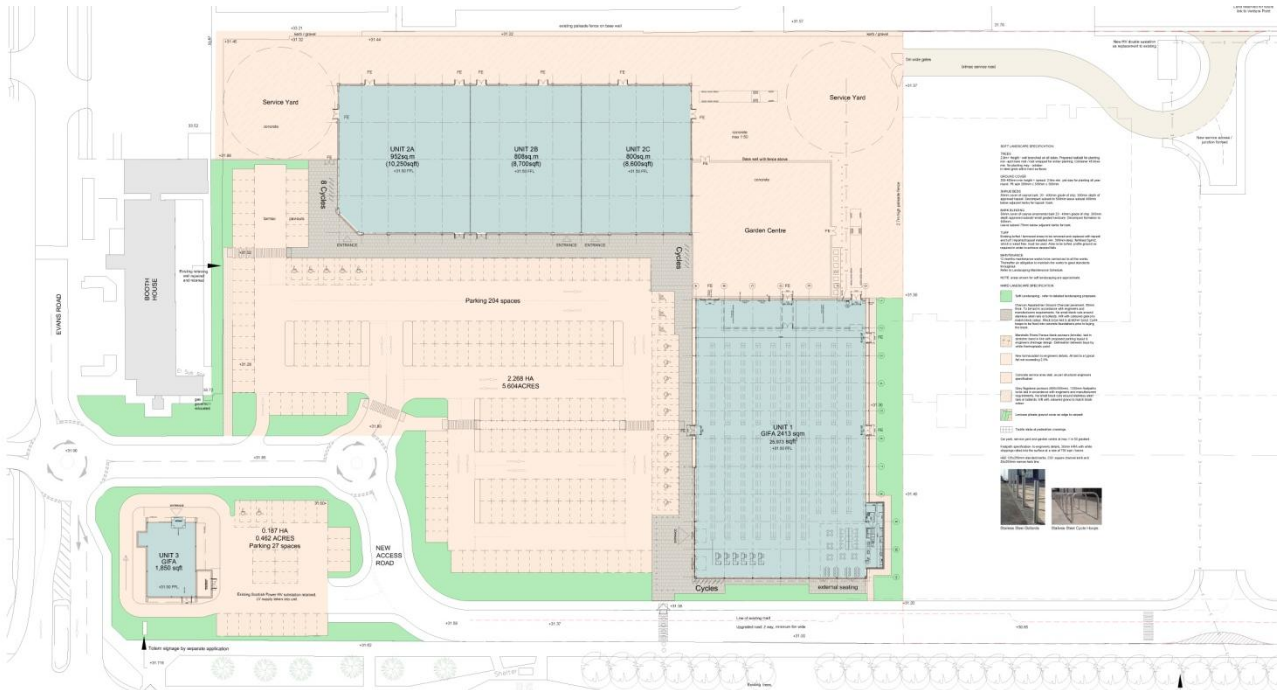
Air Quality Assessment



Former Rayware Site, Speke, Liverpool

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1 Introduction

1.1 Introduction

Encon Associates were commissioned by Quod to carry out an air quality assessment in connection with the redevelopment of the Former Rayware Site located on Speke Boulevard, Liverpool (the 'Site').

The Site falls within the city of Liverpool. Liverpool City Council (LCC) has declared a city wide Air Quality Management Area (AQMA) due to exceedence of the annual mean nitrogen dioxide (NO_2) objective limit. Traffic generated by the operational development therefore has the potential to impact air quality within an AQMA and air quality is therefore a high priority within the planning process.

This report assesses air quality impacts associated with the proposed development. 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.

1.2 Scope of the Assessment

The proposed development would replace the existing buildings and airport car parking with new retail and commercial units. The assessment has therefore focused on impacts associated with traffic generated by the proposed development and the impact on air quality at nearby sensitive receptors. The development would not introduce sensitive receptors to the Site therefore air quality at the Site has not been assessed.

Impacts associated with the construction phase of the development have also been considered.

The scope of the assessment has been discussed and agreed with the air quality officer (Paul Farrell) at LCC.

2 Site Description

2.1 The Existing Site

The Site is located on the south-eastern side of Liverpool in the area of Speke. The Site is currently occupied by two large unused warehouse buildings and a surface level car parking area currently used as airport parking.

The Site is bounded to the south by Speke Boulevard, to the east by Pharmacy Road, to the north by industrial and commercial premises and to the west by a commercial building with Evans Road beyond. To the south of Speke Boulevard is a residential area with the nearest residential properties being approximately 60 m from the southern boundary of the Site, although the majority are over 100 m. To the east, north and west the main land-uses are industrial and commercial.

The location of the Site is presented in Figure 2.1.

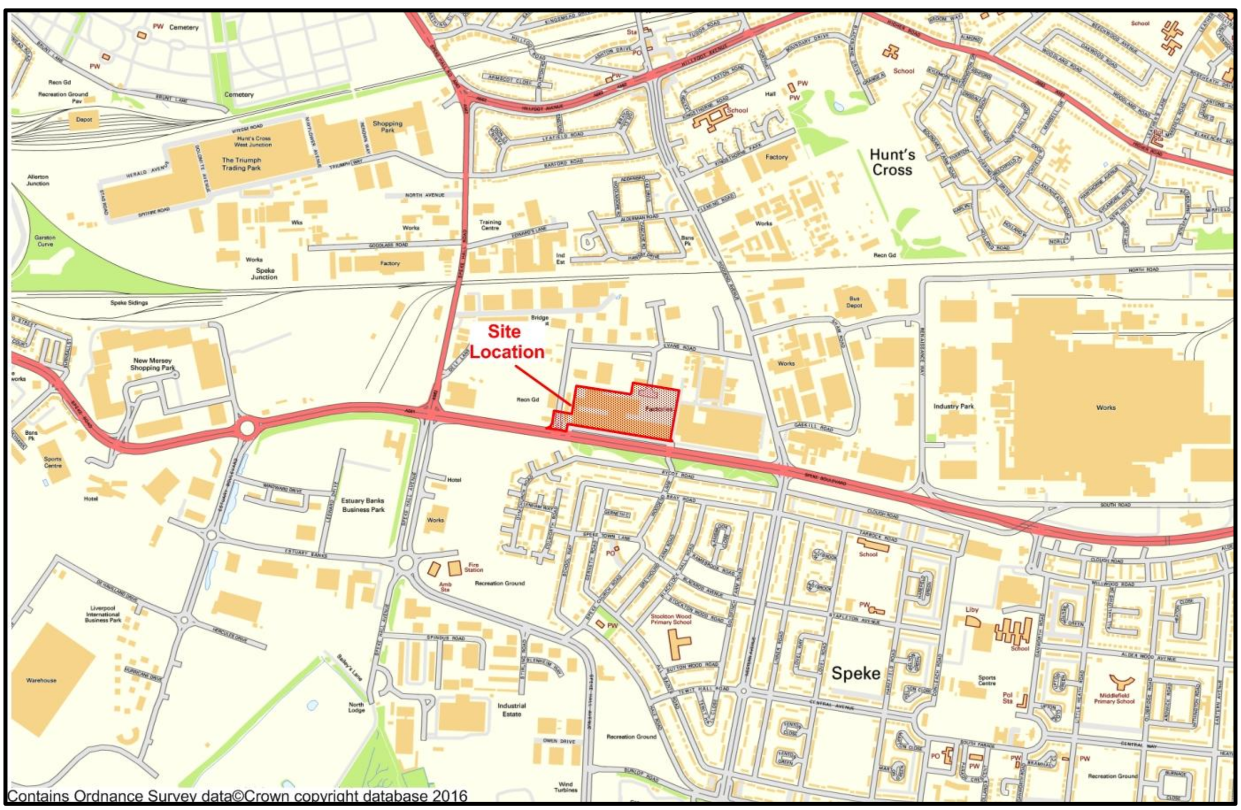

Figure 2.1: Location of proposed development site

2.2 Proposed Development

It is proposed to submit a Hybrid planning application for comprehensive retail-led regeneration comprising; demolition of existing buildings and cessation of temporary airport car parking use; full planning application for erection of 1 no. flagship retail unit (Class A1) for Home Bargains (Class A1 non-food retail use with 30% ancillary food and drink for consumption off the premises and ancillary customer café) with associated external garden centre, 1 no. building for Class A1 retail use, and 1 no. leisure/café/restaurant unit for class A3 or class D2 uses along with access and servicing arrangements, car parking, landscaping and associated highway works; outline planning application for up to 9,000 square metres of employment uses (classes B1(c), B2 and B8) including details of access with all other matters reserved.

The proposed layout of the Site is presented in Figure 2.2 below.

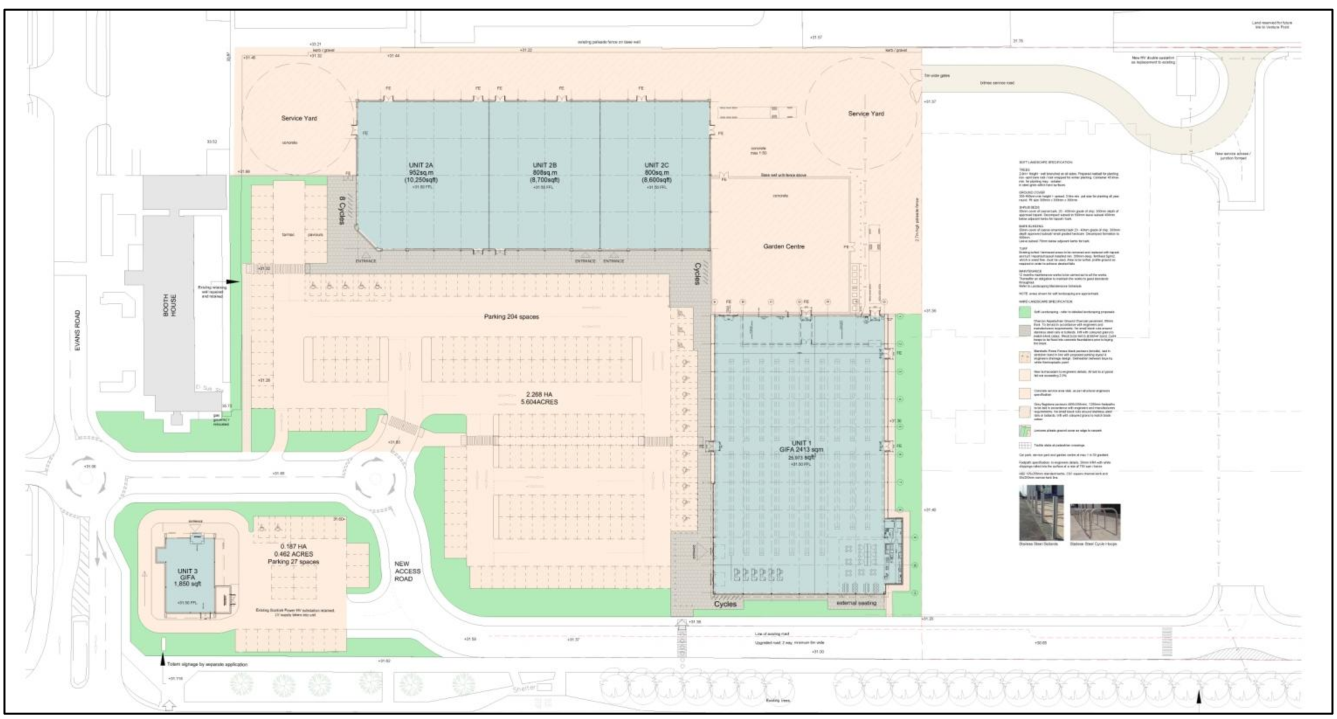

Figure 2.2: Layout of Proposed Development

3 Policy Context

3.1 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 NO_2 and PM_{10}, to be achieved by 1st January 2010 and 2005 respectively. 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, including within Liverpool.

3.2 National Legislation and Policy

3.2.1 Local Air Quality Management

Part IV of the Environment Act 1995[3], requires the UK Government to publish an Air Quality Strategy and local authorities to review, assess and manage air quality within their areas. This is known as Local Air Quality Management (LAQM). The 2007 Air Quality Strategy[4] establishes the policy for ambient air quality in the UK. It includes the National Air Quality Objectives (NAQOs) for the protection of human health and vegetation for 11 pollutants. Those NAQOs included as part of LAQM are prescribed in the Air Quality (England) Regulations 2000[5] and the Air Quality (Amendment) (England) Regulations 2002[6] . Table 3.1 presents the NAQOs for NO_2 and PM_{10}, the two key pollutants emitted from traffic.

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[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] Secretary of State The Environment Act 1995 part IV Air Quality HMSO
[4] Department for Environment, Food and Rural Affairs, July 2007, Air Quality Strategy for England, Scotland, Wales and Northern Ireland
[5] The Air Quality (England) Regulations 2000 (SI 2000 No. 928)
[6] The Air Quality (England) (Amendment) Regulations 2002 (SI 2002 No. 3043)

The Air Quality Strategy also introduced a new policy framework for tackling fine particles ($PM_{2.5}$) including an exposure reduction target. This pollutant is not included within LAQM however, the recently published air quality guidance by Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM)[7] recommends assessing impacts on local $PM_{2.5}$ instead of PM_{10} providing a more conservative approach to an assessment. The NAQO for $PM_{2.5}$ is also included in Table 3.1.

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 µg/m^3 not to be exceeded more than 18 times per year	1 hour mean	31 December 2005
	40 µg/m^3	Annual mean	31 December 2005
Particulate Matter (PM_{10})	50 µg/m^3 not to be exceeded more than 35 times per year	24 hour mean	31 December 2004
	40 µg/m^3	Annual mean	31 December 2004
Particulate Matter ($PM_{2.5}$)	25 µg/m^3	Annual mean	2020

The NAQOs 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(09))[8] issued by the Defra for Local Authorities, on where the NAQOs 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).

It should be noted that the EU Limit Values are numerically the same as the NAQO values but differ in terms of compliance dates, locations where they apply and legal responsibility. The compliance date for the NO_2 Limit Values is 1 January 2010, which is five years later than the date for the NAQO.

[7] EPUK & IAQM (2015) Land-use Planning & Development Control: Planning for Air Quality
[8] Defra (2009) Local Air Quality Management. Technical Guidance LAQM.TG(09)

The Limit Values are mandatory, whereas the NAQOs are policy objectives. Local authorities are not required to achieve them, but have to work towards their achievement. In addition, the limit Values apply in all locations except where members of the public do not have access and there is no fixed habitation, on factory premises or at industrial installations, and on the carriageway/central reservation of roads except where there is normally pedestrian access.

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, libraries etc. Building facades of offices or other places of work where members of the public do not have regular access. 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. 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.

3.2.2 National Planning Policy Framework

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.

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 applications 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'*.

[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

3.3 Local Policy

3.3.1 Liverpool Unitary Development Plan

The Liverpool Unitary Development Plan (UDP)[11], was adopted in December 2014 and sets out the polices to control development within the City. LCC is currently developing a new Local Plan for the City, however until such time as this is adopted the polices within the UDP will continue to be sued in making planning decisions.

Under chapter 13.6 the UDP asserts that '*recent environmental improvements should not be jeopardised by allowing new development which is likely to cause unacceptable pollution'*, indicating that this can be achieved by *'ensuring new development does not generate significant pollution and reduces pollution where possible'* and stating that *'new development should not take place where there is an unacceptable risk from existing pollution'*.

Policy EP11 deals specifically with pollution setting out the following in relation to air quality:

- *Planning permission will not be granted for development which has the potential to create unacceptable air pollution;*
- *Where existing uses adversely affect the environment through soot, grit, smoke, fumes or smell the City Council will:*
    - *Seek to reduce the problem on site;*
    - *Refuse planning permission for development which would result in a consolidation or expansion of uses giving rise to environmental problems;*
    - *Impose appropriate conditions on any permission which may be granted and/or legal agreements in relation to such a permission, in order to regulate uses;*
    - *Take enforcement action where appropriate; and*

[11] Liverpool City Council (2002) A Plan For Liverpool, Written Statement, Liverpool Unitary Development Plan

- *In appropriate circumstances, compulsorily acquire the premises whilst endeavouring to assist in the relocation of the firm, where resources permit.*

- *In the case of new development close to existing uses which are authorised or licensed under pollution control legislation and which are a potential nuisance to the proposed development, planning permission will not be granted unless the City Council is satisfied that sufficient measures can and will be taken to protect amenity and environmental health.*

3.3.2 Local Air Quality Management

Where a local authority's review and assessment of its air quality identifies that air quality is likely to exceed the NAQOs, it must designate these areas as Air Quality Management Areas (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out measures to reduce pollutant concentrations with the aim of meeting the NAQOs.

LCC has declared a city wide AQMA due to exceedences of the annual mean NO_2 objective. The Site therefore falls within the AQMA and based on local monitoring NO_2 concentrations in the vicinity are expected to exceed the NO_2 objective.

Where a local authority designates an AQMA they are required to produce an Air Quality Action Plan setting out actions that will be implemented to reduce air quality levels within the AQMA and work towards achieving the relevant air quality objectives. LCC produced an updated AQAP[12] in 2011 to cover the amended city wide AQMA which sets the measures the Council will take to reduce NO_x emissions within the city.

[12] AEA Technology (2011) Liverpool City Council Air Quality Action Plan for the City-Wide AQMA, January 2011

The primary focus of the plan is the reduction of emissions from buses with measures such as the enforcement of bus lanes, setting strict guidelines covering busses operated on certain bus routes and improving bus lane infrastructure. Other measures within the plan relate to tackling congestion, increasing sustainable travel and providing better and more easily accessible information on air quality to the public to increase awareness.

4 Baseline Assessment

4.1 Air Quality Monitoring

LCC have three automatic monitoring sites within the city, a background site at Speke which monitors NO_2, PM_{10} and $PM_{2.5}$ concentrations and two roadside sites which record NO_2 concentrations. The Speke site is operated by DEFRA and forms part of the UK wide Automatic Urban and Rural Network (AURN). The two automatic roadside sites are over 8 km from the Site in the centre of the City. As there are other sites in closer proximity monitoring NO_2 concentrations, data from these two automatic sites are not consider relevant to this assessment and have not been included within the baseline.

NO_2 concentrations are also measured at a number of locations across the City using diffusion tubes. These 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 factors calculated from a co-location site where both diffusion tubes and an automatic monitor are located in the same location.

To assess baseline NO_2 concentrations in the vicinity of the Site data has been taken from the Speke background site and a number of diffusion tube sites in the area. The data is provided in Table 4.1 below. The diffusion tube data has been adjusted by LCC using a bias adjustment factor obtained from triplicate tubes located at the automatic sites within the City. For 2014 a factor of 1.07 was applied.

The locations of the sites are shown in Figure 4.1.

Table 4.1: Annual Average NO_2 Concentrations Measured in the Vicinity of the Site (μgm^{-3})

Site	Classification	Distance to kerb of nearest rd (m)	Year			
			2011	2012	2013	2014
Speke - AURN	Background	5 (minor road)	24	25	23	24.7
SP54 Hillfoot Road/Allerton Road	Roadside	2	44	55	58	56
SP55 Speke Road Dual Pelican	Roadside	2	60	72	71[1]	63
Speke DEFRA Site (triplicate Diffusion tubes)	Background	5 (minor road)	25	26	26[1]	26
[1] data capture was less than 90% therefore comparison against the annual mean should be treated with caution.						

The monitoring data shows exceedence of the annual mean objective limit at the two roadside locations. Concentrations at both locations have been above the objective since 2011. The highest concentrations are being recorded at SP55 adjacent to Speke Road. The site is at the roadside directly adjacent to a pelican crossing therefore emissions are likely to be elevated due to stop/start and queuing vehicles. The monitoring site on Hillfoot Road is located on the central reservation. Concentrations are also expected to be elevated in this location due to the site being located in the centre of the road.

The data is showing no overall trend in concentrations with concentrations increasing between 2011 and 2013 followed by a decline between 2013 and 2014.

Diffusion tubes cannot monitor short-term NO_2 concentrations, however, research[13] has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean

[13] 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).

concentrations do not exceed 60 µg/m^3. Annual mean NO_2 concentrations are below 60 µg/m^3 at monitoring site SP54 indicating that the 1-hour objective is likely to be met in this location. However, concentrations have been above 60 µg/m^3 all the site adjacent to Speke Road (SP55) over the last four years indicating a possible exceedence of the 1-hour objective.

As detailed above PM_{10} and $PM_{2.5}$ concentrations are only monitored at the Speke AURN site. Concentrations for both pollutants are set out in Table 4.2 below.

Concentrations of both pollutants are below the annual mean objectives at the Speke site. Both sites have recorded an overall decline in concentrations over the last five years.

Exceedence of the 24-hour PM_{10} objective has been recorded at the Speke site in recent years, however the objective allows for up to 35 exceedences of the 50 µg/m^3 limit in any given year therefore the objective is being met in this location.

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Table 4.2: PM_{10} and $PM_{2.5}$ Concentrations Measured in the Speke AURN Site (µgm^{-3})

Pollutant	Objective	Year				
		2011	2012	2013	2014	2015
PM_{10}	Annual Mean	16	13	14	14.5[1]	13.9
	Number of Exceedences of the 24-hour Mean	8	4	5	-	-
$PM_{2.5}$	Annual Mean	11.8	10.6	11.6	10.8[1]	9.1
[1] data capture is less than 90% therefore comparison against the annual mean objective should be treated with caution						

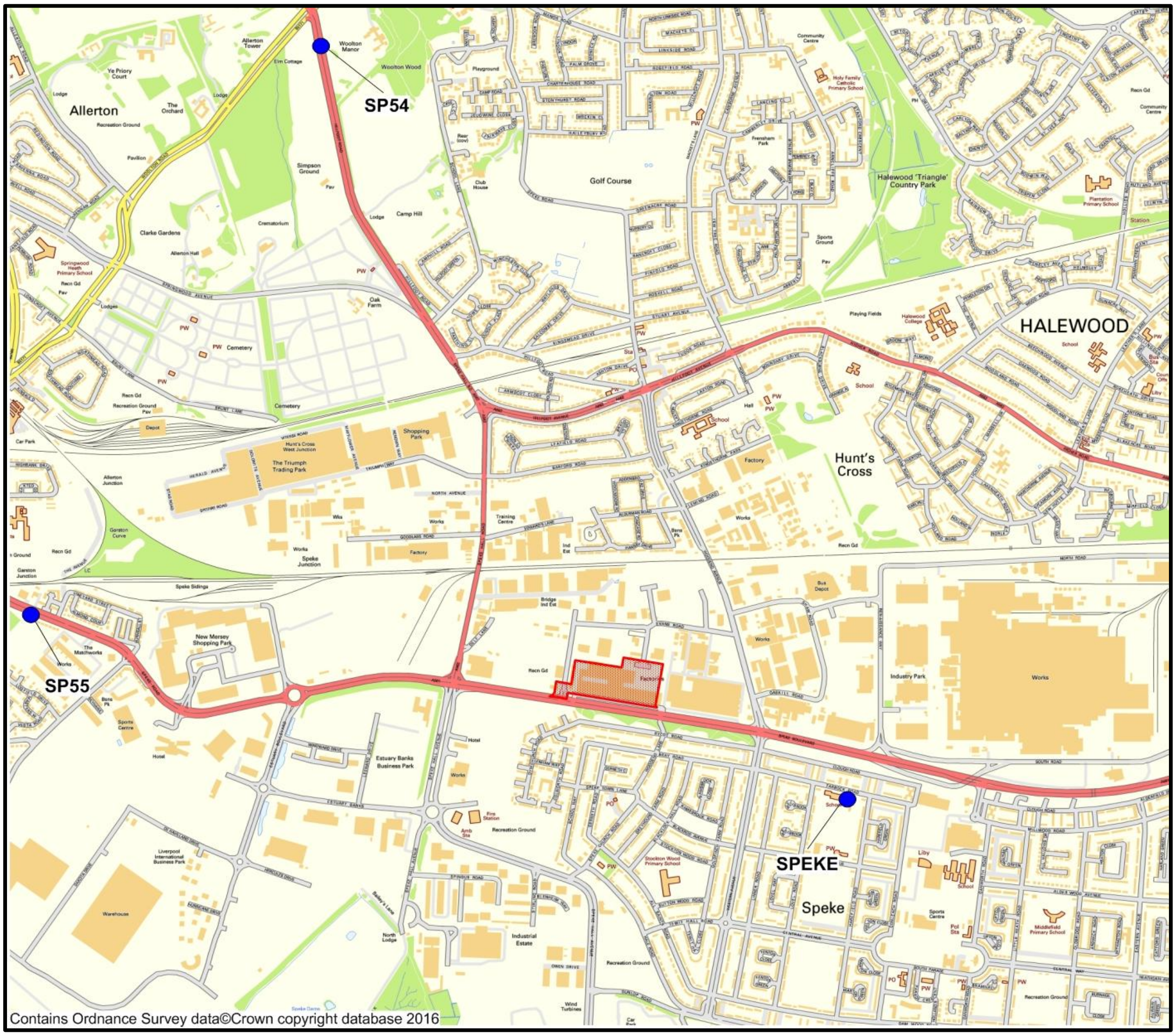

Figure 4.1: Location of Air Quality Monitoring Sites

4.2 Defra Background Maps

Additional information on estimated background pollutant concentrations has been obtained from the Defra background maps provided on the 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 2011 background pollution maps for the UK, which were published in 2014. These maps are available in 1 km x 1 km grid squares and provide an estimate of concentrations between 2011 and 2030. Concentrations have been taken from the following grid squares: 342500, 384500 for 2014 and 2019 (the anticipated year of completion) and are provided in Table 4.3.

The NO_x, PM_{10} and $PM_{2.5}$ background maps are provided not only as total concentrations but are also broken down into sector contributions (i.e. motorways and rail). However, as this assessment is considering air quality at the Site in relation to exposure of future occupants, background concentrations from all sources should be considered. Therefore data presented in Table 4.3 provides total background concentrations of both pollutants.

Table 4.3: Annual Mean Background Air Pollution Concentrations in 2014

Year	Annual mean concentrations (μgm^{-3})			
	Oxides of Nitrogen	Nitrogen dioxide	PM_{10}	$PM_{2.5}$
2014	30.8	18.5	15.6	10.6
2019	25.4	18.1	14.9	9.9

The data indicates that existing background concentrations are comfortably meeting the NO_2, PM_{10} and $PM_{2.5}$ objectives at the Site.

4.3 Air Quality at the Development Site

The monitoring data indicates that NO_2 concentrations are exceeding the annual mean objective at roadside locations adjacent to the A351 Speke Road. The monitoring site is located close to a pelican crossing where emissions will be higher due to stop/start and queuing vehicle. The Site is located adjacent to the A351 Speke Boulevard. Traffic flows along this section of the A351 are relatively free flowing compared to adjacent to monitoring site SP55, although the total flows are slightly higher and the HGV flows are also higher. NO_2 concentrations at roadside locations adjacent to Speke Boulevard are therefore expected to be similar to those recorded at SP55. However the southern boundary of the Site is 20 m from the roadside of Speke Boulevard. NO_2 concentrations are known to decline rapidly away from source therefore concentrations at the Site are expected to be significantly lower than at roadside locations. It is expected that concentrations are just above the objective along the southern boundary of the site but would fall to below the objective within a few meters remaining below the objective across the majority of the site.

Local monitoring of PM_{10} and $PM_{2.5}$ indicates concentrations of both pollutants at background locations to be less than 75% of the annual mean objectives of 40 µg/m^3 and 25 µg/m^3 respectively. Based on professional judgement it is consider unlikely that PM_{10} and $PM_{2.5}$ concentrations would increase sufficiently to breach the annual mean objectives at roadside locations along Speke Boulevard. Concentrations of both pollutants are therefore expected to meet the relevant objectives across the Site.

5 Construction Impacts

5.1 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 will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO_2 and PM_{10}.

It is anticipated that during the construction phase there would be no more than 25 heavy duty vehicles (HDV) accessing the Site in any given day. The recently published EPUK and IAQM air quality guidance 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 HGV movements per day within an AQMA and less than 100 per day elsewhere. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO_2 and PM concentrations and has not been considered any further in this assessment.

5.2 Construction Dust

5.2.1 Methodology

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) can travel up to 200 – 300m[14]. 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
- 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.

[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

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

Table 5.1: 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 pattern of use of the land. • E.g. dwellings, museums and other important collections, medium and long term car parks and car showrooms.	• 10 – 100 dwellings within 20 m of site. • Local PM_{10} concentrations close to the objective (e.g. annual mean 36 -40 $\mu g/m^3$). • 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).
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.	• Less than 10 receptors within 20 m. • Local PM_{10} concentrations below the objective (e.g. annual mean 30-36 $\mu g/m^3$). • 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.

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
	• E.g. parks and places of work.		
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 5.2 to 5.4 indicate the criteria used to determine the sensitivity of the area to dust soiling, human health and ecological impacts.

Table 5.2: 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 5.3: 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 μg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 μg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 μg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 μg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source (m)				
			<20	**<50**	**<100**	**<200**	**<350**
Medium	**-**	**>10**	High	Medium	Low	Low	Low
	-	**1-10**	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 5.4: 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

Defining 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 5.5 to 5.7 indicate the method used to assign the level of risk for each construction activity.

Table 5.5: 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 5.6: 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 5.7: 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

5.2.2 Significance Criteria

The assessment of construction effects identifies whether there is a low, medium or high risk of effects occurring at adjacent sensitive receptors as a result of dust and PM_{10} emissions emitted by specific construction activities. The mitigation strategy is defined based on the level of risk identified during the assessment process.

To allow the identified level of risk to be considered in terms of significance, the criteria set out in Table 5.8 have been used.

Table 5.8: Defining the Significance of Effects Associated with Construction Activities

Risk of Impact	Significance of Impact
High Risk	Major Adverse
Medium Risk	Moderate Adverse
Low Risk	Minor Adverse
Negligible	Negligible

5.3 Assessing the Risk of Dust Effects

5.3.1 Site and Surroundings

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

There are residential properties located to the south of the Site within 100 m of the Site boundary. An assessment of construction related impacts in relation to human receptors is therefore considered necessary.

Significant impacts on ecologically sensitive receptors are unlikely to occur beyond 50 m from any construction activities. A review of data held on the DEFRA MAGIC website[16] 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 4, PM_{10} concentrations are expected to meet the annual mean objective in the vicinity of the Site being less than 75% of the objective at the Speke background monitoring site. It is therefore expected, based on professional judgement, that concentrations at roadside locations are unlikely to be higher than 24 µg/m^3, making the surrounding area low in sensitivity to human health impacts.

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 Liverpool Meteorological Station for 2014 is provided below in Figure 5.1, which shows that the prevailing wind is from the north-west and south-east. Receptors located to the north-west and south-east are therefore most at risk of experiencing impacts. Land-uses and properties to

[16] http://magic.defra.gov.uk/

the north-west of the Site are a mix of industrial and commercial premises. These are not considered to be overly sensitive to dust impacts although places of work are considered to be of medium sensitivity. However, the residential area of Speke is located to the south-east. These receptors are considered sensitivity to dust effects. Based on the prevailing winds the properties located on Rycot Road are most at risk of experiencing impacts.

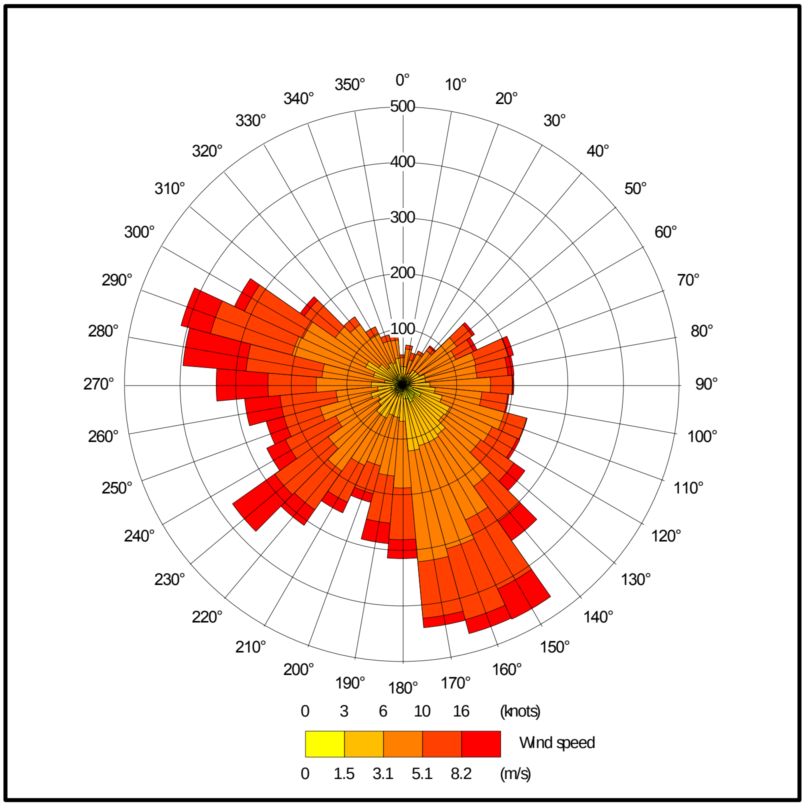

Figure 5.1: Windrose from Liverpool Meteorological Site (2013)

5.3.2 Risk Assessment of Dust Impacts

Defining the Dust Emission Magnitude

With reference to the criteria detailed in section 5.2, the dust emission magnitude for each of the categories demolition, earthworks, construction and trackout have been determined. These have been summarised in Table 5.9.

Table 5.9: Dust Emission Magnitude for each Activity

Activity	Criteria	Magnitude
Demolition	Building volume >50,000 m^3,construction material includes bricks and concrete, on-site crushing and screening likely.	Large
Earthworks	Site area > 10,000 m^3, >10 HDV on site, excavated material stored in bunds >8m	Large
Construction	Total build volume 25,000 – 100,000 m^2, concrete and brick construction materials, on site concrete batching	Medium
Trackout	10-150 HDV per day, unpaved roads of 50-100 m	Medium

Sensitivity of Surrounding Area

Using the criteria set out in Tables 5.2 and 5.3, the sensitivity of the surrounding area to impacts from dust emissions has been determined and are set out in Table 5.10.

Dust Soiling

The nearest residential receptors to the Site are approximately 60 m to the south on Bognor Close, with properties along Roycot Road approximately 100 m to the south. The sensitivity of residential receptors in the surrounding area in relation to dust soiling effects is therefore considered to be low. However, there are a number of ‘places of work’ adjacent to the Site with more than 1 within 20 m of the Site boundary. The overall sensitivity of the surrounding area is therefore classed as medium.

There will be <25 (>3.5t) movements per day during the construction phase which are expected to travel to and from the Site via Evans Road and along Speke Boulevard. 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 less than 3 sensitive receptors (residential properties) within 20 m of Speke Boulevard and less than 10 within 20 to 50 m of the Site entrance. The sensitivity of the area to dust soiling effects from trackout is therefore considered to be medium.

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 5.10: Sensitivity of Surrounding Area

Source	**Dust Soiling**	**Human health**
Demolition	Medium	Low
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Medium	Low

Defining the Risk of Impacts

The dust emission magnitude as set out in Table 5.9 is combined with the sensitivity of the area (Table 5.10) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures applied at site (Tables 5.5 to 5.6). The risk of impacts associated with each activity is provided in Table 5.11 below and has been used to identify site-specific mitigation measures, which are discussed in Section 5.4 and set out in Appendix A.

Table 5.11: Summary of Risk Effects to Define Site Specific Mitigation

Source	Dust Soiling	Human health
Demolition	High Risk	Low Risk
Earthworks	Medium Risk	Low Risk
Construction	Medium Risk	Low Risk
Trackout	Medium Risk	Low Risk

5.4 Determining Appropriate Mitigation

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.

An overall high risk of impacts is predicted at adjacent receptors during construction of the proposed development which equates to a major adverse impact. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Table 5.11. It is recommended that the 'highly recommended' measures set out in Appendix A are incorporated into a DMP and approved by LCC prior to commencement of any work on site.

The LAQM guidance recommends that where there is a medium/high risk of impacts at nearby residential receptors that monitoring of dust or PM_{10} is carried out throughout the construction period. The requirement for monitoring should be discussed and agreed with LCC and if required baseline monitoring should commence at least three months before construction work commences on site.

In addition to the ‘recommended’ measures, the IAQM guidance also sets out a number of ‘desirable’ measures which should also be considered for inclusion within the DMP. These are also set out in Appendix A.

Based on the risk effects identified during each of the four types of activities and following implementation of the recommended mitigation measures, the significance of residual impacts during construction of the proposed development will be **negligible.**

6 Operational Impacts

6.1 Operational Traffic Impacts

6.1.1 Prediction method and Approach

The prediction of local air quality has been undertaken using the ADMS Roads dispersion model. 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 Liverpool Meteorological Station for 2014 has been used for the assessment.

The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x), PM_{10} and $PM_{2.5}$. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the DEFRA air quality website (http://uk-air.defra.gov.uk).

Emissions Data

The assessment has predicted air quality during 2014 for verification and in 2019, the anticipated completion year. The emission factors released by DEFRA in July 2014, provided in the emissions factor toolkit EFT2014_6.0.2 and built into the ADMS model (Version 4.0.1.0, released in December 2015) have been used to predict existing and future traffic related emissions. These are the latest emission factors available.

Emission factors and background data used in the prediction of future air quality concentrations predict a gradual decline in pollution levels over time due to improved emissions from new vehicles and the gradual renewal of the vehicle fleet. However, recent monitoring carried out in urban areas throughout the UK have found that NO_2 concentrations are not declining as rapidly as previously thought and in some locations concentrations have increased. It is thought that this discrepancy is related to the on-road performance of modern diesel vehicles with emissions being higher than indicated during test drive cycles for the different vehicle euro classification. Although the emission factors released in the latest EFT go some way towards addressing this disparity it does not fully tackle the discrepancy. Air Quality Consultants Ltd (AQC) have recently undertaken research comparing the COPERT emissions data used within the EFT against on-road emissions of diesel vehicles for the different EURO categories for both LDV and HDV vehicles[17]. The research concluded that there was very little difference in emission emitted by the different vehicle categories prior to Euro 6 during on-road driving cycles compared to the emissions set out in COPERT. Furthermore, although there has been a significant improvement in emissions from Euro 6 vehicles compared to Euro 5, the emissions are still higher on-road than those used within the EFT. To address this discrepancy AQC have developed the CURED spreadsheet which provides more realistic NO_x emission factors by taking account of actual on-road emissions.

The modelling assessment has used the 2019 EFT emission factors to predict concentrations in the future year scenario. An additional sensitivity test has subsequently been undertaken for all three 2019 assessment scenarios using the NO_x emission factors generated within the CURED spreadsheet.

The ADMS model cannot predict short-term pollutant concentrations with any degree of accuracy. The LAQM.TG(09) guidance recommends calculating the number of exceedences of 50 µg/m^3 as a 24-hour mean PM_{10} concentration from the annual mean using the following formula:

A = -18.5 + 0.00145 x annual mean3 + (206/annual mean)

where A is the number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration.

[17] Air Quality Consultants, Emissions of Nitrogen Oxides from Modern Diesel Vehicles, January 2016

LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[18] has concluded that exceedences of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

Traffic Data

Traffic data for the road links in the vicinity of the Site have been provided by the Transport Consultants Iceni Projects. Base flows have been provided for 2014 and 2019. Traffic generated by the following committed developments have been added to the 2019 base flows to provide the future year committed development scenario:

- Venture Point – 13,530 m^2
- Former tea factory site – ref 12/02431
- Imagine Park – ref 11/F1890
- A2/A3 Development (currently part occupied by Toby Carvery) – ref 11/F1459

Full details of these developments are set out in the Transport Assessment (TA).

Traffic generated by the operational development has been added to the committed development flows to provide the future with development scenario.

The traffic data used within this assessment are provided in Table 6.1 below.

[18] 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).

Table 6.1: Traffic Data

Road	Speed (kph)	% HGV	2014 Base	2020 Base	2020 Base + Committed Development	2019 Base + Committed + Development
A561 Speke Road west of Cavalier Drive	35 (20 at pelican crossing and road junctions)	5.9	33901	35950	36163	36453
A561 Speke Road west of Speke Hall Rd	35	6.8	36344	38540	38754	39043
Speke Hall Road	35 (25 at junctions)	2.5	20702	21953	22341	23009
Evans Road	35	3.0	1782	1890	1902	4359
A561 Speke Road east of Evans Rd	35	9.2	36883	39111	39749	40815
Woodend Avenue	35 (25 at junctions)	2.4	14963	15867	15918	15918
A561 Speke Boulevard east of Woodend Ave	35	9.8	41350	43848	44444	45058
A562 Hillfoot Avenue	35 (20 at junctions)	2.0	19626	20812	20909	21076
A562 Hillfoot Road	25 (20 at junction)	1.7	20197	21417	21708	22210
B5171 Allerton Road	20	0.7	15496	16432	16626	16961

Receptors

Annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ have been predicted at a number of locations represented existing sensitive receptors, mainly residential facades. The receptor locations are shown in Figure 6.1 and the details provided in Table 6.2.

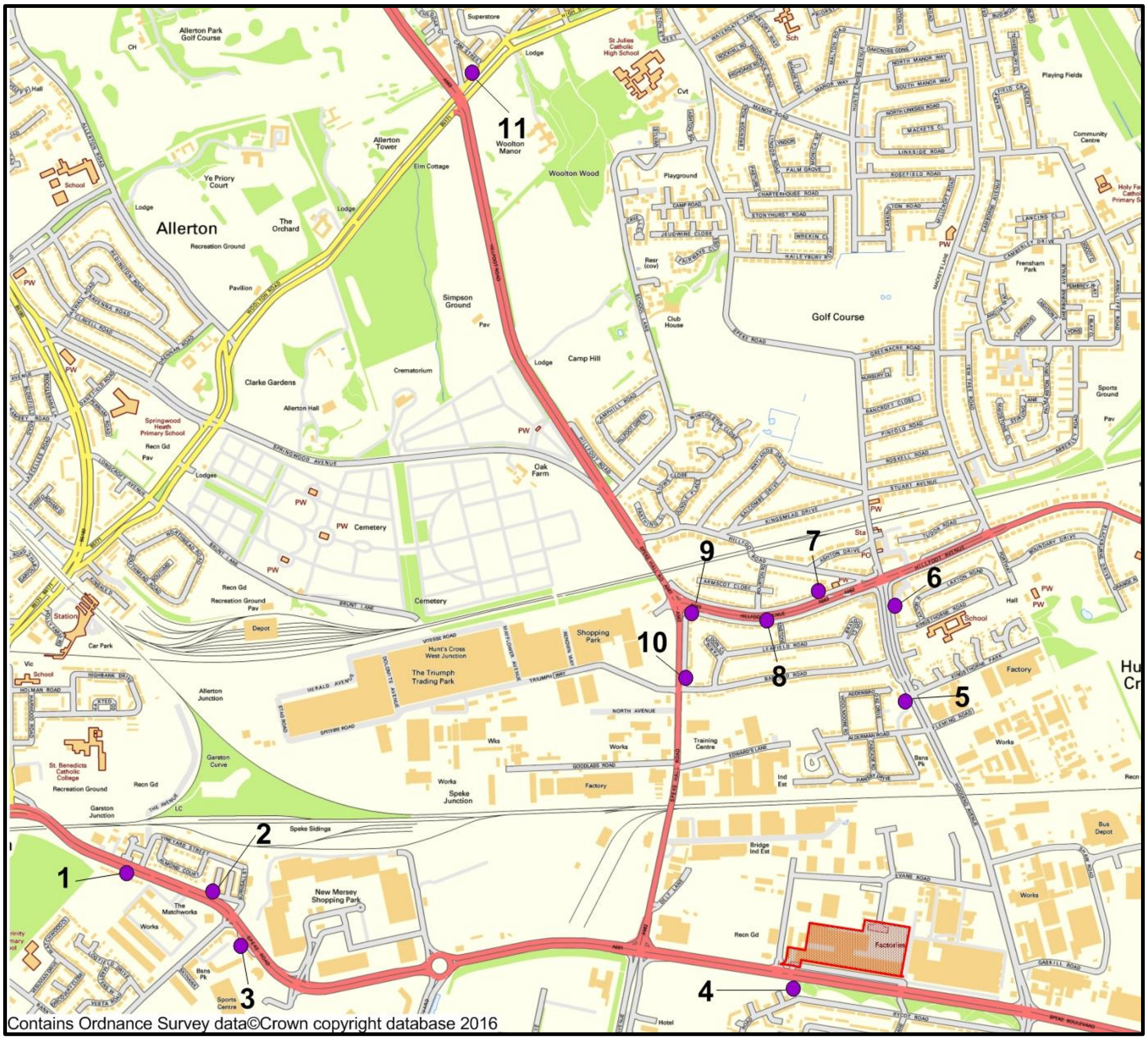

Figure 6.1: Receptor Locations

Table 6.2: Receptors Used in ADMS Model

Receptor Number	Location	OS Grid Reference
1	16B Speke Road	341099, 384217
2	57 Speke Road	341256, 384168
3	166 Speke Road	341349, 384021
4	2 Dymchurch Road	342888, 383907
5	38 Woodend Avenue	343190, 384719
6	15 Woodend Avenue	343171, 384977
7	73 Hillfoot Avenue	342958, 385004
8	36 Hillfoot Avenue	342832, 384919
9	4B Hillfoot Avenue	342611, 384934
10	45 Speke Hall Road	342594, 384784
11	145 Allerton Road	341898, 386458

Background Concentrations

The ADMS model predicts 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.

Background concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ for use in the modelling assessment have been taken from the Speke AURN background monitoring site. Details of the background data used within the modelling are provided in Section 4.2.

The 2014 background concentrations for each pollutant have been factored forward to 2019 using adjustment factors calculated between the 2014 and 2019 DEFRA data set out in Table 4.3. The resulting 2019 background concentrations used in the assessment are set out in Table 6.3 below.

As part of the research undertaken by AQC they investigated the DEFRA background maps. The future year DEFRA maps are based on similar emissions assumptions used to calculate the EFT data. AQC found that background concentrations within the DEFRA maps were under predicting future year concentrations and have developed a method to adjust the DEFRA data based on the results of their research. Their methodology refers specifically to the use of DEFRA data for background concentrations and suggests using their methodology to obtain more representative future year concentrations to use within the sensitivity test. However, this assessment has used data from the Speke AURN site, not data from the DEFRA background maps. There is a risk that the adjustment factors used to obtain 2019 background concentrations are too low as these are based on the DEFRA data. However, the resulting 2019 background concentrations are not substantially different to the 2014 monitored data therefore any further adjustment of the data is unlikely to make a significant difference and is considered unnecessary.

Table 6.3: Background Pollution Concentrations used in Modelling Assessment

Year	Annual mean concentrations (μgm^{-3})			
	Oxides of Nitrogen	**Nitrogen dioxide**	**PM_{10}**	**$PM_{2.5}$**
2014	37.2	24.7	14.5	10.8
2019	30.7	24.2	13.8	10.1

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(09) 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.

The model has been used to predict NO_2 concentrations at the two nearest diffusion tube sites SP54 (Hillfoot Road) and SP55 (Speke Road).

The results of the comparison are presented below in Table 6.4.

Table 6.4: Comparison of Modelled and Monitored Nitrogen Dioxide Concentrations (μgm^{-3})

Monitoring Location	Measured Concentrations	Modelled Concentrations	% Difference
S54	56.0	31.8	-43.2
S55	63.0	34.1	-45.9

The comparison of monitored and modelled concentrations indicates that the model is under-predicting concentrations at both monitoring sites by an average of 45 % compared to monitored concentrations. It is therefore considered necessary to adjust the model results to better represent local concentrations. The results of the modelling assessment have been adjusted using the methodology given in LAQM.TG(09). Full details of the verification and calculation of adjustment factors are provided in Appendix B.

Following application of the calculated adjustment factors the model results are showing no overall tendency to under or over predict at the monitoring locations and predicted concentrations are within 1% of monitored concentrations.

There is no suitable monitoring of PM_{10} or $PM_{2.5}$ data to allow verification of the PM model results. However, LAQM.TG(09) suggests applying the NO_x adjustment factor to modelled road-PM_{10} where no appropriate verification against PM_{10} data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} and $PM_{2.5}$ concentrations.

Significance of Impacts

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 6.4. 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 6.4 below.

Table 6.4: 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.

6.2 Assessment and Evaluation of Results

6.2.1 Results

NO_2 concentrations predicted at the selected receptor locations are provided in Tables 6.6 below. Concentrations predicted under the NO_x sensitivity test are set out in Table 6.7.

The predicted PM_{10} and $PM_{2.5}$ concentrations are set out in Tables 6.8 and 6.9.

Table 6.6: Predicted Annual Mean NO_2 Concentrations at Existing Receptors based on EFT Emission Factors (μgm^{-3})

Receptor	2014 Base	2019 Base	2019 Base + Committed	2019 Base + Committed + Proposed	Change in $PM_{2.5}$ due to Development (as % of the AQAL)	Significance of Impact
1	44.7	34.7	34.8	34.9	0	Negligible
2	59.9	43.2	43.3	43.4	0	Negligible
3	52.2	38.8	38.9	39.0	0	Negligible
4	41.6	35.1	35.2	35.4	1	Negligible
5	31.3	29.1	29.1	29.2	0	Negligible
6	34.7	31.5	31.6	31.6	0	Negligible
7	36.1	32.6	32.7	32.8	0	Negligible
8	32.8	30.2	30.3	30.4	0	Negligible
9	35.9	32.4	32.6	32.7	0	Negligible
10	35.0	31.7	31.8	32.0	0	Negligible
11	38.6	34.8	35.0	35.2	0	Negligible

Table 6.7: Sensitivity Test of Predicted Annual Mean NO_2 Concentrations based on CURED Emission Factors (μgm^{-3})

Receptor	2014 Base	2019 Base	2019 Base + Committed	2019 Base + Committed + Proposed	Change in $PM_{2.5}$ due to Development (as % of the AQAL)	Significance of Impact
1	44.7	37.5	37.7	37.7	0	Negligible
2	59.9	48.0	48.1	48.3	0	Negligible
3	52.2	42.8	42.9	43.0	0	Negligible
4	41.6	38.3	38.4	38.7	1	Minor Adverse
5	31.3	30.2	30.2	30.2	0	Negligible
6	34.7	33.1	33.1	33.1	0	Negligible
7	36.1	34.4	34.4	34.5	0	Negligible
8	32.8	31.5	31.5	31.6	0	Negligible
9	35.9	34.2	34.3	34.5	0	Negligible
10	35.0	33.3	33.4	33.6	1	Negligible
11	38.6	36.7	36.9	37.1	1	Negligible

Table 6.8: Predicted Annual Mean PM_{10} Concentrations at Existing Receptors (μgm^{-3})

Receptor	2014 Base	2019 Base	2019 Base + Committed	2019 Base + Committed + Proposed	Change in $PM_{2.5}$ due to Development (as % of the AQAL)	Significance of Impact
1	16.9	16.3	16.3	16.3	0	Negligible
2	19.5	18.3	18.3	18.4	0	Negligible
3	18.0	17.1	17.1	17.2	0	Negligible
4	16.8	16.6	16.6	16.7	0	Negligible
5	15.5	15.4	15.4	15.4	0	Negligible
6	16.0	15.9	15.9	15.9	0	Negligible
7	16.3	16.2	16.2	16.2	0	Negligible
8	15.7	15.7	15.7	15.7	0	Negligible
9	16.1	15.9	16.0	16.0	0	Negligible
10	16.1	16.0	16.0	16.0	0	Negligible
11	16.5	16.3	16.3	16.4	0	Negligible

Table 6.9: Predicted Annual Mean $PM_{2.5}$ Concentrations at Existing Receptors (μgm^{-3})

Receptor	2014 Base	2019 Base	2019 Base + Committed	2019 Base + Committed + Proposed	Change in $PM_{2.5}$ due to Development (as % of the AQAL)	Significance of Impact
1	12.3	11.8	11.8	11.8	0	Negligible
2	14.0	13.0	13.0	13.0	0	Negligible
3	13.0	12.3	12.3	12.3	0	Negligible
4	12.2	12.0	12.0	12.0	0	Negligible
5	11.4	11.3	11.3	11.3	0	Negligible
6	11.7	11.6	11.6	11.6	0	Negligible
7	11.9	11.8	11.8	11.8	0	Negligible
8	11.6	11.5	11.5	11.5	0	Negligible
9	11.8	11.6	11.6	11.6	0	Negligible
10	11.8	11.6	11.7	11.7	0	Negligible
11	12.0	11.8	11.8	11.8	0	Negligible

6.2.2 Assessment of Results

NO_2 Concentrations

The ADMS model is predicting an exceedence of the annual mean NO_2 objective at receptors 1 to 4 under the 2014 base scenario, all of which are located adjacent to the A561. At the other 7 receptors concentrations are predicted to be below the objective.

The modelling assessment is predicting a decline in NO_2 concentrations between 2014 and 2019 due to improvements in vehicle emissions from the introduction of cleaner cars. This results in the NO_2 objective being met at all receptors with the exception of receptor 2 under the 2019 base scenario (Table 6.6). However, under the sensitivity test, as set out in Table 6.7, the decline in not as pronounced and NO_2 concentrations remain above the objective at receptors 2 and 3.

The assessment has taken into consideration traffic generated by other committed developments in the vicinity of the Rayware site which results in an increase in NO_2 concentrations of up to 0.2 $\mu g/m^3$ under both the EFT assessment and the NO_x sensitivity test. In both instances NO_2 concentrations are predicted to be similar to those predicted in the 2019 base scenario.

Traffic generated by the operational development is predicted to increase NO_2 concentrations by 0.2 $\mu g/m^3$ at receptor 2 using the EFT emissions data. This equates to 1% of the AQAL. Based on the significance criteria set out in Table 6.5, this is classed as a negligible impact due to concentrations in 2019 being less than 94% of the AQAL. However, under the sensitivity test the impact is classed as minor adverse due to concentrations being between 95-102% of the AQAL.

At all other locations the impact of the development is predicted to be negligible due to the change in NO_2 concentrations being less than 1% of the AQAL using the EFT emissions data and under the sensitivity test.

It is considered appropriate to assess the overall impact of the development based on the results of the sensitivity test as this presents the most realistic and worst-case assumptions. The overall impact of the development on local NO_2 concentrations would therefore be minor adverse at the 4 residential receptors located adjacent to the A561 at Bognor Close but negligible in all other locations.

PM_{10} Concentrations

The modelling assessment is predicting PM_{10} concentrations at less than 75% of the AQAL at all receptor locations under all assessment scenarios.

Traffic generated by the committed developments is not predicted to change local PM_{10} concentrations. There is also predicted to be no change in PM_{10} concentrations as a result of the operational development.

Based on the predicted annual mean PM_{10} concentrations the number of exceedences of the 24-hour objective would be between 1-3 at the selected receptor locations, with no change as a result of the proposed development.

The overall impact of the development on local PM_{10} concentrations would therefore be negligible.

$PM_{2.5}$ Concentrations

The modelling assessment is predicting $PM_{2.5}$ concentrations at less than 75% of the AQAL at all receptor locations under all assessment scenarios.

Traffic generated by the committed developments is not predicted to change local $PM_{2.5}$ concentrations. There is also predicted to be no change in $PM_{2.5}$ concentrations as a result of the operational development.

The overall impact of the development on local PM_{10} concentrations would therefore be negligible.

Cumulative Impacts

As detailed above the committed developments in the vicinity of the Rayware Site are predicted to increase NO_2 concentrations by up to 0.2 $\mu g/m^3$. With the addition of traffic generated by the proposed development NO_2 concentrations would increase by up to 0.4 $\mu g/m^3$. The predicted change equates to a 1% change in the AQAL at receptors 2, 3, 4, 9, 10 and 11.

Using the EFT emissions data this equates to a moderate adverse impact at receptor 2 where NO_2 concentrations are predicted to be over 103% of the AQAL and a minor adverse impact at receptor 3 where concentrations are between 95-102% of the AQAL. At the other locations the impact is negligible. However, under the sensitivity test the impact would be moderate adverse at both receptors 2 and 3 and a minor adverse impact at receptor 4 due to the higher predicted NO_2 concentrations.

Overall, as the moderate adverse impact would occur at less than 10 properties and give the number of receptors experiencing a negligible impact, the overall cumulative impact on NO_2 concentrations is considered to be minor adverse.

With regards PM_{10} and $PM_{2.5}$ concentrations of both pollutants would remain at less than 75% of the annual mean objectives and the cumulative impact would be negligible.

6.3 Mitigation

The modelling assessment has predicted a minor adverse impact on local NO_2 concentrations as a result of traffic generated by the operational development.

As part of the planning process a Draft Travel Plan Framework (TPF) has been developed by Iceni Projects aimed at reducing the number of single-occupancy car trips and reducing the overall vehicle mileage from the operational site. Although draft at this stage the document sets out the overall framework for a Travel Plan that would be finalised and implemented by the operational development.

The TPF sets out the objectives to be met through the final site wide Travel Plan providing measures that would be implemented at the Site and targets that would be used to measure the effectiveness of the plan. The measures included in the TPF include:

- Provision of Travel Information Packs to all staff members;

- Parking restraint measures i.e. 88% of the maximum allowable parking spaces will be provided and staff will be discouraged from driving to the Site due to the lower parking provision available;
- Promotion of car sharing including the promotion of car sharing clubs such as carshare.com;
- Provision of secure, covered cycle parking plus showering and changing facilities. IN addition the travel plan coordinator will promote a cycle buddy scheme;
- Provision of information on pedestrian network around the site to all staff, promotion of walking buddy scheme and provision of showering facilities;
- Encouragement of staff to combine bus and rail services with walking and cycling for journeys to work and provision of up-to-date public transport information to all staff.

Based on the above measures the TPF has an aspirational target to reduce single occupancy car trips by 10% over the first 5 years with an overall 20% reduction in car drivers to the site within this same time frame. This would significant reduce the number of vehicles generated by the Site and the resulting impact on local air quality is expected to reduce from minor adverse to negligible.

No other mitigation measures are therefore considered necessary.

7 Conclusion

Encon Associates were commissioned by Quod to carry out an air quality assessment in connection with the redevelopment of the Former Rayware Site located on Speke Boulevard, Liverpool (the 'Site').

The scope of the assessment was discussed and agreed with Paul Farrell, the air quality officer at LCC at the outset of the project.

It is inevitable that with any development, demolition and construction activities will cause some disturbance to those nearby. Dust arising from most construction activities tends to be of a coarse nature, which through dispersion by the wind can lead to soiling of property including windows, cars, external paintwork and laundry. However, as well as giving rise to annoyance due to soiling of surfaces from dust emissions, there is evidence of major construction activities causing increases in long term PM_{10} concentrations and in the number of days exceeding the short term PM_{10} objective of 50 μgm^{-3}.

An assessment of the potential risk of impacts during construction of the proposed development has been assessed using the IAQM 2014 guidance. Appropriate mitigation measures have been recommended based on the identified risk. Following implementation of these measures impacts associated with the construction of the development are considered to be negligible.

The ADMS dispersion model has been used to predict the impact of the operational development on local NO_2, PM_{10} and $PM_{2.5}$ concentrations. To ensure a robust assessment a sensitivity test has been undertaken using emissions factors generated by the CURED spreadsheet developed by Air Quality Consultants. The significance of any predicted impacts on local NO_2 concentrations has been based on the results of the sensitivity test which represent a more realistic prediction of future changes in NO_2 concentrations.

The assessment has predicted a negligible impact on PM_{10} and $PM_{2.5}$ concentrations at sensitive receptors located adjacent to the local road network. However traffic generated by the operational development is predicted to result in a minor adverse impact on local NO_2 concentrations.

A Draft Travel Plan Framework has been developed by Iceni Projects aimed at reducing the number of single-occupancy car trips and reducing the overall vehicle mileage from the operational site. Although draft at this stage the document sets out the overall framework for a Travel Plan that would

The TPF has an aspirational target to reduce single occupancy car trips by 10% over the first 5 years with an overall 20% reduction in car drivers to the site within this same time frame. This would significant reduce the number of vehicles generated by the Site and the resulting impact on local air quality is expected to reduce from minor adverse to negligible.

Appendix A
Construction Mitigation Measures

It is recommended that the ‘highly recommended’ measures set out below are incorporated into a DMP and approved by LCC 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;
- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary, with cleaning provided if necessary;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to LCC when asked;
- 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;
- 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;
- 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 being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;
- 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;
- produce a construction logistic plan to manage the sustainable delivery of goods and materials;
- 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;

- 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 bonfires and burning of waste materials;
- soft strip inside buildings before demolition;
- ensure effective water suppression is used during demolition operations;
- avoid explosive blasting, using appropriate manual or mechanical alternatives;
- bag and remove biological debris or damp down such material before demolition;
- 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;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surfaces as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent action in a site log book;
- install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned;
- implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud);
- ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit;

- access gates to be located at least 10 m from receptors where possible.

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

- for smaller supplied of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust;
- re-vegetate earthworks and exposed areas/soil stockpiles to stablise surfaces as soon as practicable;
- use hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable;
- only remove the cover in small areas during work and not all at once;
- avoid scabbling (roughening of concrete surfaces) if possible;
- 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;
- impose and signpost a maximum speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas;
- implement a travel plan that supports and encourages sustainable travel.

Appendix B
Roads Modelling Verification

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.

The model has been run to predict annual mean road-NO_x concentrations at two local 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 (Figure B1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations, by first converting the measured NO_2 into an equivalent measured NO_x using the NO_x from NO_2 DEFRA calculator, then subtracting the background value.

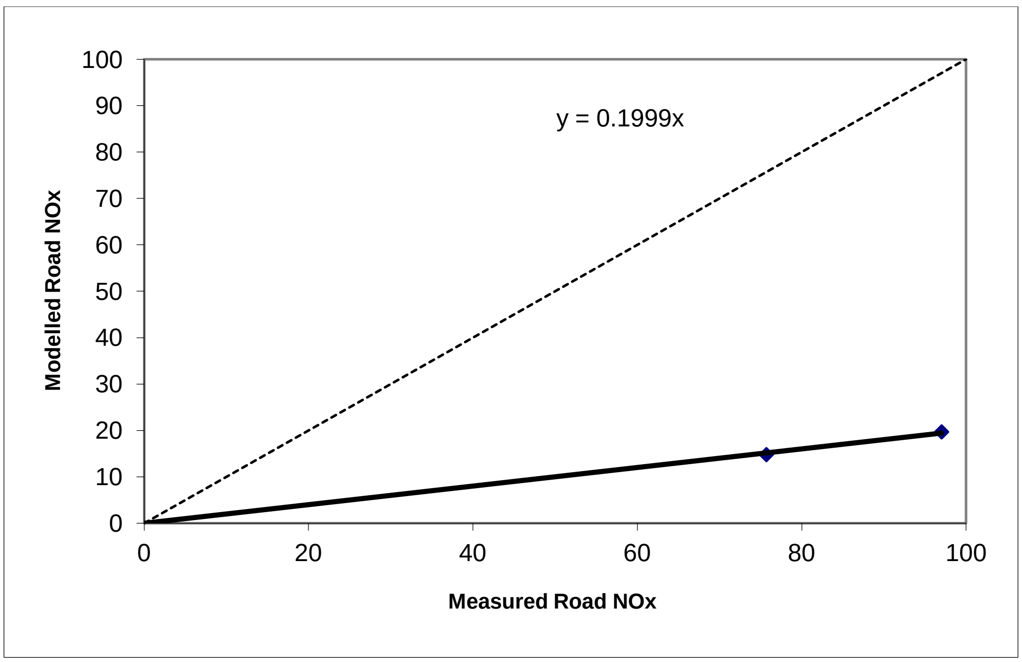

Figure B1: Comparison of Modelled Road NO_x to 'Measured' Road NO_x

A primary adjustment factor was then determined as the ratio between the measured road-NO_x contribution and the model derived road-NO_x contribution, forced through zero (1/0.0.1999 = 5.00).

This factor was then applied to the modelled road-NO_x concentration for each monitoring location to provide an adjusted modelled road-NO_x concentration. The background concentration was then added to these concentrations to determine the adjusted total modelled NO_x concentration.

The NO_2- road contribution to the total annual mean NO_2 concentration was then determined using the DEFRA NO_x:NO_2 calculator tool.

The total NO_2 concentration was then determined by adding the background NO_2 concentration to this calculated road contribution. 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 (1/0.9989 = 1.001).

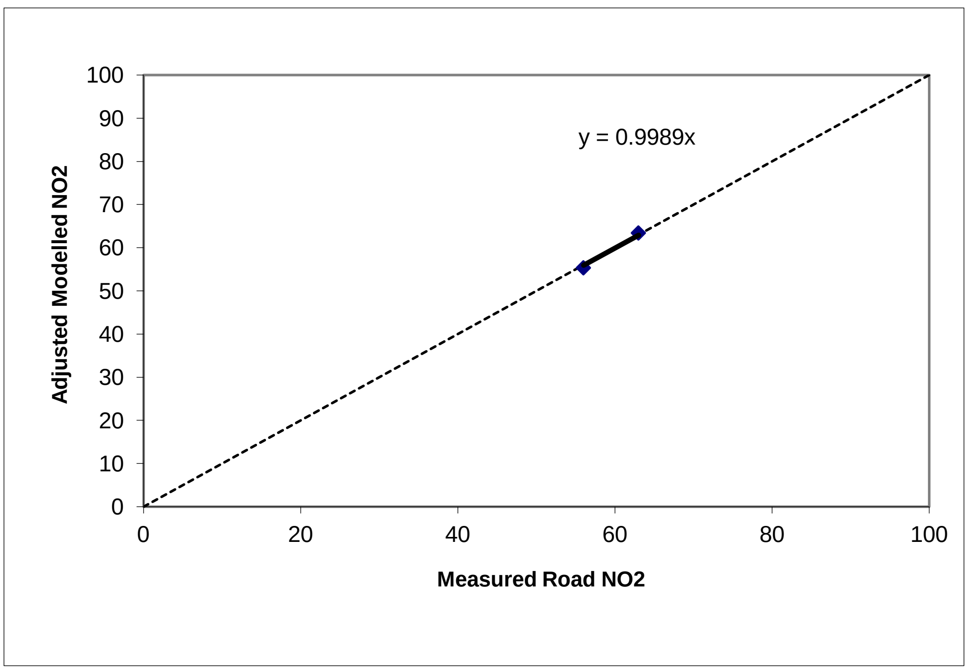

Figure B2: Comparison of Modelled NO_2 with Measured NO_2 before Secondary Adjustment.

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 which shows that all results are within 10% and 25% of monitored concentrations.

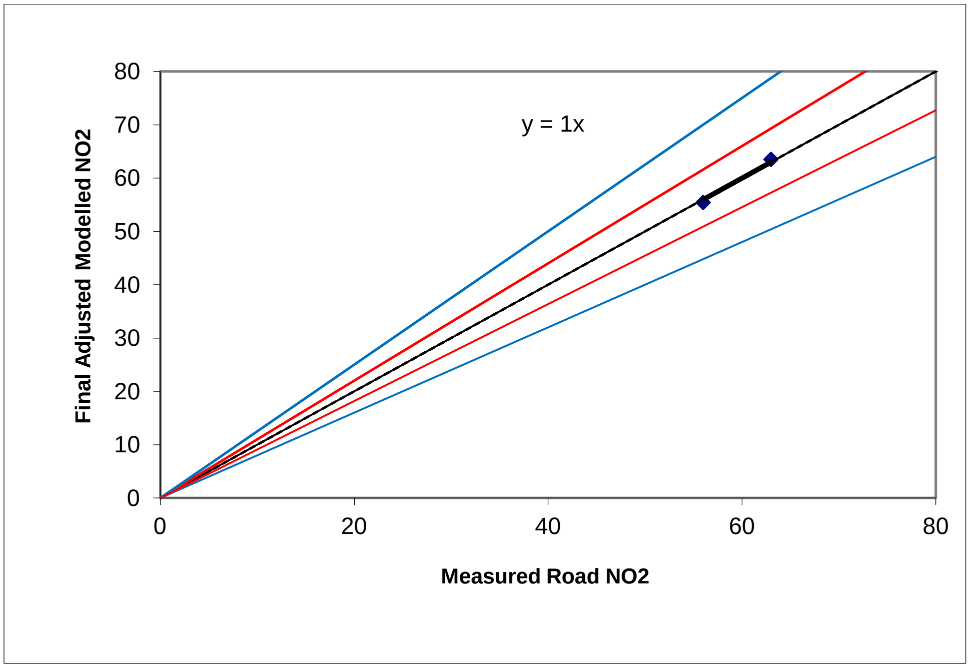

Figure B3: Comparison of Final Modelled NO_2 with Measured NO_x

The adjustment factor of 5.0 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 concentrations and adjusted by 1.001 to provide the final predicted annual mean NO_2 concentrations at each receptor.

This method was also applied to the predicted PM_{10} and $PM_{2.5}$ concentrations.