Kairus Ltd

Air Quality Assessment

WPD Site, Moor Lane
Exeter

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1 Introduction

1.1 Introduction

Kairus Ltd was commissioned by Richard Walker Developments Ltd to carry out an air quality assessment in connection with the proposed development of the WPD Site off Moor Lane, Sowton Industrial Estate, Exeter to provide retail units and a restaurant (the 'Site').

Due to exceedences of the national air quality objectives for nitrogen dioxide (NO_2) Exeter City Council (ECC) has declared an Air Quality Management Area (AQMA) covering the main traffic routes through the city. The AQMA extends along the B3183 to include Honiton Road up to Ringswell Avenue and Sidmouth Road up to Middlemoor Roundabout, approximately 1.3 km to the south-west of the Site. No exceedences of the air quality objectives have been identified in the vicinity of the Site, however due to the level of development planned in the Monkerton area to the north there is concern as to the impact of any future additional vehicle movements on local air quality, particularly travelling into the city through the AQMA.

This report addresses the impact of the proposed development on local air quality. Potential sources of emissions are identified and assessed in the context of existing air quality and emission sources and the nature and location of receptors.

A glossary of common air quality terminology is provided in Appendix A.

1.2 Scope of Assessment

The proposed development would provide 5 separate retail units totaling 7246 m^2 plus a 1114 m^2 restaurant. The development would result in additional vehicle movements on the adjacent road network, therefore an assessment of the impact of traffic generated by the proposals has been carried out. At the request of ECC the assessment has included an assessment of impacts along East Wonford Hill, which falls within the AQMA.

An assessment of air quality impacts associated with the construction of the proposed development has also been undertaken.

The scope of the assessment and data inputs have been discussed and agreed with ECC.

2 Site Description

2.1 The Existing Site

The WPD Site is located to the south of the A3015 Honiton Road, to the east of the Moor Lane roundabout and Moor Lane and is accessed off Moor Lane. The Site is bounded to the east by B&Q superstore with the M5 beyond. To the south is the Flyparks and South West Communications Group commercial units with Avocet Way beyond.

The WPD substation currently occupies the south-eastern part of the Site. There are a number of commercial/industrial buildings, storage and parking areas across the remainder of the Site.

The Site is bounded by the A30 to the north with commercial units such as Ashfords on the opposite side of the Road.

The location of the Site is shown below in Figure 2.1.

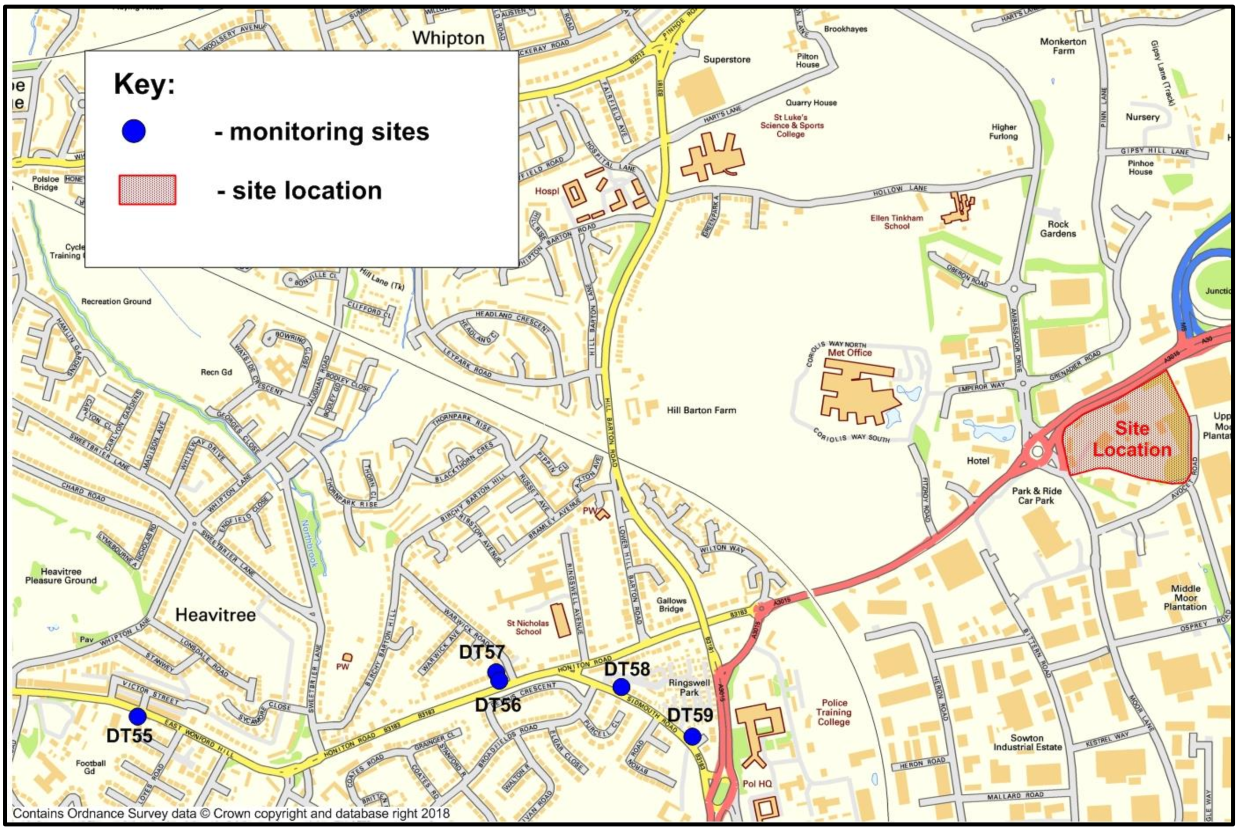

Figure 2.1: Location of Development Site

2.2 The Proposed Development

The proposals are to retain the WPD substation but to demolition all other buildings on the Site and construct 5 retail units, two providing 1393 m^2 of retail space each, two providing 929 m^2 each and the fifth providing a total of 2601 m^2. The Site would also accommodate a 1114 m^2 restaurant, a large car parking area and associated infrastructure.

An indicative layout of the proposed development is shown in Figure 2.2.

Figure 2.2: Layout of Proposed Development

3 Policy Context

3.1 Air Quality

3.1.1 International Legislation and Policy

The EU Directive 2008/50/EC[1] on ambient air quality and cleaner air for Europe (the CAFE directive) sets out the ambient air quality standards for a number of pollutants and the dates by which these objectives should be met. The Air Quality Standards Regulations 2010[2] implements the requirements of the Directive into UK legislation. The Directive contains a series of limit values for the protection of human health and critical levels for the protection of vegetation. These limit values are legally binding and the UK may incur infringement action if it does not meet the required objective limits within the agreed time limits. The UK is currently exceeding the objective limits for NO_2 and PM_{10} within London and a number of other air quality zones within the UK.

3.1.2 National Legislation and The UK Air Quality Strategy

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[3], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

1 Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe

2 Air Quality Regulations 2010 – Statutory Instrument 2010 No. 1001

3 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007

Of the pollutants included in the AQS, NO_2 and PM_{10} would be particularly relevant to this project as these are the primary pollutants associated with road traffic. The current statutory standards and objectives for NO_2 and PM_{10} in relation to human health are set out in Table 3.1.

The recently published DEFRA Local Air Quality Management Policy Guidance (LAQM.PG(16))[4] sets out new guidance on the role and responsibilities of local authorities and $PM_{2.5}$. There is no regulatory standard applied to the $PM_{2.5}$ role for local authorities in England however, local authorities are expected to work towards reducing emissions and concentrations of $PM_{2.5}$ in their area. The policy guidance recommends that local authorities in England use the EU Ambient Air Quality Directive[5] standards for $PM_{2.5}$ including an exposure reduction obligation, a target value and a limit value as a guide. However, although it was previously recommended within the 2015 Air quality guidance published by Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM)[6] that impacts on local $PM_{2.5}$ should be assessed instead of PM_{10} to provide a more conservative approach to the assessment, the revised 2017 guidance[7] raises the issue of emissions from brake/tyre wear and road abrasion, where the particulates are predominantly in the 2.5-10 µm fraction. Consequently, the guidance recommends that when assessing impacts from road traffic PM_{10} is the more appropriate pollutant to assess. This assessment therefore concentrations on PM_{10} rather than considering $PM_{2.5}$.

Table 3.1: Relevant Objectives set out in the Air Quality Strategy

Pollutant	Concentrations	Measured As	Date to be Achieved by
Nitrogen Dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times per year	1-hour mean	31 December 2005
	40 μgm^{-3}	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times per year	24-hour mean	31 December 2004
	40 μgm^{-3}	Annual mean	31 December 2004

The statutory standards and objectives apply to external air where there is relevant exposure to the public over the associated averaging periods within each objective. Guidance is provided within Local Air Quality Management Technical Guidance 2009 (LAQM.TG(16))[8] issued by DEFRA for Local Authorities on where the objectives apply, as detailed in Table 3.2. The objectives do not apply in workplace locations, to internal air or where people are unlikely to be regularly exposed (i.e. centre of roadways).

3.1.3 Local Air Quality Management

Local authorities are seen to play a particularly important role. Section 82 of the Environment Act 1995 requires every local authority to conduct a review of the air quality from time to time within the authority's area. The recently released DEFRA technical guidance, LAQM.TG(16), describes a new

4 DEFRA (2016) Local Air Quality Management Policy Guidance (PG16) LAQM.PG(16)

5 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF

6 EPUK & IAQM (2015) Land Use Planning & Development Control: Planning for Air Quality

7 EPUK & IAQM (2017) Land-use Planning and Development Control: Planning for Air Quality

8 DEFRA (2009) Local Air Quality Management. Technical Guidance LAQM.TG(16)

streamlined approach to the Local Air Quality Management (LAQM) regime, whereby every authority has to undertake and submit a single Annual Status Report/Annual Progress Report within its area, to identify whether the objectives have been or will be achieved at relevant locations by the applicable date. If the objectives are not being met, the authority must declare an Air Quality Management Area (section 83 of the Act) and prepare an action plan (section 84) which identifies measures that will be introduced in pursuit of the objectives.

Table 3.2: Locations Where Air Quality Objectives Apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care home etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building facade), or any other location where public exposure is expected to be short term.
24 Hour Mean	All locations where the annual mean objective would apply together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.
1 Hour Mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside Sites (e.g. pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where the public might reasonably be expected to spend 1-hour or more. Any outdoor locations where the public might reasonably be expected to spend 1-hour or longer.	Kerbside sites where the public would not be expected to have regular access.

3.2 Planning Policy

3.2.1 National Planning Policy

Published on 27th March 2012, the National Planning Policy Framework (NPPF)[9] sets out the Government's planning policies for England and how these are expected to be applied. It replaces Planning Policy Statement 23: Planning and Pollution Control[10] which provided planning guidance for local authorities with regards to air quality.

9 Communities and Local Government (2012) National Planning Policy Framework
10 Office of the Deputy Prime Minister (2004) Planning Policy Statement 23: Planning and Pollution Control. HMSO

At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development.

Current planning law requires that application for planning permissions must be determined in accordance with the relevant development plan (i.e. Local Plan or Neighbourhood Plan). The NPPF should be taken into account in the preparation of development plans and therefore the policies set out within the Framework are a material consideration in planning decisions.

The NPPF identifies 12 core planning principles that should underpin both plan-making and decision-taking, including a requirement for planning to *'contribute to conserving and enhancing the natural environment and reducing pollution'*.

Under Policy 11: Conserving and Enhancing the Natural Environment the Framework requires the planning system to *'prevent both new and existing developments from contributing to or being put at unacceptable risk or being adversely affected by unacceptable levels of air pollution'*.

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

3.3 Control of Dust and Particulates Associated with Construction

Section 79 of the Environmental Protection Act (1990)[11] states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

- *'any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and*
- 'any accumulation or deposit which is prejudicial to health or a nuisance'.

Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses. In the context of the proposed development, the main potential for nuisance of this nature would arise during the construction phase - potential sources being the clearance, earthworks, construction and landscaping processes.

There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist - 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates. However, impacts remain subjective and statutory limits have yet to be derived.

3.4 Local Planning Policy

3.4.1 Exeter City Council Core Strategy

ECC Local Development Framework (LDF) consists of a portfolio of documents of which the Core Strategy[12] is the principal overarching part. The Strategy was formally adopted in February 2012 and

11 Secretary of State, The Environment Act 1990 HMSO

12 Exeter City Council (2012) Exeter City Core Strategy

sets out the spatial vision, objectives, development strategy and a series of key policies that will guide the scale, location and type of development in the district until 2026.

One of the objectives of the Core Strategy *is 'promote development that contributes to a healthy population - by implementing the Green Infrastructure Strategy and ensuring that environmental quality and air quality is protected and enhanced'*.

To protect air quality policy CP11 states that *'development should be located and designed so as to minimise and if necessary, mitigate against environmental impacts'*.

4 Methodology

4.1 Construction Phase

4.1.1 Construction Traffic

During construction of the proposed development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery may also work on site including generators and cranes. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

Based on the development proposals it is anticipated that there would be between 20-25 additional Heavy Duty Vehicles (HDV) generated on the adjacent road network on any given day.

The recently published Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) air quality guidance[13] sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are unlikely to occur where a development results in less than 25 HDV movements per day in locations within an AQMA and less than 100 HDV outside of an AQMA. As the development Site is not within an AQMA, it is anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM_{10} concentrations and has not been considered any further in this assessment.

4.1.2 Construction Dust

The main air quality impacts that may arise during construction activities are dust deposition resulting in the soiling of surfaces e.g. cars, window sills; visible dust plumes and elevated PM_{10} concentrations as a result of dust generating activities on the site. These dust emissions can give rise to annoyance at nearby receptors due to the soiling of surfaces by the dust.

Separation distance is also an important factor. Research indicates that particles greater than 30µm, will largely deposit within 100 metres of sources, while intermediate particles (10-30µm) are likely to travel 100 –250m[14] under normal meteorological conditions before returning to the surface. Particles of greater than 30µm are responsible for the majority of dust annoyance. Consequently, significant dust annoyance is usually limited to within a few hundred metres of its source. Smaller particles (<10µm) are deposited slowly and can travel up to 1 km; however, the most significant impacts on short term concentrations of PM_{10} occur within a shorter distance from source. This is due to the rapid decrease in concentrations with distance from the source due to dispersion.

The assessment of construction impacts has followed the methodology set out within guidance produced by the IAQM on assessing impacts from construction activities[15].

In order to assess the potential impacts, the activities on construction sites are divided into four categories. These are.

- demolition (removal of existing structures);
- earthworks (soil-stripping, ground-leveling, excavation and landscaping);
- construction (activities involved in the provision of a new structure); and

13 EPUK & IAQM (May 2015) Land-Use Planning & Development Control: Planning for Air Quality

14 Arup, The Environmental Effects of Dust at Surface Mineral Workings. (Report to the DETR)

15 Institute of Air Quality Management (January 2014) Guidance on the Assessment of Dust from Demolition and Construction

- trackout (the transport of dust and dirt from the construction site onto the public road network where it may be deposited and then re-suspended by vehicles using the network).

For each activity, the risk of dust annoyance, health and ecological impact is determined using three risk categories: low, medium and high risk. The risk category may be different for each of the four activities. The risk magnitude identified for each of the construction activities is then compared to the number of sensitive receptors in the near vicinity of the site in order to determine the risks posed by the construction activities to these receptors.

Step 1: Screen the Need for an Assessment

The first step is to screen the requirement for a more detailed assessment. An assessment is required where there is

- a 'human receptor' within 350m of the boundary of the site or 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- an 'ecological receptor' within 50m of the boundary of the site; or 50m of the route(s) used by the construction vehicles on the public highway, up to 500m from the site entrance(s).

Step 2A: Define the Potential Dust Emission Magnitude

This is based on the scale of the anticipated works and the proximity of nearby receptors. The risk is classified as small, medium or large for each of the four categories.

Demolition: The potential dust emission classes for demolition are:

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

Earthworks: This involves excavating material, haulage, tipping and stockpiling. The potential dust emission classes for earthworks are:

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

Construction: The important issues here when determining the potential dust emission magnitude include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build. The categories are:

- Large: Total building volume >100,000m^3, on site concrete batching, sandblasting;

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

Trackout: The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout. The categories are:

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

Step 2B: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health (PM_{10}) and ecological receptors. The sensitivity of the area takes into account the following factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of receptors;
- in the case of PM_{10}, the local background concentration; and
- site specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Table 4.1 is used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Table 4.1: Examples of Factors Defining Sensitivity of an Area

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
High	• Users can reasonably expect enjoyment of a high level of amenity • The appearance, aesthetics or value of their property would be diminished by soiling' • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal	• 10 – 100 dwellings within 20 m of site. • Local PM_{10} concentrations close to the objective (e.g. annual mean 36 -40 µg/m^3). • E.g. residential properties, hospitals, schools and residential care homes.	• Locations with an international or national designation and the designated features may be affected by dust soiling. • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red List for Great Britain. • E.g. A special Area of Conservation (SAC).

Table 4.1: Examples of Factors Defining Sensitivity of an Area			
Sensitivity of Area	**Dust Soiling**	**Human Receptors**	**Ecological Receptors**
	pattern of use of the land. • E.g. dwellings, museums and other important collections, medium and long term car parks and car showrooms.		
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home. • The appearance, aesthetics or value of their property could be diminished by soiling • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • E.g. parks and places of work.	• Less than 10 receptors within 20 m. • Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 µg/m^3). • E.g. office and shop workers but will generally not include workers occupationally exposed to PM_{10} as protection is covered by the Health and Safety at Work legislation.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. • Locations with a national designation where the features may be affected by dust deposition • E.g. A site of Special Scientific Interest (SSSI) with dust sensitive features.
Low	• The enjoyment of amenity would not reasonably be expected. • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • E.g. playing fields, farmland unless commercially sensitive horticultural, footpaths, short lived car [parks and roads.	• Locations where human exposure is transient. • No receptors within 20 m. • Local PM_{10} concentrations well below the objectives (less than 75%). • E.g. public footpaths, playing fields, parks and shopping streets.	• Locations with a local designation where the features may be affected by dust deposition. • E.g. local Nature Reserve with dust sensitive features.

Based on the sensitivities assigned to the different receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification can be defined for each. Tables 4.2 to 4.4 indicate the criteria used to determine the sensitivity of the area to dust soiling, human health and ecological impacts.

Table 4.2: Sensitivity of the Area to Dust Soiling on People and Property

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

Table 4.3: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	<50	<100	<200	<350
High	**>32 $\mu g/m^3$**	**>100**	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 $\mu g/m^3$	**>100**	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 $\mu g/m^3$	**>100**	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 $\mu g/m^3$	**>100**	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	**>32 $\mu g/m^3$**	**>10**	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32 $\mu g/m^3$	**>10**	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Table 4.3: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	**Annual Mean PM_{10} Concentration**	**Number of Receptors**	**Distance from Source (m)**				
			<20	**<50**	**<100**	**<200**	**<350**
	24-28 µg/m³	**>10**	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m³	**>10**	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	**-**	**>1**	Low	Low	Low	Low	Low

Table 4.4: Sensitivity of the Area to Ecological Impacts		
Receptor Sensitivity	**Distance from the Source (m)**	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Define the Risk of Impacts

The final step is to combine the dust emission magnitude determined in step 2A with the sensitivity of the area determined in step 2B to determine the risk of impacts with no mitigation applied. Tables 4.5 to 4.7 indicate the method used to assign the level of risk for each construction activity.

Table 4.5: Risk of Dust Impacts from Demolition			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

Table 4.6: Risk of Dust Impacts from Earthworks/ Construction			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

Table 4.7: Risk of Dust Impacts from Trackout			
Sensitivity of Area	**Large**	**Medium**	**Small**
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

4.2 Operational Phase

4.2.1 Traffic Related Emissions

Introduction

Potential impacts on air quality due to local traffic emissions have been predicted using the ADMS-Roads dispersion model (version 4.1, released February 2017). This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from Exeter Meteorological Station for 2016 has been used for the assessment.

Quantitative assessment of the impacts on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in Table 3.1 for NO_2 and PM_{10}.

Emissions Data

The model uses traffic flow data and vehicle related emission factors to predict road specific concentrations of NO_x, PM_{10} and $PM_{2.5}$ at sensitive receptors selected by the user. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator (Version 6.1, released October 2017) available on the DEFRA air quality website (http://uk-air.defra.gov.uk).

The assessment has predicted air quality during 2016 for verification and in 2023, the anticipated completion year. The emission factors release by DEFRA in October 2017, provide in the emissions factor toolkit EFT2017_8.1 have been used to predict traffic related emissions of NO_2 and PM_{10}. These are the latest emission factors available.

The ADMS model cannot predict short-term concentrations of NO_2 or PM_{10}. However, the following approach has been set out by DEFRA in LAQM.TG(16) to calculate the number of exceedences of 50 $\mu g/m^3$ as a 24-hour mean PM_{10}:

$$A = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

where A is the number of exceedences of 50 $\mu g/m^{-3}$ as a 24-hour mean PM_{10} concentration.

LAQM.TG(16) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[16] has concluded that exceedences of the 1-

16 D Laxen and B Marner: *Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites* (July 2003).

hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. This approach has been taken within this assessment.

Background Concentrations

The ADMS model estimates concentrations arising as a result of vehicle emissions. It is necessary to add an estimate of local background concentrations to obtain the total concentration for comparison against the air quality objectives.

A 2016 background NO_2 concentration for use within the modelling assessment has been taken from the background monitoring site on Langaton Lane.

The Langaton Road site is a diffusion tube site and therefore does not monitor PM_{10} or oxides of nitrogen (NO_x). Estimated concentrations for NO_x and PM_{10} have been taken from the DEFRA 2015 background maps. Concentrations have been extracted from the maps for the grid squares, which represent the Site, monitoring sites used in the model verification and surrounding road network.

Details of the background data used within the modelling assessment are provided in Table 5.4 for NO_2 and Table 5.5 for PM_{10}. The assessment has assumed no change in future background concentrations with the 2016 background concentrations used to predict concentrations in 2023. This is considered to represent a worst-case prediction of future concentrations.

Traffic Data

Base traffic flows for 2016 for use in the assessment have been provided by the transport consultants, Trace Design.

The base flows have been factored forward to 2023 to provide the future year base scenario. Traffic generated by the following committed developments have been added to the base flows to allow a cumulative assessment to be undertaken:

- 13/4067/OUT – residential development of 92 units at Devon and Cornwall Police Headquarters, Middlemoor;
- 13/4073/FUL – development of a criminal justice centre and police hub, Class A1 supermarket at Devon and Cornwall Police Headquarters, Middlemoor;
- 13/4984/OUT – residential scheme of 400 dwellings at Monkerton Farm, east and west of Cumberland Way;
- 18/0076/OUT – mixed use development to provide town centre facilities comprising retail units and restaurants units, Land north of Honiton Road and west of Fitzroy Road;
- 14/1375/FUL – 178 residential dwellings, land to the north west and south east of The Paddocks, Harts Lane;
- 10/1594/FUL – redevelopment to provide a new foodstore, R D & E Hospital, Gladstone Road

Traffic generated by the proposed development has subsequently been added to provide the future with development scenario.

The traffic data used within the assessment for the following road links is provided below in Table 4.8:

- 1 – Cumberland Way between B3181 and Tithebarn Lane;
- 2 – Cumberland Way between Oberon Road and Tithebarn Lane;
- 3 – Honiton Road west of Ambassador Drive;
- 3b – Honiton Road west of Fitzroy Road;

- 4 – Honiton Road between Wilton Way and B3183;
- 5 – Honiton Road between B3183 and East Wonford Hill;
- 6 – East Wonford Hill west of Honiton Road.

Table 4.8: AADT traffic Flows used in ADMS Modelling Assessment

Link Number	Speed (kph)	%HGV	2016 Base	2023 Base	2023 Base + Committed Development	2023 Base + Committed + Proposed
1	48 (25 at junctions)	5	18584	22264	22293	22373
2	48 (25 at junctions)	5	18584	25639	25668	25748
3	48 (25 at junctions)	1.4	20666	21932	22222	23040
3a	48 (25 at junctions)	0.7	17477	18555	18844	19663
4	48 (25 at junctions)	0.9	12562	13337	13504	13978
5	48 (25 at junctions)	1.6	19773	20994	21160	21635
6	48 (25 at junctions)	3.4	22797	25900	26007	26311

Verification of Model Results

It is recommended that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

LAQM.TG(16) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. Also, the guidance recommends that any adjustment factors applied to model results should be calculated based on verification using monitoring sites in a similar location i.e. roadside, intermediate or background sites.

To verify the model results, the ADMS model has been used to predict NO_x concentrations at the Honiton Road (DT56) and East Wonford Hill (DT55) monitoring sites. (see Appendix B for further details on the verification method).

There is no suitable monitoring of PM_{10} data to allow verification of the PM model results. However, LAQM.TG (16) suggests applying the NO_x adjustment factor to modelled road-PM where no appropriate verification against PM data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

Receptors

As set out in Table 3.2, LAQM.TG(16) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations *'where members of the public are regularly present'* should be considered. At such locations, members of the public would be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

For instance, on a footpath, where exposure would be transient (for the duration of passage along that path) comparison with short-term standards (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term standards (such as 24-hour mean or annual mean) may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

For the completion of this assessment, air quality has been predicted at the facades of sensitive receptors (i.e. residential properties) located adjacent to West Wonford Hill, Honiton Road and Cumberland Way. Receptors proposed within the Monkerton Farm development (which lies directly east and west of Cumberland Way) have also been included. The majority of receptors located along Honiton Road, east of Wilton Lane, are commercial or retail premises. To provide a better indication of changes in air quality as a result of the operational development receptors have also been selected to represent the two hotels located adjacent to Honiton Road. Each receptor has been selected to represent worst-case exposure to local traffic emissions.

The details of each receptor are presented below in Table 4.9 and their locations shown in Figure 4.1.

Table 4.9: Location of Receptors used in ADMS Modelling Assessment

Receptor Number	Receptor Location	OS Grid Reference	Receptor Height (m)
1	Monkerton Farm development	296341, 93664	1.5
2	Monkerton Farm development	296257, 93731	1.5
3	Monkerton Farm development	296123, 93807	1.5
4	Higher Furlong, Cumberland Way	296337, 93520	1.5
5	Holiday Inn	296285, 92846	1.5
6	Premier Inn	296104, 92688	1.5
7	Chard Stock Close, residential	295799, 92571	1.5
8	134 Honiton Road	295712, 92554	1.5
9	145 Honiton Road	295502, 92444	1.5
10	125 Honiton Road	295391, 92409	1.5
11	Honiton Road Façade Diffusion tube	295194, 92388	1.5
12	11 Honiton Road	294914, 92275	1.5
13	2 Honiton Road	294827, 92245	1.5
14	Honiton Road	294778, 92188	1.5
15	84 East Wonford Road	294686, 92175	1.5
16	79 East Wonford Road	294604, 92251	1.5

Table 4.9: Location of Receptors used in ADMS Modelling Assessment			
Receptor Number	Receptor Location	OS Grid Reference	Receptor Height (m)
17	42 East Wonford Road	294517, 92260	1.5
18	49 East Wonford Road	294470, 92304	1.5
19	18 East Wonford Road	294416, 92307	1.5
20	East Wonford Road Diffusion Tube	294409, 92309	1.5

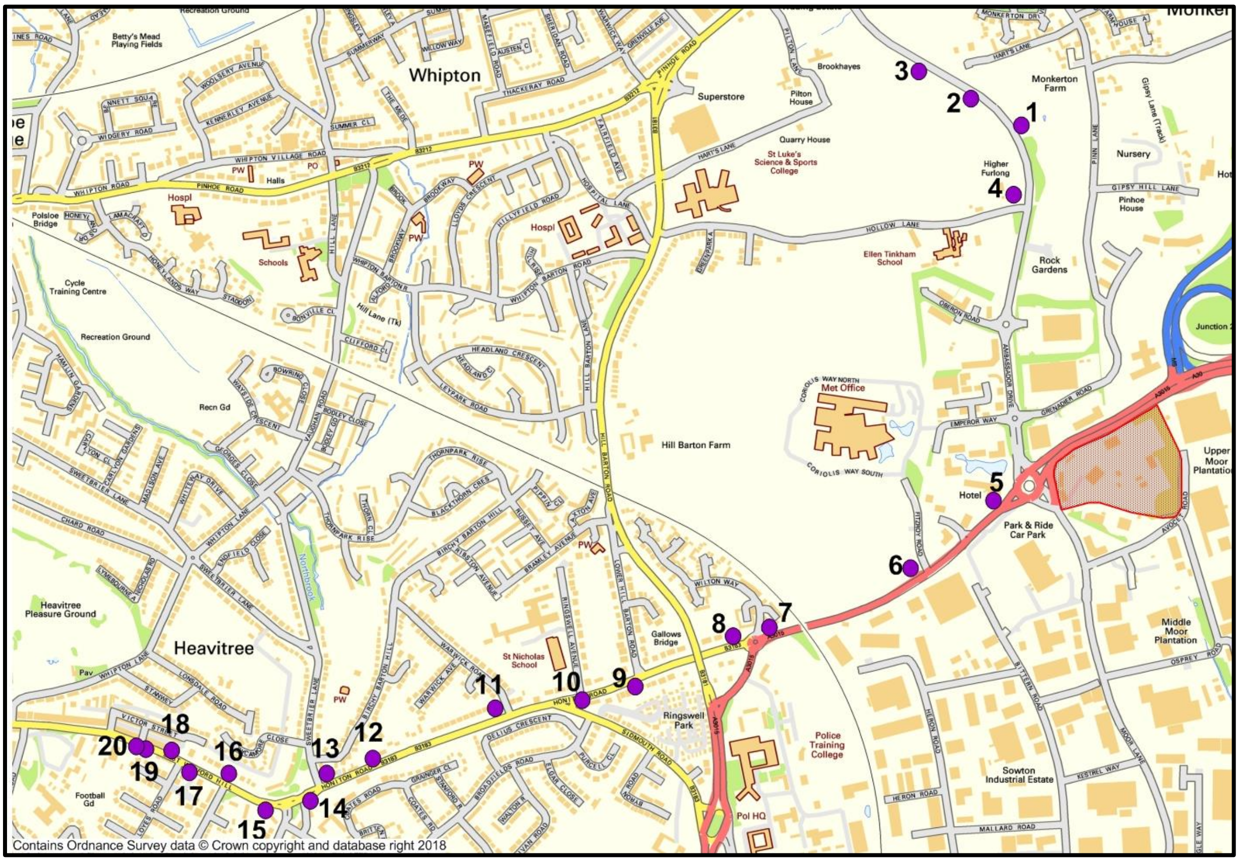

Figure 4.1: Receptor Locations used in Modelling

4.3 Significance Criteria

4.3.1 Operational Phase

The guidance issued by EPUK & IAQM relates to Air Quality considerations within the planning process and sets criterion which identify the need for an Air Quality Assessment, the type of Air Quality assessment required, and the significance of any predicted impact.

The guidance suggests expressing the magnitude of incremental change in concentrations as a proportion of an Air Quality Assessment Level (AQAL) such as the air quality objectives set out in Table 3.1.

The significance of impact is then identified based on the incremental change in the context of the new total concentrations and its relationship with the assessment criteria, noting whether the impact is adverse or beneficial based on a positive or negative change in concentrations. The criteria suggested for assigning significance is set out in Table 4.11 below.

Table 4.11: Impact Descriptors for Individual Receptors

Long-term Average Concentration at Receptor in Assessment Year	% Change in Concentrations Relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Minor	Moderate
76-94% of AQAL	Negligible	Minor	Moderate	Moderate
95-102% of AQAL	Minor	Moderate	Moderate	Major
103-109% of AQAL	Moderate	Moderate	Major	Major
110% of AQAL	Moderate	Major	Major	Major

AQAL – Air Quality Assessment Level which in this assessment refers to the Air Quality Objectives set out in Table 3.1

The percentage change in concentration should be rounded to a whole number

The table should only be used with annual mean concentrations

The descriptors are for individual receptors only: overall significance should be based on professional judgment

When defining the concentrations as a percentage of the AQAL use the 'without scheme' concentration where there is a decrease in pollutant concentrations and the 'with scheme' concentrations for an increase

The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value i.e. well below, the degree of harm is likely to be small. As exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL

It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year, it is impossible to define the new total concentrations without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

5 Baseline Assessment

5.1 Exeter Review and Assessment of Air Quality

ECC has completed a number of detailed assessments of air quality in the city and as a result has declared an AQMA due to exceedences of both the annual and hourly mean NO_2 objectives. The AQMA covers the main traffic routes through the city. The closest parts of the AQMA to the Site are Honiton Road west of Ringswell Avenue and Sidmouth Road leading to Middlemore Roundabout (approximately 1.4 km to the south-west).

5.1.1 Automatic Monitoring

As detailed in the ECC 2017 Annual Status Report (ASR)[17], ECC operates two automatic monitoring sites within the city. One of these sites is located adjacent to Queen Street at the Royal Albert Memorial Museum (RAMM), which is approximately 4.6 km west of the Site. The site monitors NO_2 concentrations using a chemiluminescent gas analyser and PM_{10} concentrations using a TEOM. The Alphington Site is approximately 5 km south-west of the Site and measures PM_{10} concentrations using a TEOM.

Details of the sites are provided in Table 5.1 below. NO_2 and PM_{10} concentrations recorded since 2009 are provided in Tables 5.2 and Table 5.3 provides the number of exceedences of the 24-hour 50 µg/m^3 PM_{10} objective for PM_{10}.

Table 5.1: Details of the Automatic Monitoring Sites

Site	Classification	OS Grid Ref	Pollutants Monitored	In AQMA	Distance to Kerb of nearest Road
Exeter Roadside	Kerbside	291939, 092830	NO_2, NO_x, PM_{10}, SO_2, O_3 and CO	Y (For NO_2)	1m
Alphington Street	Roadside	291670, 091773	PM_{10}	N	3m

Table 5.2: Annual Mean Concentrations Recorded at the Automatic Sites (µgm^{-3})

Site	Year							
	2009	2010	2011	2012	2013	2014	2015	2016
Exeter Roadside (NO_2)	40	40	32	32	33	31[1]	28	30.5
Exeter Roadside (PM_{10})	23.8	23.7	26.5	18.7	22.6	19.9	19.0	15.0
Alphington Street (PM_{10})	28.0	25.5	24.3	16.5	21.4	19.9	19.0	15.0

[1] data capture less than 90% therefore comparison against the objective should be treated with caution.

17Exeter City Council. 2017 Air Quality Annual Status Report, May 2017.

The NO_2 data presented for Exeter Roadside shows concentrations below the annual mean NO_2 objective of 40 µg/m^3 during 2016, with the objective having been met every year since 2009. The monitoring site did not record any exceedences of the 1-hour objective during 2016, indicating that the short-term NO_2 objective is being met along Queen Street. The 1-hour objective has also been met during previous years with no more than 1 exceedence recorded in any given year (the objective allows for up to 18 exceedences of the limit in any given year).

The data shows a downward trend in NO_2 concentrations since 2009, although concentrations increased in 2016 compared to 2015.

Table 5.3: Number of Exceedences of the 24-hour 50 µgm^{-3} PM_{10} objective

Site	Year							
	2009	2010	2011	2012	2013	2014	2015	2016
Exeter Street	8	9	21	3	8	2	6	0
Alphington	16	17	15	3	3	2	6	0

[1] data capture less than 90% therefore comparison against the objective should be treated with caution.

The data presented in Table 5.2 shows annual mean PM_{10} concentrations considerably below the 40 µg/m^3 objective along Queen Street and Alphington Road. Both sites have recorded exceedences of the 24 hour 50 µg/m^3 objective limit since 2009 (Table 5.3), however as the objective allows for up to 35 exceedences of the limit in any given year the objective is being met at both monitoring locations.

The data shows an overall downward trend in PM_{10} concentrations over the eight-year monitoring period.

5.1.2 Non-Automatic Monitoring Sites

ECC also measures NO_2 using diffusion tubes at over 60 locations throughout the city. Diffusion tubes are a passive form of monitoring, which, due to their relative in-expense, allow for a much greater spatial coverage than with automatic monitoring sites. Diffusion tubes are acknowledged as a less accurate method of monitoring ambient air pollutants than automatic monitors, with diffusion tubes over or under estimating concentrations by as much as 30 %.

To allow the results to be reliably compared with the AQ Objectives, the data should be bias corrected using data collected from tubes co-located with continuous monitoring sites. The data provided below has been adjusted by ECC using locally derived correction factors from diffusion tubes co-located with the automatic monitoring site on Exeter Road.

No monitoring of pollution concentrations is carried out in the immediate vicinity of the development Site. The closest diffusion tube monitoring sites are located LONG Honiton Road and Sidmouth Road.

Details of the diffusion tube monitoring sites are presented in Table 5.4. The location of those adjacent to the B3183 are shown in Figure 2.1.

Exceedences of the annual mean NO_2 objective have been recorded consistently at the Honiton Road monitoring site since 2013, although there is no relevant exposure at this location and concentrations recorded at DT57, representing the nearest residential façade, show a rapid decline in concentrations away from the roadside.

NO_2 concentrations have also been consistently above the annual mean objective at the East Wondford Hill site (Site DT55). Both this site and the site on Honiton Road fall within the Exeter AQMA. Data recorded at all the other monitoring sites shows concentrations consistently below the annual mean objective since 2013.

The data shows an overall downward trend in concentrations along East Wonford Road and Honiton Road although there has been little change in concentration on the Sidmouth Road and at the background site on Langaton Lane.

It is not possible to monitor short-term NO_2 concentrations using diffusion tubes, however, as discussed previously, research has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations are below 60 µg/m^3. Based on the monitoring data presented in Table 5.4, it is unlikely that the short-term objective is currently being exceeded along Honiton Road and Sidmouth Road. Concentrations also indicate the objective is being met on East Wonford Hill, although concentrations have previously exceeded 60 µg/m^3 and were only just below 60 µg/m^3 during 2015 to 2017. There is therefore the potential for the 1-hour to be exceeded in this location.

Table 5.4: Diffusion Tube annual average nitrogen dioxide concentrations (µgm^{-3})

Site	Type	OS Grid Ref	Distance to kerb of nearest road	Distance from Develop-ment Site (km)	Year				
					2013	2014	2015	2016	2017[1]
DT45 – Langaton Lane	Background	296984, 94327	0 m	1 km N	17.7	18.7	16.7	18.1	15.4
DT55 – East Wonford Hill	Roadside	294410, 92311	2 m	2.2 km SW	**60.8**	**64.2**	**59.2**	**57.9**	**57.7**
DT58- Sidmouth Road Lamp post	Roadside	295466, 92365	1.5m	1.6 km SW	34.6	35.3	31.4	35.0	35.0
DT59-Sidmouth Road (Middlemoor)	Roadside	295636, 92232	10m	1.6km SW	23.8	24.0	21.2	22.0	22.7
DT56 - Honiton Road	Roadside	295203, 92378	1.5m	1.7km SW	**54.0**	**58.4**	**42.7**	**49.9**	**48.2**
DT57 - Honiton Road façade	Roadside	295191, 92395	15 m	1.7km SW	21.0	21.9	18.4	20.1	19.2

[1] data is currently provisional and may be subject to change.

5.2 DEFRA Background Maps

Additional information on estimated background pollutant concentrations has been obtained from the DEFRA background maps provided on UK-AIR, the Air Quality Information Resource (http://uk-air.defra.gov.uk). Estimated air pollution concentrations for oxides of nitrogen (NO_x), NO_2, PM_{10} and

$PM_{2.5}$ have been extracted from the 2013 background pollution maps for the UK, which were published in July 2016. The maps are available in 1 km x 1 km grid squares and provide an estimate of concentrations between 2013 and 2030. Concentrations have been taken for 2016 from the grid squares: which represent the Site and road network considered within the assessment.

The PM_{10} and NO_x background maps are provided not only as total concentrations but are also broken down into sector contributions (i.e. primary A roads and brake tyre). However, as this assessment is considering the impact of the proposed development on existing air quality, background concentrations from all sources should be considered. Therefore, data presented in Table 5.5 provides total background concentrations for all three pollutants.

The data indicates that background concentrations of NO_2 and PM_{10} in the vicinity of the Site are comfortably below the annual mean objectives.

Table 5.5: Annual Mean Background Air Pollution Concentrations

Pollutant	2016
NO_x	20.0
NO_2	14.4
PM_{10}	14.4

5.3 Air Quality at the Development Site

The proposed development is located to the south of the A30, the main source of emissions to air affecting air quality at the Site. Given the proximity of the A30 pollution concentrations at the Site are expected to be higher than background, and there is the potential that the annual mean NO_2 objective may be exceeded along the northern boundary closest to the A30. However the proposed scheme would not introduce new sensitive receptors to the Site therefore impacts associated with exposure are consider to be negligible.

6 Construction Impacts

6.1 Site and Surroundings

A summary of the proposed development is provided in Section 2 of this report.

There are a small number of residential properties located within 350 m of the Site therefore an assessment of construction related impacts in relation to human receptors has been undertaken.

Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50 m from the site boundary. A review of data held on the DEFRA MAGIC website[18] shows no sites designated as important for wildlife within 50 m of the Site therefore impacts on ecological receptors has not been considered any further within this assessment.

As discussed in Section 5, the PM_{10} concentrations, taken from the DEFRA background maps, in the vicinity of the Site are expected to be below the relevant objective limits (Table 5.5). The data indicates background concentrations in the region of 14 $\mu g/m^3$, while concentrations recorded at monitoring sites in the city centre indicate roadside concentrations in the region of 15-28 $\mu g/m^3$. Given the location of the Site, outside of the AQMA, and based on the most recent monitoring data (Table 5.2) PM_{10} concentrations in the vicinity of the Site are expected to be less than 24 $\mu g/m^3$.

The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

A windrose from the Exeter Meteorological Station is provided in Figure 6.1, which shows that the prevailing winds are from the south south-west and north-west direction. Areas most consistently affected by dust are those located downwind of an emission source. Therefore, the highest risk of impacts would occur to the north north-east and south-east of the Site. The main land-uses to the north north-east and south-east are commercial premises which are low in sensitivity to dust effects.

18 http://magic.defra.gov.uk/

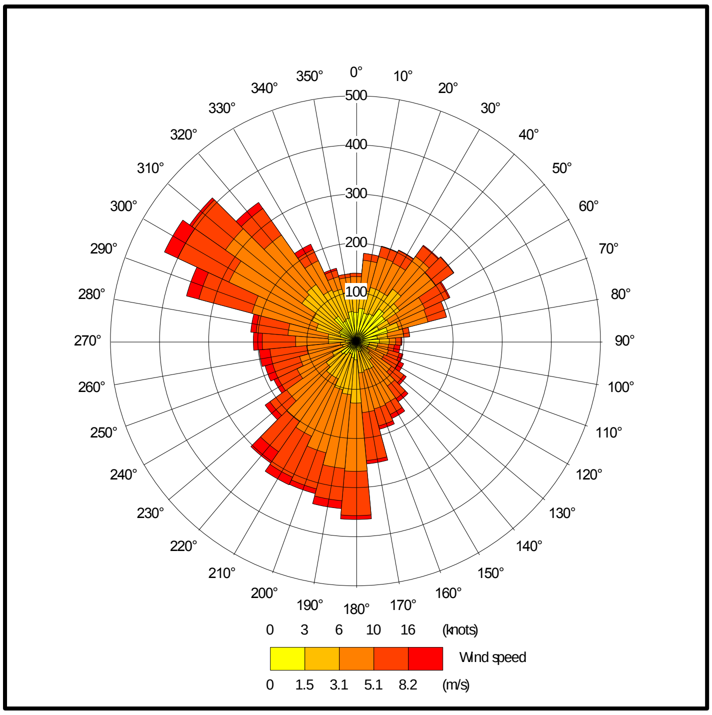

Figure 6.1: Windrose from Exeter Meteorological Station (2016)

6.2 Risk Assessment of Dust Impacts

6.2.1 Defining the Dust Emission Magnitude

With reference to the criteria detailed in section 4, the dust emission magnitude for each of the categories demolition, earthworks, construction and trackout have been determined. These have been summarised in Table 6.1.

Table 6.1: Dust Emission Magnitudes		
Activity	**Criteria**	**Dust Emission Magnitude**
Demolition	Buildings less than <20,000 $m^3$and less than 10 m in height	**Small**
Earthworks	Building site area >10,000 m^2, expected 7-8 HDV on site and earth bunds >8 m	**Large**
Construction	Building volume between 40-50,000 m^3 main construction material to include concrete, a potentially dusty material	**Medium**
Trackout	Between 20-25 HDV (>3.5t) per day	**Medium**

6.2.2 Sensitivity of Surrounding Area

Using the criteria set out in Tables 4.2 and 4.3, the sensitivity of the surrounding area to impacts from dust emissions has been determined and are set out in Table 6.2.

Dust Soiling

The closest residential properties to the Site are to the east over 350 m from the Site boundary. The main land-uses in the vicinity of the Site are commercial and retail premises and places of work which are considered to be of medium sensitivity. There are also a number of short-stay surface car parks which are of low sensitivity to dust effects.

There will be between 20-25 HDV (>3.5t) movements per day during the construction phase which would travel to and from the Site via Moor Lane onto the A30. As a general guide, significant impacts from trackout may occur up to 500 m from large sites, 250 m from medium sites and 50 m from small sites, as measured from the site exit. There are no sensitive receptors (residential properties) located within 250 of the Site access point. The sensitivity of the area to dust soiling effects from trackout is therefore considered to be low.

***PM_{10}* Effects**

As previously discussed, annual mean PM_{10} concentrations in the vicinity of the Site are expected to be below 24 µg/m^3. Based on the proximity of sensitive receptors to the site boundary and the local concentrations of PM_{10} the sensitivity of the surrounding area is considered to be low with regards human health impacts.

Table 6.2: Sensitivity of Receptors		
Potential Impact		**Sensitivity at Site**
Dust Soiling (earthworks and construction)	Receptor Sensitivity	Medium
	Number of receptors	>1 within 20 m
	Sensitivity of the area	**Medium**
Dust Soiling (trackout)	Receptor Sensitivity	No sensitive receptors
	Number of receptors	None within 250 m of Site access
	Sensitivity of the area	**Negligible**
Human Health PM_{10} (earthworks and construction)	Receptor Sensitivity	Medium
	Annual mean PM_{10} concentration	< 24 µg/m^3
	10-20 within 100-300 m	>1 within 20 m
	Sensitivity of the area	**Low**
Human Health PM_{10} (trackout)	Receptor Sensitivity	No sensitive receptors
	Annual mean PM_{10} concentration	< 24 µg/m^3
	Number of receptors	None within 250 m of Site access
	Sensitivity of the area	**Negligible**

6.3 Defining the Risk of Impacts

The dust emission magnitude as set out in Table 6.1 is combined with the sensitivity of the area (Table 6.2) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site. The risk of impacts associated with each activity is provided in Table 6.3 below and has been used to identify site-specific mitigation measures, which are discussed in Section 8.1.1 and set out in Appendix C.

Table 6.3: Summary of Effects Without Mitigation

Source	Dust Soiling	PM_{10} Effect
Demolition	Low	Low
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Negligible	Negligible

7 Operational Impacts

7.1 NO_2 Concentrations

Annual mean NO_2 concentrations, predicted at the selected receptor locations, are presented below in Tables 7.1.

Table 7.1: Predicted Annual Mean NO_2 Concentrations ($\mu g/m^3$)

Receptor	2023 Base	2023 Base + committed	2023 Base + committed + Proposed Development	Change due to Proposed Development as a % of AQAL	Significance of Impact
1	30.1	30.1	30.2	0	Negligible
2	28.8	28.8	28.8	0	Negligible
3	26.8	26.8	26.8	0	Negligible
4	23.0	23.0	23.0	0	Negligible
5	22.6	22.7	22.8	0	Negligible
6	22.0	22.1	22.3	0	Negligible
7	22.5	22.6	22.8	0	Negligible
8	20.8	20.8	20.9	0	Negligible
9	23.1	23.2	23.3	0	Negligible
10	24.2	24.2	24.4	0	Negligible
11	26.8	26.8	27.0	0	Negligible
12	31.7	31.8	32.1	1	Negligible
13	28.3	28.4	28.6	0	Negligible
14	33.4	33.5	33.8	1	Negligible
15	37.2	37.4	37.7	1	Minor adverse
16	26.9	26.9	27.0	0	Negligible
17	41.4	41.5	41.8	0	Negligible
18	32.9	33.0	33.2	0	Negligible
19	43.7	43.8	44.1	1	Moderate adverse
20	42.1	42.2	42.4	0	Negligible

The modelling assessment is predicting annual mean NO_2 concentrations below the annual mean objective of 40 µg/m^3 (AQAL) at all the selected receptor locations with the exception of 17, 19 and 20. All three are located on East Wonford Hill within the AQMA.

With predicted annual mean concentrations being less than 60 µg/m^3, it is expected that the hourly objective of 200 µg/m^3 is being be met at all the selected receptor locations.

The maximum increase in NO_2 concentrations as a result of the operational development is predicted to be 0.4 µg/m^3. This equates to a change equivalent to 1% of the AQAL and is predicted at receptor 15. Based on the criteria set out in Table 4.11, the impact of the operational development is classed as **negligible** at this location due to annual mean concentration predicted to remain at 95% of the AQAL.

A change of 1% of the AQAL is also predicted at receptors 12, 14 and 19. The impact is classed as **negligible** at receptors 12 and 14 due to concentrations remaining at less than 94% of the AQAL. However, the operational development is deemed to be causing a **moderate adverse** impact at receptor 19 due to concentrations exceeding the annual mean objective at this location.

Receptor 19 represents exposure at a number of residential facades along East Wonford Hill therefore the operational development is predicted to result in a **moderate adverse** impact at up to 10 properties.

At all other locations the impact of the development would be negligible on NO_2 concentrations.

7.2 PM_{10} Concentrations

Predicted annual mean PM_{10} concentrations at the receptor locations are presented below in Table 7.2.

The ADMS model is predicting annual mean PM_{10} concentrations at less than 50% of the AQAL of 40 µg/m^3 at all 20 receptor locations under all three assessment scenarios.

The ADMS model is predicting a maximum change in annual mean PM_{10} concentrations of 0.1 µg/m^3 as a result of traffic generated by the operational development. This equates to less than 1% of the AQAL and is classed as a **negligible** impact.

The maximum number of days >50 µg/m^3 PM_{10} has been predicted using the methodology set out in section 4.2.1. Based on the predicted annual mean concentrations the number of exceedences of the 24-hour objective is predicted to be no more than 2-3 at the selected receptors with no change as a result of the operational development. The impact on short-term PM_{10} concentrations would also be **negligible**.

Table 7.2: Predicted Annual Mean PM_{10} Concentrations (µg/m³)					
Receptor	2023 Base	2023 Base + committed	2023 Base + committed + Proposed Development	Change due to Proposed Development as a % of AQAL	Significance of Impact
1	17.9	17.9	17.9	0	Negligible
2	17.5	17.5	17.5	0	Negligible
3	16.9	16.9	16.9	0	Negligible
4	15.8	15.8	15.8	0	Negligible
5	15.5	15.5	15.5	0	Negligible
6	15.5	15.5	15.5	0	Negligible
7	15.6	15.6	15.6	0	Negligible
8	15.2	15.2	15.2	0	Negligible
9	15.8	15.8	15.8	0	Negligible
10	16.0	16.0	16.0	0	Negligible
11	15.6	15.7	15.7	0	Negligible
12	16.3	16.3	16.3	0	Negligible
13	15.8	15.9	15.9	0	Negligible
14	16.6	16.6	16.6	0	Negligible
15	17.2	17.2	17.2	0	Negligible
16	15.8	15..8	15..8	0	Negligible
17	18.3	18.3	18.3	0	Negligible
18	16.8	16.8	16.8	0	Negligible
19	18.7	18.7	18.7	0	Negligible
20	18.4	18.4	18.4	0	Negligible

7.3 Cumulative Impacts

The modelling assessment is predicting an increase in annual mean NO_2 concentrations of up to 0.5 µg/m³ as a result of the committed developments and the proposed development. This equates to 1% of the AQAL. Based on the criteria set out within Table 4.11 the cumulative impact of all developments is classed as being **moderate adverse** at receptors 17, 19 and 20, within the AQMA and minor adverse at receptor 15. At all other locations the cumulative impact would be **negligible**.

With regards PM_{10} the cumulative impact would be **negligible**.

8 Mitigation Measures

8.1 Construction Phase

The control of dust emissions from construction site activities relies upon management provisions and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

A medium risk of impacts is predicted at adjacent receptors during construction of the proposed retail units. The developer should therefore implement appropriate dust and pollution control measures as set out within the IAQM guidance. A summary of these measures is set out in Appendix C. The proposed measures should be set out within a DMP and approved by ECC prior to commencement of any work on site.

Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the proposed development would be negligible.

8.2 Operational Phase

The modelling assessment has predicted an overall **moderate adverse** impact on air quality within the Exeter AQMA. In terms of mitigation the development would implement a Travel Plan (TP) aimed at reducing the number of car trips associated with the development by promoting more sustainable modes of transport such as walking, cycling and public transport.

The TP would be executed through an appointed Travel Plan Coordinator and would implement the following measures:

- Encourage cycling and walking to and from the site by employees and customers by:
  - ensuring internal layout of site facilitates connections to the site boundary for cyclists and pedestrians;
  - Provision of pedestrian links to existing footways on Moor Lane and avocet Road,
  - provision of cycle parking which complies with requirements of ECC. The cycle parking will be provided close to entrances of the retail units in well overlooked positions and include facilities to allow bikes to be securely locked;
  - provision of travel information on safe pedestrian and cycle routes;
  - provision of advice on cycle safety;
  - encourage the development of a bicycle user group.
- Encourage the use of public transport by provision of information on public transport services and encouraging participation in national events such as 'in Town without my Car Day'. This information will be provided for all employees directly or on information boards and for visitors on the development website. Employees will also be encouraged to adopt flexible working practices to allow the working day to be organised around public transport timetables.
- Encourage lift-sharing to reduce single occupancy of cars through promotion of the www.devon.liftshare.com website and through information sharing coordinated by the travel plan coordinators in relation to individuals with similar work patterns;
- Provision of information to all employees on eco-driving to encourage smarter and more fuel-efficient driving

Additional mitigation in the form of electric vehicle charging points will also be included within the car park area of the Site. This will encourage the use of more sustainable transport methods.

Following implementation of the measure set out above, the resulting reduction in vehicles on the road network are expected to be sufficient to reduce the impact of the operational scheme to **negligible** along East Wonford Hill and within the AQMA.

8.3 Residual Effects

8.3.1 Construction Phase

The greatest potential for dust nuisance problems to occur would generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

By following the mitigation measures outlined within this appraisal the impact would be substantially minimised and residual impacts are unlikely to be significant.

8.3.2 Operational Phase

The operational phase of the development is predicted to result in a negligible impact on local air following implementation of measures set out within the TP.

9 Conclusion

Kairus Ltd was commissioned by Richard Walker Developments Ltd to carry out an air quality assessment in connection with the proposed development of the WPD site off Moor Lane, to provide a number of retail units.

It is inevitable that with any development construction activities would cause some disturbance to those nearby and the assessment has predicted a medium risk of effects prior to the implementation of any on-site mitigation. However, following the implementation of appropriate mitigation measures, which would be set out within a DMP, impacts associated with the construction of the development are likely to be insignificant.

The ADMS dispersion model has been used to predict the impact of the operational development on local NO_2 and PM_{10} concentrations.

The assessment has predicted an overall **moderate adverse** impact on NO_2 but a **negligible** impact on PM_{10} concentrations as a result of traffic generated by the operational development. The cumulative impact of the proposed development in conjunction with other committed developments would also be moderate adverse on NO_2 concentrations.

In terms of mitigation the development would implement a Travel Plan (TP) aimed at reducing the number of car trips associated with the development by promoting more sustainable modes of transport such as walking, cycling and public transport. In additional a number of electric vehicle charging points would be incorporated within the car park area of the Site. Following implementation of these measures, the resulting reduction in vehicles on the road network are expected to be sufficient to reduce the impact of the operational scheme to **negligible** along East Wonford Road and within the AQMA.

Appendix A – Air Quality Terminology

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedence	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
μgm^{-3} micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B – Verification and Adjustment of Modelled Concentrations

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions.

Verification of concentrations predicted by the ADMS model has followed the methodology presented in LAQM.TG(16).

Verification of the model results has been carried out against the Honiton Road and East Wonford Hill monitoring sites.

The model output of road-NO_x (i.e. the component of total NO_x coming from road traffic) has been compared with the 'measured' road-NO_x (Table B1 and Figure B1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the DEFRA NO_x from NO_2 calculator available on the UK-AIR website.

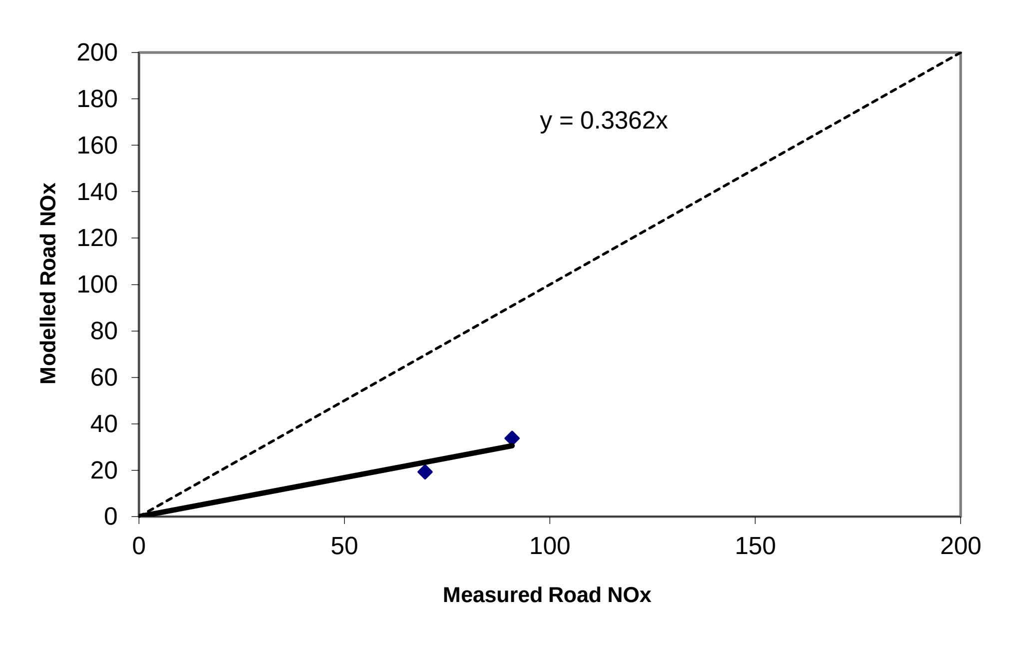

Figure B1: Comparison of Modelled Road NO_x with Measured Road NO_x

Figure B1 shows that the ADMS model is under-predicted the road-NO_x concentrations at the monitoring sites. An adjustment factor has therefore been determined as the ratio between the measured road-NO_x contribution and the modelled road-NO_x contribution, forced through zero (1/0.3362 =2.97). Further details on how this factor has been derived are set out in Table B2. This factor has been applied to the modelled road-NO_x concentration for each location to provide an adjusted modelled road-NO_x concentration.

The annual mean road-NO_2 concentration was determined using the DEFRA NO_x:NO_2 spread sheet calculation tool and added to the background NO_2 concentration to produce a total adjusted NO_2 concentration (Table B3).

Figure B2 shows the adjusted modelled total NO_2 vs monitored NO_2. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO_2, was calculated (1/0.9912=0.9912).

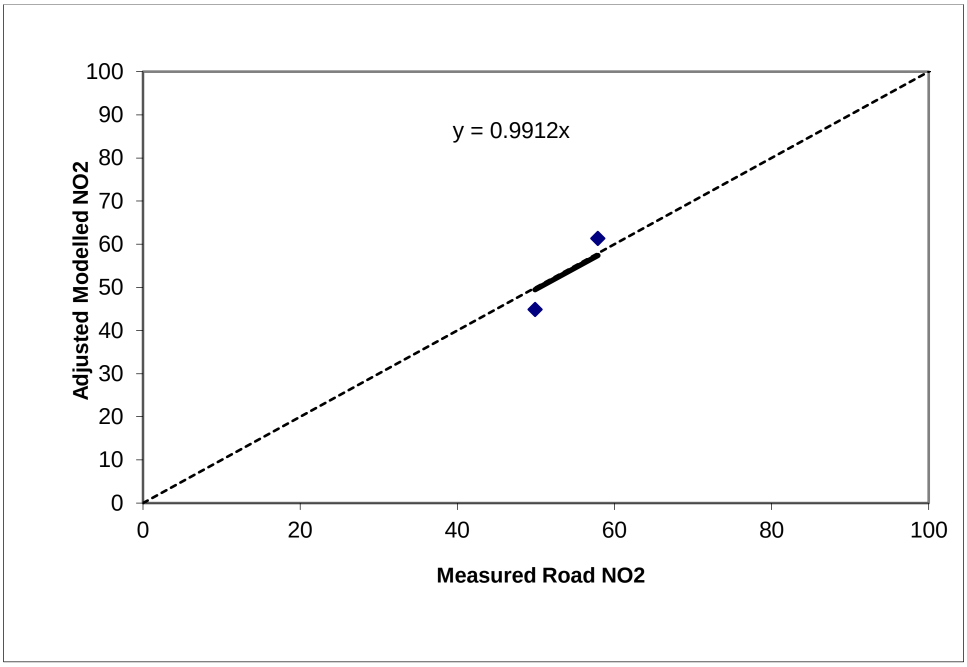

Figure B2: Comparison of Modelled NO_2 with Measured NO_x

After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO_2. The final adjustment modelled values are shown in Figure B3.

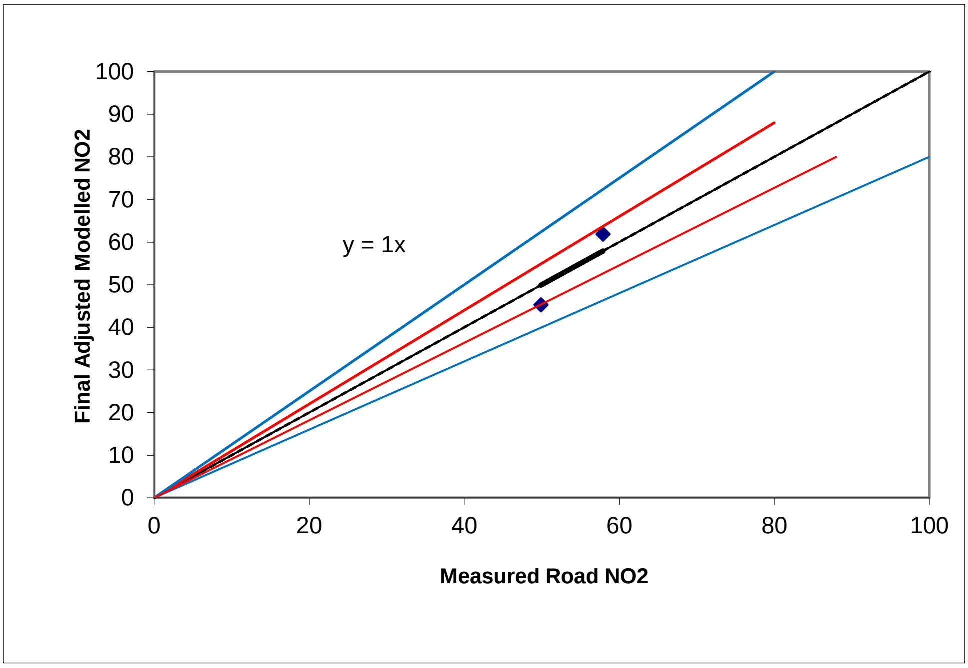

Figure B3: Comparison of Adjusted Modelled NO_2 with Measured NO_x

The adjustment factor of 2.97 has been applied to the modelled NO_x-road concentrations predicted at the selected receptor locations. The predicted NO_2-road concentrations, calculated using the NO_x-NO_2 converter tool, have subsequently been added to background NO_2 and adjusted by 1.009 to provide the final predicted annual mean NO_2 concentrations at each receptor.

These factors have also been used to adjust the predicted PM_{10} and $PM_{2.5}$ concentrations.

Table B1: Comparison of modelled and monitored NO2 Concentrations

Receptor name	X(m)	Y(m)	Monitored total NO_2	Modelled Total NO_2	% Difference ((modelled-monitored)/monitored) x100
Honiton Road	295202	92377	49.9	27.9	-44.1
East Wonford Hill	294409	92309	57.9	34.8	-40.0

Table B2: Model Adjustment Calculation (based on LAQM. TG(16) Guidance) Part 1

Receptor name	Monitored total NO_2	Monitored Total NO_x	Background NO_2 (2016)	Background NO_x (2016)	Monitored Rd contribution NO_2	Monitored Rd contribution NO_x	Modelled Rd Contribution NO_x (excludes bkgd)
Honiton Road	49.9	89.6	18.1	20.0	31.8	69.6	19.2
East Wonford Hill	57.9	90.8	18.1	20.0	39.8	90.8	33.8

Table B3: Model Adjustment Calculation (based on LAQM. TG(16) Guidance) Part 2

Receptor name	ratio of monitored road contribution NO_x /modelled road contribution NO_x	Adjustment factor for Rd Contribution (1/average ratio calculated in column L)	adjusted modelled Rd contribution NO_x	Adjusted total NO_x	Adjusted Total NO_2	1/(Ratio of monitored NO_2/adjusted modelled NO_2)	Final Adjusted Total NO2	% difference [(modelled-monitored)/monitored]x100
Honiton Road	0.3362	2.94	57.1	77.1	26.8	1.009	45.3	-9.3
East Wonford Hill			100.4	100.4	43.2		61.9	6.9

Appendix C – Construction Mitigation Measures

It is recommended that the 'highly recommended' measures set out below are incorporated into a DMP and approved by ECC prior to commencement of any work on site:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site;
- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to ECC when asked;
- fully enclose site or specific operations where there is a high potential for dust production and the activities are being undertaken for an extensive period;
- 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 being re-used on site, cover as detailed below;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles;
- avoid site runoff of water or mud;
- cover, seed or fence stockpiles to prevent wind whipping;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- avoid 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;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the site are covered to prevent the escape of materials 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).

- ensure all vehicles switch off engines when stationary - no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- 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 site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- avoid bonfires and burning of waste materials;
- ensure effective water suppression is used during demolition operations;
- avoid explosive blasting, using appropriate manual and mechanical alternatives;
- bag and remove any biological debris or damp down such material before demolition.

The following 'desirable' measures should also be considered for inclusion within the DMP:

- impose and signpost a maximum speed limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas;
- soft strip inside buildings before demolition;
- revegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as is practicable;
- use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil as soon as is practicable;
- only remove the cover in small areas during work and not all at once;
- avoid scabbling;
- ensure bulk cement and other fine powders are delivered in closed tankers and stored in silos;
- for smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately.