁₀	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

¹⁴ Air Quality and Planning Guidance, written by the London Air Pollution Planning and the Local Environment (APPLE) working group, January 2007

Figure 5 – Flowchart for Air Quality Management



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 6 the dust emission magnitude for each activity is as follows:

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

Based on the IAQM guidance the sensitivity of the surrounding area is summarised in Table 9.

Table 9 – Modelled Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
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 10.

Table 10 – Summary of Dust Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	Medium	Low	Low
Human Health	N/A	Low	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 site listed in Table 11. The following tables provide a summary of the model verification process for NO_x/NO₂ and PM₁₀ concentrations.

Table 11 – Comparison of Modelled and Monitored NO₂ Concentrations (µg/m³)

Verification Location	Modelled Concentration	Monitored Concentration	Difference [(modelled - monitored)/monitored] x100
MA28NO	24.4	36.1	-32.5%
MA36NO	24.9	31.7	-21.4%
MA71NO	31.3	45.3	-30.9%
MA78NO	21.9	33.0	-33.6%
MA88ANO	24.5	43.3	-43.5%
MA95NO	27.6	43.4	-36.5%

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 $\pm 25\%$ (ideally $\pm 10\%$) 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 NO_x (excluding background). The modelled road contribution NO_x is taken directly from the ADMS-Roads output before it has been converted to NO₂ using the NO_x to NO₂ calculator described in Section 4.6.1. The NO_x to NO₂ calculator can also be used to derive monitored road contributions of NO_x from NO₂ diffusion tube results. A summary of these calculations is provided in Table 12.

Table 12 – Monitored NOx and NO₂ concentrations

Verification 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
MA28NO	36.1	20.5	15.6	31.8	7.5	4.24
MA36NO	31.7	20.8	10.9	21.7	7.9	2.74
MA71NO	45.3	23.4	21.9	46.7	15.7	2.97
MA78NO	33.0	19.0	14.0	28.0	5.4	5.15
MA88ANO	43.3	19.0	24.3	51.3	10.5	4.90
MA95NO	43.4	19.6	23.8	50.2	15.5	3.24

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 it is 3.502 and is used to adjust the modelled road contribution of NOx. This is shown in Table 13.

Figure 6 – Linear Regression of Modelled and Monitored NO₂

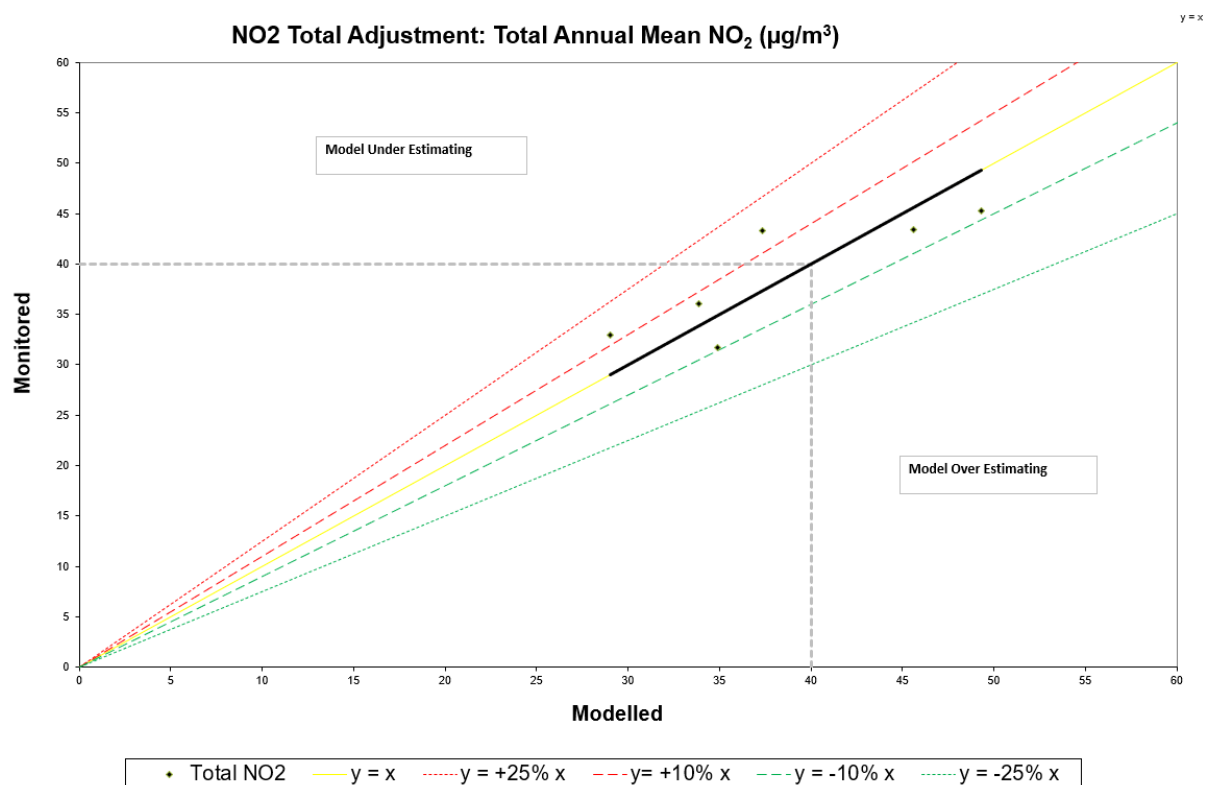


Table 13 – Adjustment of Modelled NO_x Contributions

Verification Location	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NO _x	Modelled total NO ₂ (based on empirical NO _x /NO ₂ relationship)	Monitored total NO ₂	% Difference [(modelled – monitored) / monitored] x 100
MA28NO	3.502	26.3	33.5	36.1	-7.1%
MA36NO	3.502	27.8	34.6	31.7	9.0%
MA71NO	3.502	55.0	48.8	45.3	7.7%
MA78NO	3.502	19.1	28.7	33.0	-12.9%
MA88ANO	3.502	36.7	37.0	43.3	-14.6%
MA95NO	3.502	54.3	45.1	43.4	3.9%

Following adjustment of the modelled NO_x concentrations by a factor of 3.502 the total NO₂ concentration at the model verification location has been calculated using the method described in Section 4.6.1. The revised NO₂ concentration, shown in Table 13, indicates a more acceptable model performance when compared against the monitored NO₂ concentrations. As such, an adjustment factor of 3.502 has been applied to all modelled NO_x concentrations across the model domain before conversion to NO₂.

5.2.3 Nitrogen Dioxide

Predicted annual mean concentrations for NO₂ at the proposed development in 2019 and 2025 are provided in Table 14. As mentioned in Section 4.6.1, NO₂ concentrations have been calculated from the predicted NO_x concentrations using the latest NO_x-NO₂ conversion spreadsheet available from the Air Quality Archive.

Table 14 – Predicted Annual Mean NO₂ Concentrations (µg/m³)

Receptor ID	2019	2025
1	26.1	26.3
2	26.0	26.2
3	25.8	26.0
4	25.8	26.0
5	25.9	26.1
6	25.7	25.8
7	25.6	25.8
8	25.5	25.7
9	25.5	25.7
10	25.5	25.6
11	25.4	25.6
12	25.4	25.6
13	25.4	25.5
Objective	40	

The ADMS predictions for annual mean NO₂ concentrations in 2019 and 2025 indicate that the annual mean objective (40 µg/m³) would be achieved at the modelled receptor location.

Nitrogen dioxide also has an hourly objective of 200 µg/m³ 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

NO₂ concentrations was very weak. Nonetheless, research undertaken in 2003¹⁵ has indicated that the hourly NO₂ objective is unlikely to be exceeded at a roadside location where the annual mean NO₂ concentration is less than 60 µg/m³. Given that predicted NO₂ concentrations in 2019 and 2025 are well below 60 µg/m³ at the modelled receptor locations, the likelihood of the short-term objective for NO₂ being exceeded is considered low.

5.2.4 Particulate Matter

Predicted annual mean concentrations for PM₁₀ are provided in Table 15.

Table 15 – Predicted PM₁₀ Concentrations, Annual Mean (µg/m³)

Receptor ID	2019	2025
1	13.1	13.1
2	13.1	13.1
3	13.0	13.1
4	13.0	13.1
5	13.0	13.1
6	13.0	13.0
7	13.0	13.0
8	13.0	13.0
9	13.0	13.0
10	12.9	13.0
11	12.9	13.0
12	12.9	13.0
13	12.9	13.0
Objective	40	

The ADMS predictions for annual mean PM₁₀ concentrations in 2019 and 2025 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 PM₁₀ concentrations are more than 50 µg/m³ is 1, less than the 35 exceedances 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 PM₁₀ can be reduced to negligible through suggested appropriate mitigation measures, which are listed in Table 16 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.

With these mitigation measures enforced, the likelihood of nuisance dust episodes occurring at those receptors adjacent to the development are considered low to negligible. 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 to determine the origin of a particular

¹⁵ Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003

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 16 – 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 head or regional office contact information.
	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
	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 active 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 and Sustainable Travel	Ensure all non-road mobile machinery (NRMM) comply with the standards set within this guidance.
	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.
	Implement a Travel Plan Statement that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).
	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.
Demolition	N/A

Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces
	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil
	Only remove secure covers in small areas during work and not all at once
Construction	Avoid scabbling (roughening of concrete surfaces) if possible
	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery
	For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust
Trackout	Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site
	Avoid dry sweeping of large areas
	Ensure vehicles entering and leaving sites are securely covered to prevent escape of material during transport
	Record all inspections of haul routes and any subsequent action in a site log book
	Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)

6.2 Impact of Vehicle Emissions

In terms of introducing new exposure, all predicted NO₂ and PM₁₀ concentrations at the modelled receptor locations are below the relevant air quality objectives and fall within APEC Category A, which states that there are “No air quality grounds for refusal; however, mitigation of any emissions should be considered”. Using the flow chart presented in Figure 5, air quality is a low priority consideration with regards to the impact of the proposed development.

With regard to traffic generated by the scheme and its associated air quality impacts this has not been directly assessed in this report. This is because the parking provided on site is limited to 7 accessible spaces for the apartment blocks, and one space each per townhouse (10 spaces). The movement of up to 17 cars is within likely daily traffic fluctuation levels on the surrounding highway network and therefore it is not considered necessary to specifically account for this in the modelling work undertaken. Other parking (30 spaces) will be provided off site in the Mobility Hub nearby. It is understood that the air quality impacts of the Mobility Hub were assessed separately as part of that planning approval (130627/FO/2021), and therefore they have not been reassessed / considered further in this report.