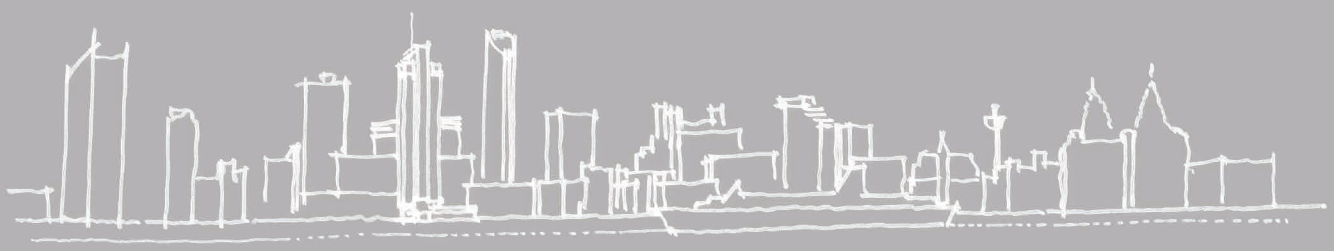
MODALIVING

A DESIGN FOR LIFE

PRINCES REACH, PRINCES DOCK

AIR QUALITY ASSESSMENT

June 2016



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Construction Dust Methodology

1 Introduction

This section describes the likely significant effects of the proposed development on local air quality. This section outlines relevant air quality management policy and legislation, describes the existing air quality conditions in the vicinity of the proposed development and the potential air quality impacts associated with its construction and operation. Mitigation measures are also proposed where relevant which would be implemented to reduce the effect of the proposed development on air quality, as far as practicable. Potential changes to air quality in the area as a result of the operation of the proposed development have been considered in relation to the national and EU air quality standards to determine their significance.

2 Methodology and Scope

2.1 Legislation and Policy

In May 2008 the Directive 2008/50/EC[1] on ambient air quality and cleaner air for Europe came into force. This Directive consolidates earlier directives (except the 4th Daughter Directive, which will be brought into the new Directive at a later date), providing EU limit values for specified pollutants and provides a new regulatory framework for $PM_{2.5}$. The European Directive has been transposed into domestic legislation in the Air Quality Standards 2010[2].

Air Quality Objectives and Limit Values

Air quality limit values and objectives are quality standards for clean air. Some pollutants have standards expressed as annual average (long-term) concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur after a prolonged period of exposure to elevated concentrations) and others have standards expressed as 24-hour, 1-hour or 15-minute average (short-term) concentrations due to the acute way in which they affect health or the natural environment (i.e. after a relatively short period of exposure). Some pollutants have standards expressed in terms of both long-term and short-term concentrations. Table 1 sets out these EU air quality limit values and national air quality objectives for the pollutants relevant to this study (NO_2 and particulate matter).

[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] HMSO, Air Quality Standards Regulations 2010 SI No. 1001

Table 1: Air Quality Standards

Pollutant	Averaging period	Limit value / Objective	Date for compliance
Nitrogen Dioxide (NO_2)	Annual mean	40µg/m^3	UK[2] 11 June 2010
			EU[1] 01 Jan 2010
	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.8th percentile)	UK[2] 11 June 2010
			EU[1] 01 Jan 2010
Particulate Matter (PM_{10})	Annual mean	40µg/m^3	UK[2] 11 June 2010
			EU[1] 01 Jan 2005
	24-hour mean	50µg/m^3 not to be exceeded more than 35 times a year (90.4th percentile)	UK[2] 11 June 2010
			EU[1] 01 Jan 2005
Fine Particulate Matter ($PM_{2.5}$)	Annual mean	25µg/m^3	UK[2]/EU[1] 01 Jan 2015

Environment Act 1995

Part IV of the Environment Act 1995[3] places a duty on the Secretary of State for the Environment to develop, implement and maintain an Air Quality Strategy with the aim of reducing atmospheric emissions and improving air quality. The Air Quality Strategy[4] for England, Scotland, Wales and Northern Ireland provides the national air quality objectives and a framework for ensuring these values are complied with based on a combination of international, national and local measures to reduce emissions and improve air quality. This includes the statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of local air quality management and declare Air Quality Management Areas (AQMA) where pollutant concentrations exceed the national air quality objectives. Where an AQMA is declared the local authority would also need to produce an Air Quality Action Plan (AQAP) which outlines the strategy for improving air quality in these areas.

Dust Nuisance

Dust is the generic term used in the British Standard document BS 6069 (Part Two) to describe particulate matter in the size range 1–75µm in diameter. Dust nuisance is the result of the perception of the soiling of surfaces by excessive rates of dust deposition. Under provisions in the Environmental Protection Act 1990[5], dust nuisance is defined as a statutory nuisance.

3 Environment Act 1995, Chapter 25, Part IV Air Quality
4 Defra (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Volume 1, July 2007
[5]Environmental Protection Act 1990, Chapter 43, Part III Statutory Nuisances and Clean Air

There are currently no standards or guidelines for dust nuisance in the UK, nor are formal dust deposition standards specified. This reflects the uncertainties in dust monitoring technology and the highly subjective relationship between deposition events, surface soiling and the perception of such events as a nuisance. In law, complaints about excessive dust deposition would have to be investigated by the local authority and any complaint upheld for a statutory nuisance to occur. However, dust deposition is generally managed by suitable on-site practices and mitigation rather than by the determination of statutory nuisance and/or prosecution or enforcement notice(s).

National Planning Policy Framework

The National Planning Policy Framework[6] (NPPF) was published in March 2012 with the purpose of planning to achieve sustainable development. Paragraph 124 of the NPPF on air quality 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."*

In addition, paragraph 120 states that:

> *"To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area of proposed development to adverse effects from pollution, should be taken into account."*

Local Planning Policy

Liverpool City Council (LCC) is in the process of producing a Local Plan for Liverpool which will set out the spatial vision and development management policies for determining planning applications in the city. The Draft Core Strategy[7] includes Strategic Policy 33: Environmental Impacts which states that:

> *"New development should seek to avoid negative impacts on the environment through adoption of best practice. Where a negative effect is identified this should be mitigated by appropriate measures. Specifically, development proposals should….minimise adverse impacts on, and include measures to improve, air quality within the city."*

[6] Department for Communities and Local Government (2012) National Planning Policy Framework
[7] Liverpool City Council, Submission Draft, Liverpool Core Strategy, 2012

> *"While this policy seeks to ensure that development contributes to improving air quality in Liverpool, the Core Strategy more generally seeks to achieve this by reducing the need to travel, and encouraging increased use of sustainable transport modes, including walking and cycling."*

The location of the proposed development near the city centre reduces the need for travel into the city centre and it is anticipated that future residents will use sustainable methods of transport to travel to and from the proposed development.

2.2 Methodology Overview

The overall approach to the air quality assessment comprises:

- A review of the existing air quality conditions at and in the vicinity of the proposed development site;
- An assessment of the potential changes in air quality arising from the construction and operation of the proposed development;
- Formulation of mitigation measures, where necessary, to ensure any adverse effects on air quality are minimised; and

The following data sources have been used to determine the baseline and future conditions of air quality in the study area:

- LCC review and assessment reports and local air quality monitoring data;
- The Defra Local Air Quality Management website8;
- The Environment Agency website[9];

Methodology for establishing baseline conditions

Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

A desk-based review was undertaken using the data sources described above. The review identified the main sources of air pollution within a radius of 1km around the proposed development site, local air quality monitoring data for recent years and local background pollutant concentrations.

Sensitive receptors are defined as those properties/schools/hospitals that are likely to experience a change in pollutant concentrations and/or dust nuisance due to the construction of the proposed development.

[8] Defra Local Air Quality Management website; http://laqm.defra.gov.uk/; Accessed: April 2016
[9] Environment Agency website; http://maps.environment-agency.gov.uk/wiyby/dataSearchController?topic=pollution&lang=_e; Accessed: April2016

Methodology for assessment of effects from construction

The effects from demolition and construction have been assessed using the qualitative approach described in the latest guidance[10] by the Institute of Air Quality Management (IAQM).

An 'impact' is described as a change in pollutant concentrations or dust deposition, while an 'effect' is described as the consequence of an impact. The main impacts that may arise during demolition and construction of the proposed development are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes;
- Elevated PM_{10} concentrations as a result of dust generating activities on site; and
- An increase in NO_2 and PM_{10} concentrations due to exhaust emissions from non-road mobile machinery and vehicles accessing the site.

The IAQM guidance considers the potential for dust emissions from activities such as demolition of existing structures, earthworks, construction of new structures and trackout. Earthworks refer to the processes of soil stripping, ground levelling, excavation and land capping, while trackout is the transport of dust and dirt from the site onto the public road network where it may be deposited and then re-suspended by vehicles using the network. This arises when vehicles leave the site with dust materials, which may then spill onto the road, or when they travel over muddy ground on site and then transfer dust and dirt onto the road network.

For each of these dust-generating activities, the guidance considers three separate effects: annoyance due to dust soiling; harm to ecological receptors; and the risk of health effects due to a significant increase in PM_{10} exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and PM_{10} exposure.

The methodology takes into account the scale to which the above effects are likely to be generated (classed as small, medium or large), along with the levels of background PM_{10} concentrations and the distance to the closest receptor, in order to determine the sensitivity of the area. This is then taken into consideration when deriving the overall risk for the site. Suitable mitigation measures are also proposed to reduce the risk of the site.

There are five steps in the assessment process described in the IAQM guidance. These are summarised in Figure 1 and a further description is provided in the following paragraphs.

[10] Institute of Air Quality Management (2014); Guidance on the assessment of dust from demolition and construction

Step 1: Need for assessment

The first step is the initial screening for the need for a detailed assessment. According to the IAQM guidance, an assessment is required where there are sensitive receptors within 350m of the site boundary (for ecological receptors that is 50m) and/or within 50m of the route(s) used by the construction vehicles on the public highway and up to 500m from the site entrance(s).

Step 2: Assess the risk of dust impacts

This step is split into three sections as follows:

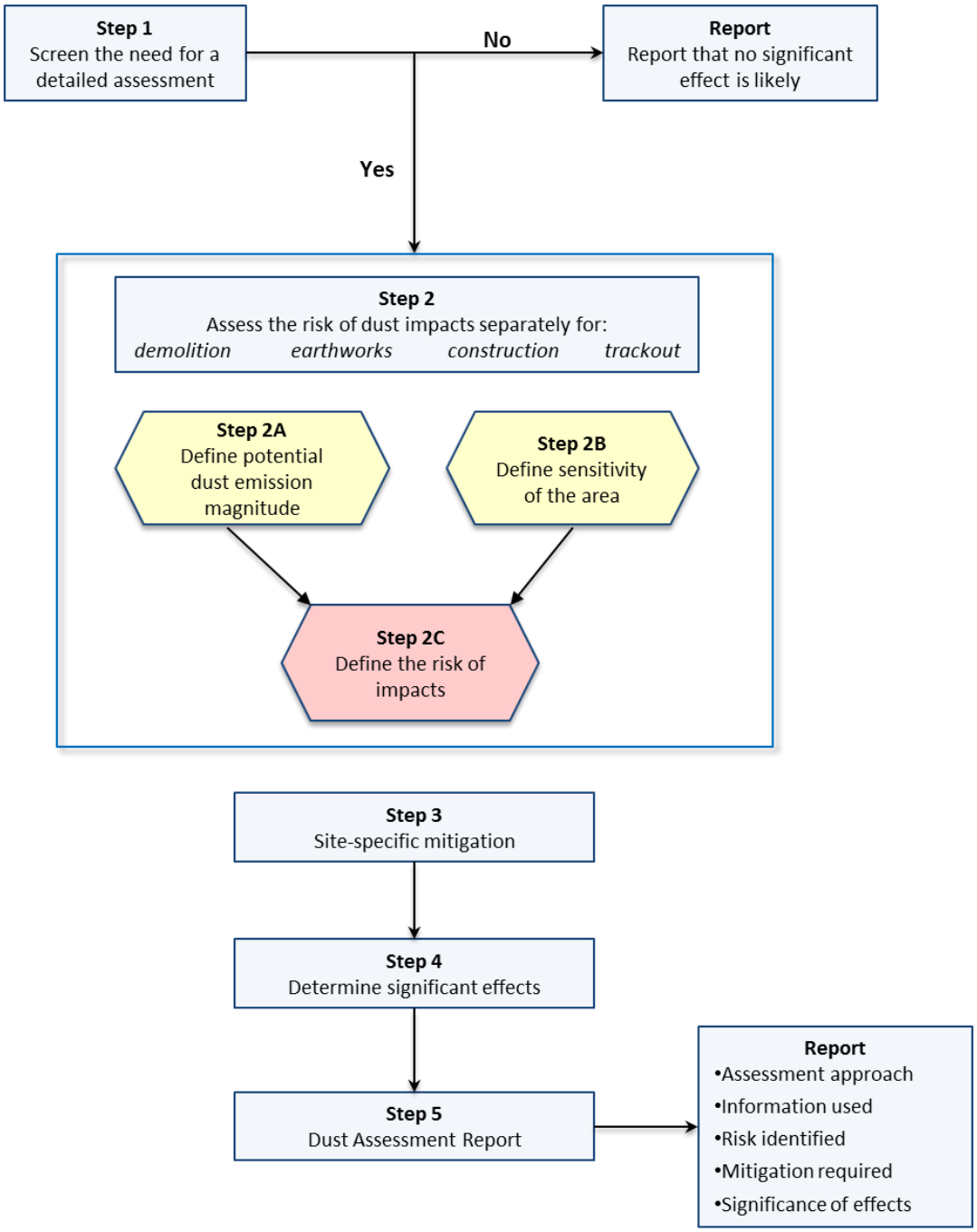
- 2A. Define the potential dust emission magnitude;
- 2B. define the sensitivity of the area; and
- Define the risk of impacts.

Each of the dust-generating activities is given a dust emission magnitude depending on the scale and nature of the works (step 2A) based on the criteria shown in Table A.1 (Appendix A).

The sensitivity of the surrounding area is then determined (step 2B) for each dust effect from the above dust-generating activities, based on the proximity and number of receptors, their sensitivity to dust, the local PM10 background concentrations and any other site-specific factors. Tables A.2 to A.4 (Appendix A) show the criteria for defining the sensitivity of the area to different dust effects.

The overall risk of the impacts for each activity is then determined (step 2C) prior to the application of any mitigation measures (Table A.5, Appendix A) and an overall risk for the site derived.

Figure 1: IAQM dust assessment methodology



Step 3: Determine the site-specific mitigation

Once each of the activities is assigned a risk rating, appropriate mitigation measures are identified. Where the risk is negligible, no mitigation measures beyond those required by legislation are necessary.

Step 4: Determine any significant residual effects

Once the risk of dust impacts has been determined and the appropriate dust mitigation measures identified, the final step is to determine whether there are any residual significant effects. The IAQM guidance notes that it is anticipated that

with the implementation of effective site-specific mitigation measures, the environmental effect will not be significant in most cases.

Step 5: Prepare a dust assessment report

The last step of the assessment is the preparation of a Dust Assessment Report. This forms part of this report (see section 4.1).

Methodology for assessment of effects from operation

Road Traffic Emissions

The development has the potential to impact on existing air quality as a result of road traffic exhaust emissions, such as NO_2 and PM_{10}, associated with vehicles travelling to and from the site during the operational phase. A screening assessment was therefore undertaken using the criteria contained within the EPUK/IAQM land-use guidance document[11] to determine the potential local air quality effects associated with the potential trip generation as a result of the proposed development.

As the proposed development lies in an AQMA, the EPUK/IAQM guidance document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:

- A change of Light Duty Vehicle flows of more than 100 Annual Average Daily Traffic (AADT) movements; and
- A change of Heavy Duty Vehicle flows of more than 25 AADT movements;

Should screening of the traffic data indicate that any of the above criteria are met, then potential impacts at sensitive receptor locations can be assessed by calculating the predicted change in NO_2 and PM_{10} concentrations as a result of the proposed development. The significance of predicted impacts can then be determined in accordance with the methodology outlined in the EPUK/IAQM guidance. Should the criteria above not be met as a result of the proposed development, then the EPUK/IAQM guidance document consider air quality impacts associated with road traffic emissions of a scheme to be negligible and no further assessment is required.

Combustion Plant Emissions

Emissions associated with the proposed combustion plant to be installed as part of the development have the potential to cause increases in pollutant concentrations in the vicinity of the site. The design team has provided the following information on which the assessment of air quality effects has been based:

- 1 x 1,038Wth input CHP; and
- 2 x 1,000kW gas fired boilers.

[11] Moorcroft and Barrowcliffe. et al. (2015) Land-use Planning & Development Control: Planning for Air Quality. Institute of Air Quality Management, London

Emissions from on-site back-up generators have been scoped out of the detailed assessment as they will be used only in emergencies. Emissions from this source will therefore have a negligible impact on the local air quality.

A detailed assessment of air quality effects has been undertaken following EPUK/IAQM guidance, as the on-site combustion plant will have a total capacity of greater than 300kW. The effect on local air quality has been quantified through dispersion modelling in accordance with the methodology described in the following sections.

An industry standard atmospheric dispersion model, ADMS 5, was used to calculate resulting concentrations of NO_2. As the combustion plant is proposed to be gas-fired, emissions of particulate matter would be negligible and therefore this pollutant has been scoped out of the assessment.

The modelling procedure was as follows:

- Information on stack dimensions and position, as well as boiler operating conditions, were obtained for the proposed development;
- Appropriate data to describe meteorological conditions in the vicinity of the site was obtained from Atmospheric Dispersion Modelling (ADM) Ltd for the latest three years of data;
- A receptor grid of potentially sensitive locations was identified in the vicinity of the installation using digital mapping;
- Information on buildings surrounding the development was obtained;
- The above information was entered into the dispersion model;
- The dispersion model was run to determine pollutant concentrations in the vicinity of the site. The interpretation of the results was based on the modelled concentrations at potential receptor locations; and
- The study results were compared with the relevant assessment criteria.

Dispersion Model

The ADMS 5 dispersion model (version 5.1.2) has been used for this assessment. This was the most up-to-date version of the model at the time of the assessment[12].

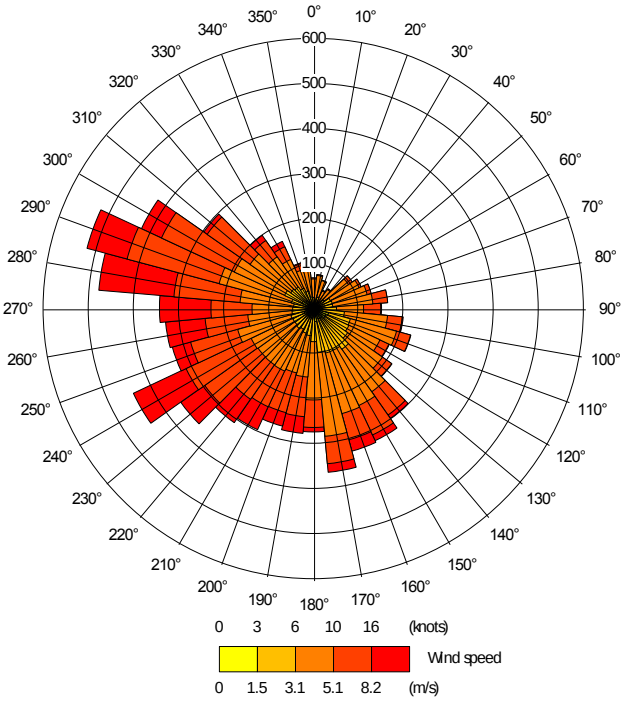
The ADMS model has been widely validated for point sources and is accepted by the industry as being 'fit-for-purpose' for air quality assessments of stack releases. It is regularly tested against other dispersion models by the EA's Air Quality Modelling and Assessment Unit (AQMAU) and is suitable for EIAs. The model incorporates the latest understanding of boundary layer meteorology and dispersion.

12 CERC (2012); ADMS 5 Atmospheric Dispersion Modelling System User Guide

Meteorological data

Meteorological data used in this assessment was measured at Liverpool John Lennon Airport meteorological station over the period 1st January 2013 to 31st December 2015 (inclusive). Liverpool John Lennon Airport is located approximately 12km south east of the proposed development. Figure 2 shows the wind rose for the latest full year of data, 2015; it can be seen that the predominant wind direction is north westerly.

Figure 2: Wind Rose for 2015 meteorological data



Building effects

Buildings can have a significant effect on the dispersion of pollutants. If tall buildings are close to a stack, the plume can be entrained in the cavity zone downwind of the building. This can lead to higher ground concentrations near the stack than would be expected in the absence of buildings and can affect the dispersion of pollutants in the atmosphere.

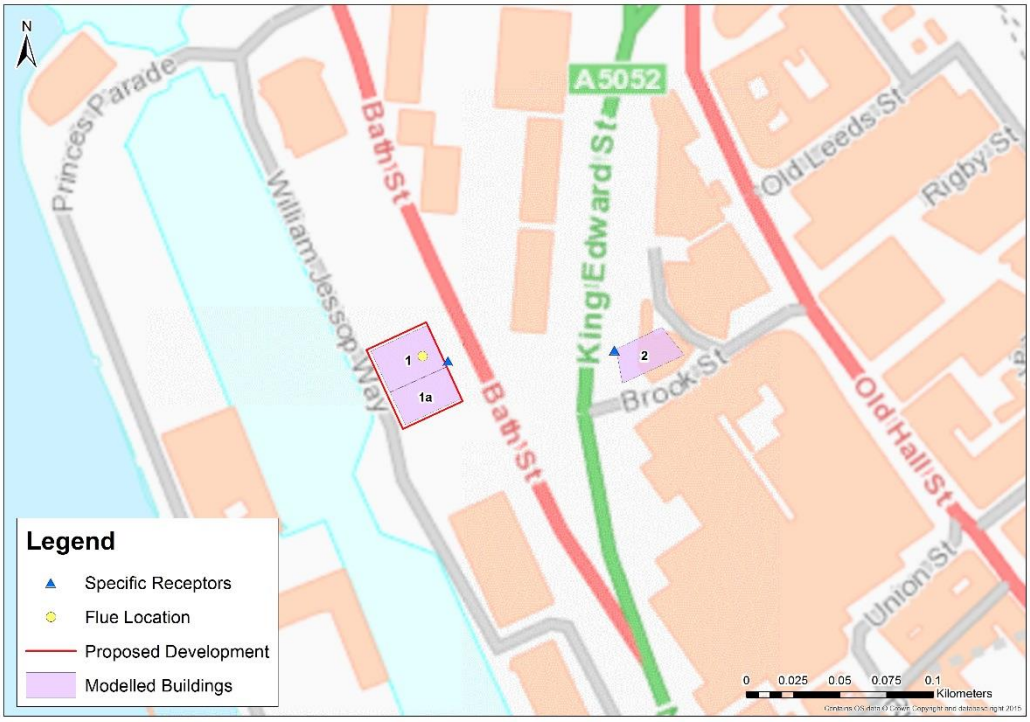
The assessment considers the existing situation plus the proposed development, an assessment of the Liverpool Waters consented development has not been included.

Figure 3 shows the buildings which have been included in the dispersion model. Buildings can only be added as rectangular or circular shapes therefore some simplification has been made. Details of building geometries included in the model are provided in Table 2.

Table 2: Modelled Building Parameters

ID	Name	Easting	Northing	Height (m)	Length (m)	Width (m)	Angle of building (degrees)
1	Proposed Development	333715	390807	110	34	24	65
1a	Proposed Development Car Park and Roof Terrace	333725	390788	10	34	19	65
2	8-10 Brook Street	333843	390810	134	27	17	63

Figure 3: Modelled Buildings in Existing Scenario plus Proposed Development



Assessment extents

The assessment has been undertaken to assess the predicted concentrations in areas where the air quality objectives apply for NO_2. The long-term annual mean objective applies at locations where sensitive receptors are located, these would include residential properties, hospitals and schools. The short-term hourly mean objective applies at locations where members of the public may spend more than an hour at a single location.

The area surrounding the proposed development is currently predominantly commercial but residential development with some residential. A grid of results was run across a 1x1 km area with a 10m grid spacing. This method ensures that potential impacts are assessed across the entire study area. The receptor grid has been modelled at heights of 1.5m (representative of ground level), 10m (representative of the communal terrace proposed as part of the development) and 110m (representative of roof level).

Specific receptors have also been assessed at the façades of each of the buildings included in the model, which includes the proposed development and 10-11 Brook Street. Receptors have been included at 25m intervals up to roof level to assess likely concentrations at height as well as at ground level. Specific receptor locations are shown on Figure 3.

Process conditions

The design of the proposed development includes the installation of two natural gas boiler units and one combined heat and power (CHP) unit. At the time of

writing it is unclear whether the exhaust gases from each of the units will be combined into a single flue or whether each unit will have a separate flue. A sensitivity test was undertaken which showed that separate flues provided the highest pollutant concentrations, therefore, it has been assumed for the purposes of this assessment that each of the units will exhaust to air through a separate flue. The approximate flue location is shown in Table 3. Details of the exhaust gas parameters included in the dispersion model are provided in Table 3. It has been assumed that the gas boiler and CHP would operate continuously, to provide a worst case scenario.

Table 3: Process conditions

Parameter	Unit	Gas Boiler 1	Gas Boiler 2	CHP
Combustion plant, thermal input capacity	kW	1,000	1,000	1,038
Stack location	NGR	333722, 390809	333722, 390809	333722, 390809
Stack diameter	mm	0.2	0.2	0.2
Flue gas efflux velocity	m/s	15	15	15
Temperature	˚C	80	80	70
Stack height – above building	m	3	3	3
NOx Emission Rate	g/s	0.01	0.01	0.14

NOx to NO2

The model predicts NOx concentrations which comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NOx is emitted from combustion processes, primarily as NO with a small percentage of NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form NO_2. NO_2 is associated with effects on human health and therefore the air quality standards for the protection of human health are based on NO_2 rather than total NOx or NO. A suitable NOx:NO_2 conversion has been applied to the modelled NOx concentrations in order to determine the impact of the NOx emissions on ambient concentrations of NO_2. This assessment has followed the methodology set out by the EA which states it should be assumed as a worst case scenario that 70% of long-term and 35% of short-term NOx concentrations will convert to NO_2[13].

Assessment of Significance

The 2015 EPUK/IAQM guidance note 'Land-Use Planning & Development Control' provides an approach to determining the air quality impacts resulting from a proposed development and the overall significance of local air quality effects arising from a proposed development.

[13] Environment Agency; *Air Quality Modelling and Assessment Unit, Conversion ratios for NO_x and NO_2*

Firstly, impact descriptors are determined based on the magnitude of incremental change as a proportion of the relevant assessment level, in this instance the annual mean NO_2 objective. The change is then examined in relation to the predicted total pollutant concentrations in the assessment year and its relationship with the annual mean NO_2 objective.

The assessment framework for determining impact descriptors at each of the assessed receptors is shown in Table 4.

Table 4: Impact Descriptors

Annual average concentrations at receptor in the assessment year	**% Change in concentrations relative to annual mean NO_2 and hourly mean objectives**			
	1	**2-5**	**6-10**	**>10**
75% or less of objective	Negligible	Negligible	Slight	Moderate
76-94% of objective	Negligible	Slight	Moderate	Moderate
95-102% of objective	Slight	Moderate	Moderate	Substantial
103-109% of objective	Moderate	Moderate	Substantial	Substantial
110% of more of objective	Moderate	Substantial	Substantial	Substantial

Note: Changes in pollutant concentrations of 0% i.e. <0.5% would be described as negligible

The guidance also provides advice for determining the magnitude of change for hourly mean NO_2 concentrations, which is shown in Table 5. The impact descriptor is determined by considering the process contribution only. However, consideration is also given to total pollutant concentrations, including background concentrations, and comparison of these with the hourly mean NO_2 objective.

Table 5: Magnitude of Change for Hourly Mean NO_2 Concentrations

Change in hourly mean concentrations at receptor in the assessment year	**Magnitude of Change**	**Impact Descriptor**
<10% of hourly mean NO_2 threshold	Imperceptible	Negligible
10-20% of hourly mean NO_2 threshold	Small	Slight
20-50% of hourly mean NO_2 threshold	Medium	Moderate
>50% of hourly mean NO_2 threshold	Large	Substantial

The impact descriptors at each of the assessed receptors can then be used as a starting point to making a judgement on the overall significance of effect of a proposed development, however other influences would also need to accounted for, such as:

- The existing and future air quality in the absence of the development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

Professional judgement should be used to determine the overall significance of effect of the proposed development, however in circumstances where the proposed development can be judged in isolation, it is likely that a 'moderate' or 'substantial' impact will give rise to a significant effect and a 'negligible' or 'slight' impact will not result in a significant effect.

3 Baseline Conditions

3.1 Sources of air pollution

Industrial processes

Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part A or Part B processes, regulated through the Pollution Prevention and Control (PPC) system[14,15]. The larger more polluting processes are regulated by the Environment Agency (EA) and the smaller less polluting ones by the local authorities.

There are no regulated processes within 1km of the proposed development listed on the EA website.

Part B processes are regulated and reviewed by LCC and, given the nature of these processes, are unlikely to significantly affect ambient air quality in the vicinity of the proposed development.

Local air quality

As discussed in section 2.1, the Environment Act 1995 requires local authorities to review and assess air quality with respect to the objectives for seven pollutants specified in the National Air Quality Strategy. Local authorities are required to carry out an Updating and Screening Assessment of their area every three years. If this assessment identifies potential hotspot areas likely to exceed air quality objectives, then a further Detailed Assessment of those areas is required. Where objectives are not predicted to be met, local authorities must declare the area as an AQMA. In addition, local authorities are required to produce an Air Quality Action Plan which includes measures to improve air quality within the AQMA.

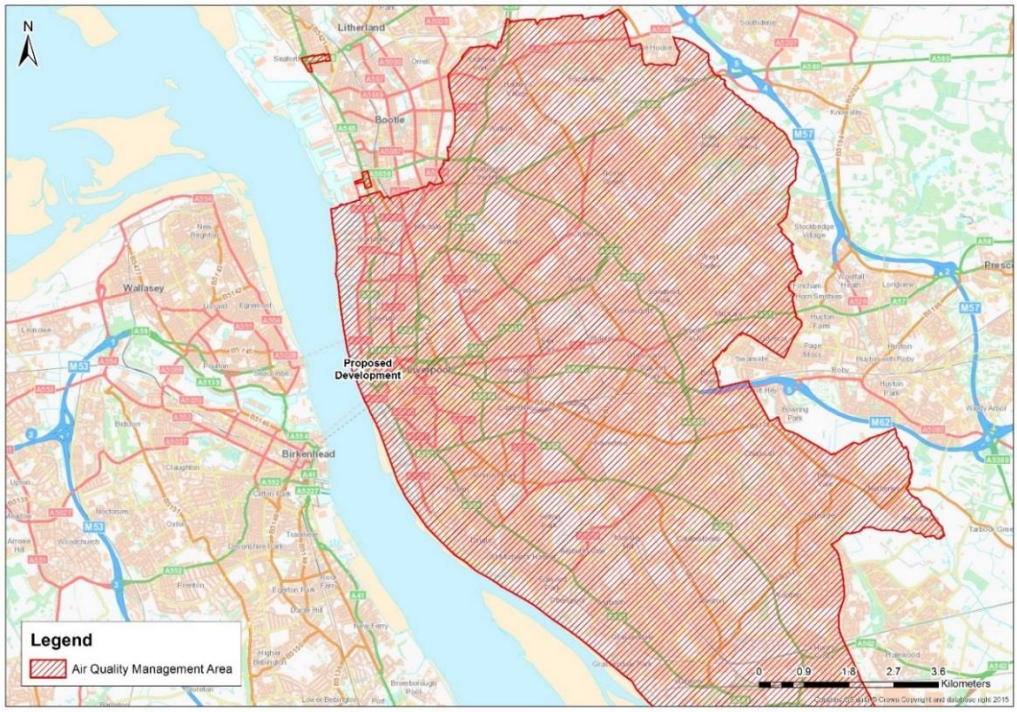
LCC has declared an area encompassing the entire city centre as an AQMA for exceedences of the annual mean NO_2 objective, the extent of the AQMA is shown in Figure 4, and as required LCC produced an AQAP in January 2011[16]. This

[14] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
[15] The Environmental Permitting (England and Wales) (Amendment) Regulations 2013, SI 2013/390

[16] Liverpool City Council, Air Quality Action Plan for the City-Wide AQMA, January 2011

AQAP outlines measures that are to be implemented to improve local air quality in the city.

Figure 4: Liverpool City Council AQMA



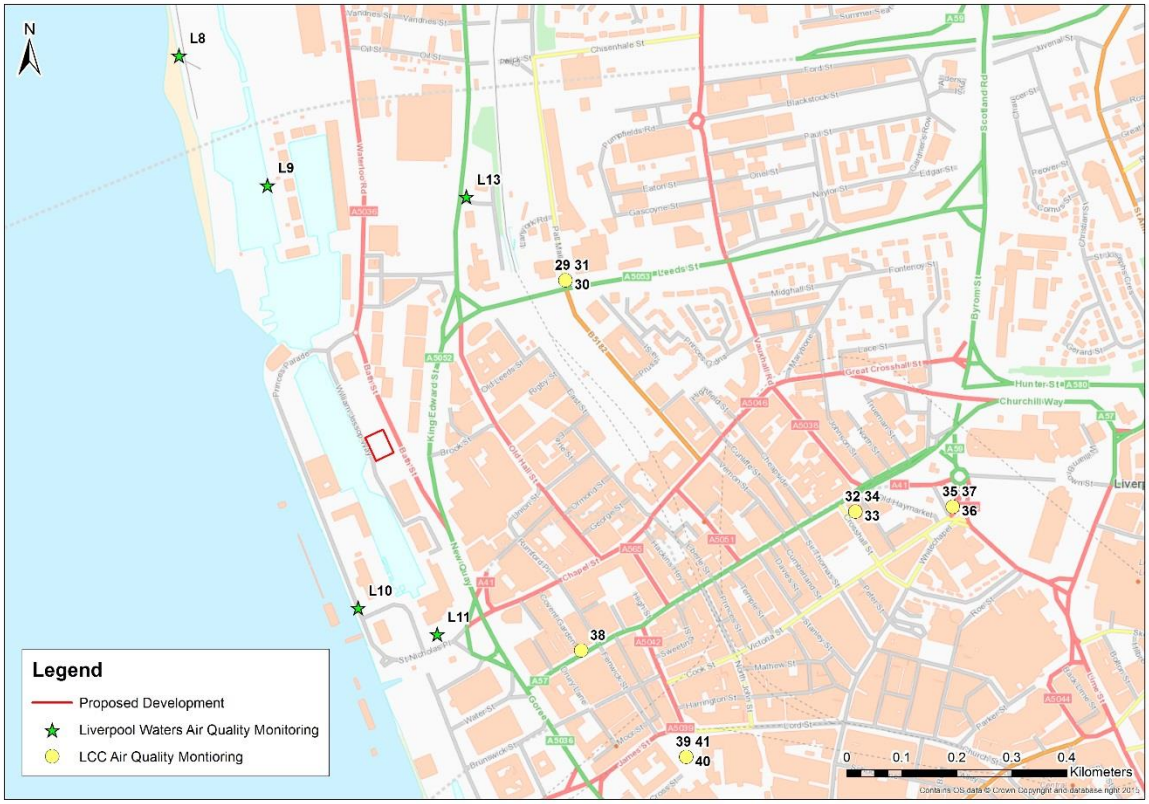
The council carries out monitoring of NO_2 concentrations using passive diffusion tubes within the vicinity of the proposed development. The locations of the monitoring sites in relation to the proposed development are shown in Figure 5. No monitoring of particulate matter is undertaken within the vicinity of the proposed development. Details of the monitoring locations and monitored concentrations between 2010 and 2014 are shown in Table 6.

Air quality monitoring undertaken by LCC shows that the annual mean NO_2 objective is exceeded at roadside locations within the vicinity of the proposed development. Local Air Quality Management Technical Guidance (LAQM.TG16) states that where monitored annual mean NO_2 concentrations are greater than 60µg/m^3, there is the potential for the hourly mean NO_2 objective to also be exceeded.

Table 6: LCC Monitored Annual Mean NO_2 Concentrations ($\mu g/m^3$)

ID	Site	Location type	2010	2011	2012	2013	2014
			Annual Mean NO_2 concentrations ($\mu g/m^3$)				
29/30/31	Leeds Street/Pall Mall Roadside	Urban Roadside	**59.7**	**52**	**53.3**	**53.3**	**51**
32/33/34	Crosshall Street	Urban Roadside	**62.3**	**61.7**	**67.7**	**71**	**68.3**
35/36/37	Old Haymarket	Urban Roadside	**60.7**	**56.3**	**60.7**	**61.3**	**56.7**
38	Covent Garden/Dale Street	Urban Roadside	**54**	**44**	**52**	**50**	**46**
39/40/41	Strand Street/Water Street	Urban Roadside	**74**	**67**	**69.7**	**71.3**	**67.6**

Figure 5: Air Quality Monitoring Locations



Passive NO_2 diffusion tube monitoring was also undertaken as part of the Liverpool Waters outline planning application[17] for a period of six months between December 2008 and June 2009. This monitoring would have been more representative of the proposed development site itself than monitoring undertaken by LCC at roadside sites in the city undertaken over the same time period, but is

[17] Peel Holdings Ltd, Liverpool Waters, Environmental Statement, Appendix 10.4: Nitrogen Dioxide Monitoring Survey

now considered out of date compared with the alternative sources of data described below. Monitored data is shown in Table 7 which provides an annual mean NO_2 concentration derived from the six month monitoring survey.

Given the length of time since this monitoring data was collected, it is unlikely that this is representative of the current conditions in the area. Therefore, more recent information available from Defra has been used to determine background pollutant concentrations, as discussed below.

Table 7: Liverpool Waters Monitored Annual Mean NO_2 Concentrations ($\mu g/m^3$)

ID	Site	Location type	Annual Mean NO_2 Concentration
L8	Trafalgar Dock Wall	Urban Background	23.1
L9	West Waterloo Dock	Urban Background	20.9
L10	Lamppost, Princess Parade	Urban Background	26.4
L11	St Nicholas Place, Crowne Plaza Hotel gate	Urban Background	31.1
L13	A565 (Great Howard Street)	Roadside	32.0

Background concentrations

Background pollutant concentrations are available on the Defra air quality website[18] for every 1km x 1km grid square across the UK. Background pollutant concentrations for the latest full year of data (2015) have been obtained for the grid squares in which the proposed development lies, these are shown in Table 8. Defra background pollutant concentrations are below the relevant air quality objectives.

Table 8: Baseline (2015) background pollutant concentrations ($\mu g/m^3$)

OS grid square		2015		
X	Y	NOx	NO_2	PM_{10}
333500	390500	30.6	21.1	14.5

LCC operate an urban background monitoring using both continuous and passive methods at the Speke Defra site on Tarbock Road. The continuous monitor at this location is part of the Automatic Urban and Rural Network (AURN). The site is approximately 6.4km south east of the proposed development site. Monitored pollutant concentrations for recent years are shown in Table 9. It can be seen the monitored pollutant concentrations are similar to the published Defra background concentrations, therefore the background concentrations shown in Table 8 have been used as an input to the modelling of total pollutant concentrations.

[18] Background Pollutant Concentrations, Defra Air Quality Website, http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2011

Table 9: Monitored NO_2 and PM_{10} concentrations ($\mu g/m^3$)

Site	Location type	2013	2014	2015	2013	2014	2015
		Annual Mean NO_2 Concentrations			Annual Mean PM_{10} Concentrations		
Speke Continuous Monitor, Tarbock Rd	Urban Background	23	24.7	22.3	14	14	13.9
B56, Speke Diffusion Tube	Urban Background	25	27	-	N/A	N/A	N/A
B57, Speke Diffusion Tube	Urban Background	25	25	-	N/A	N/A	N/A
B58, Speke Diffusion Tube	Urban Background	27	25	-	N/A	N/A	N/A

4 Assessment

4.1 Assessment of effects from construction

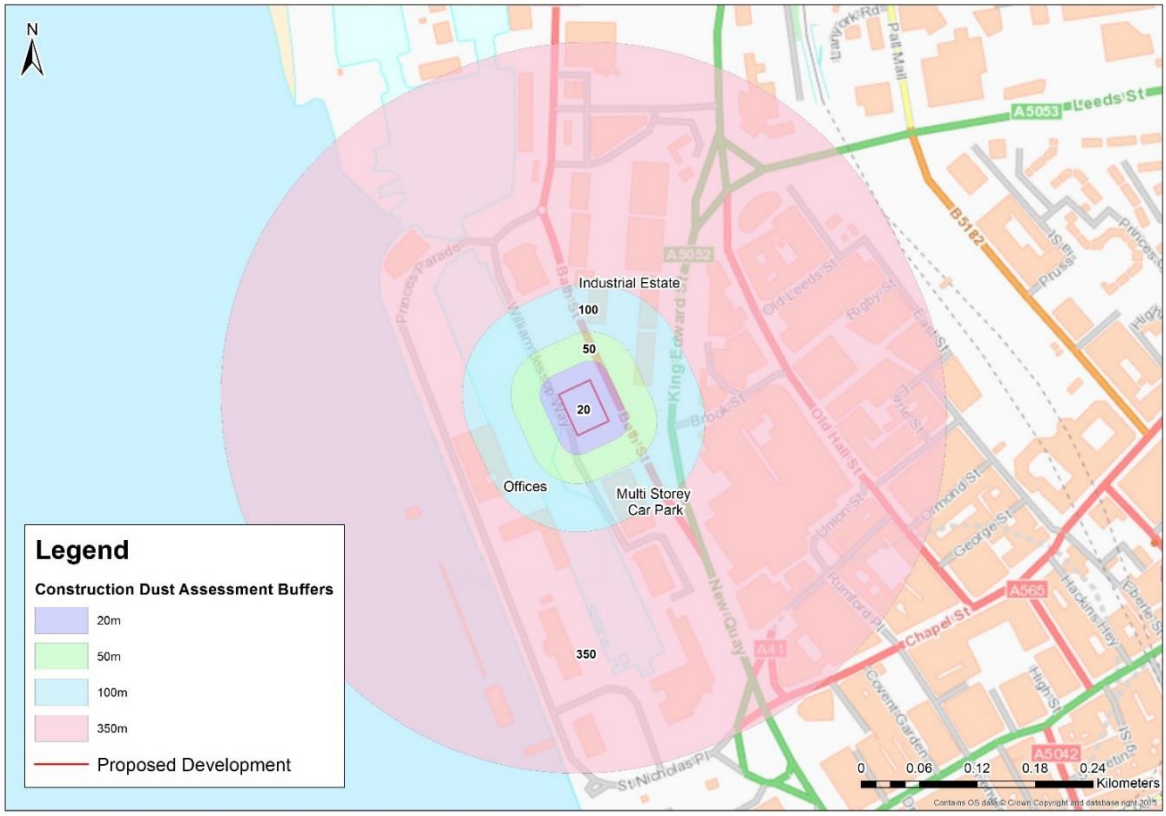
As discussed above the IAQM guidance takes into consideration four dust generating activities: demolition, earthworks, construction and trackout. The development land is currently vacant and no demolition is required to enable the proposed development. No assessment has therefore been required of effects associated with demolition. The site of the proposed development covers an area of approximately 0.25 hectares.

The closest sensitive receptors are within 100m of the site boundary (Figure 6); these are mainly commercial properties and a multi storey car park to the south of the proposed development, there are no residential properties within 100m of the site boundary. It has been assumed that no other properties consented as part of the Liverpool Waters outline application will have been progressed by the construction phase of the proposed development.

The sensitivity of nearby receptors to dust soiling and PM_{10} exposure has been classified as medium according to the IAQM guidance.

No ecological receptors sensitive to changes in dust have been identified within 50m of the site boundary.

Figure 6: Construction dust buffers



Dust emission magnitude

Each dust generating activity has been assigned a dust emission magnitude as shown in Table 10. This has been determined based on information provided by the construction/design team.

Table 10: Dust emission magnitude for dust generating activities

Activity	Dust emission magnitude	Reasoning
Earthworks	Small	It is likely that earthworks will occur across an area of the site of approximately 1,600m^2. The tonnage of material to be moved is approximately 5,000 tonnes.
Construction	Medium	Total volume of building to be constructed is approximately 92,000m^3; Piling is also likely to be employed as a construction method.
Trackout	Medium	It has been assumed that between 10 – 50 additional HGV movements would be required per day as a result of the construction phase; It is also likely that construction vehicles would travel along paved roads for the entirety of their journey.

Sensitivity of the area

The sensitivity of the area to dust soiling and human health effects has been assigned as low, due to the presence of medium sensitivity receptors within 100m of the site boundary.

Risk of impacts

Taking into consideration the dust emission magnitude and the sensitivity of the area, the site has been classified as low risk to dust soiling and human health impacts for all activities at worst (Table 11). Specific mitigation to minimise the risk of dust soiling and human health impacts is described in section 5.

Table 11: Summary dust risk table prior to mitigation

Activity	Dust soiling	Human health
Earthworks	Negligible	Negligible
Construction	Low risk	Low risk
Trackout	Low risk	Low risk

4.2 Assessment of effects from operation

Road Traffic Emissions

The transport consultants for the scheme (Mott Macdonald) have produced a Transport Assessment[19] (TA) for the proposed development. The proposed development is located close to the city centre where public transportation is readily accessible. A total of 40 car parking spaces, 8 motorcycle spaces and 80 bicycle spaces will be available as part of the proposed development.

As a result of limited car parking and good access routes into the city centre including walking, cycling and public transport options, the TA shows that weekday trips would be below 100 additional movements per day. This does not meet the change criteria discussed in section 2.2. Therefore, following EPUK/IAQM guidance it is likely that air quality effects associated with vehicle movements to and from the site would be negligible and no further assessment was required.

The TA also includes a travel plan for the proposed development which aims to improve the quality of non-car modes and provide disincentives for the use of private vehicles.

Combustion Plant Emissions

The maximum predicted process contribution from on-site combustion plant at ground level is presented in Table 12**.** For all meteorological years assessed. The results show that interannual variability

[19] Mott Macdonald, Transport Assessment and Framework Travel Plan, April 2016

between the meteorological years assessed is low. 2014 meteorological data produce the highest ground level concentrations for annual and hourly mean NO_2 concentrations. The maximum point of impact for long-term concentrations occurs at the northern façade of the proposed development.

The maximum process contribution to annual mean NO_2 concentrations is predicted to be 0.3 µg/m^3 (<1 % of the annual mean NO_2 objective). The maximum process contribution to hourly mean NO_2 concentrations is predicted to be 1.7 µg/m^3 (<1% of the hourly mean NO_2 objective).

Table 12: Modelled Process Contributions to NO_2 and PM_{10} Concentrations (µg/m^3) for all Meteorological Years Assessed

Meteorological Year	**Process Contribution (µg/m^3)**	
	Annual Mean NO_2	**Hourly Mean NO_2 (99.79th Percentile)**
2013	0.2	1.6
2014	0.3	1.7
2015	0.2	1.7

At the area of maximum impact and across the study area assessed, background levels of annual mean NO_2 have been assumed to be 21.1µg/m^3 as set out in Table 8. Following LAQM.TG16 background hourly mean NO_2 concentrations have been calculated by doubling the annual mean NO_2 concentration (42.2µg/m^3). Therefore, both annual and hourly mean NO_2 concentrations are predicted to be below the relevant objectives at ground level.

Predicted annual mean and hourly mean NO_2 concentrations at various modelled grid heights are summarised in Figure 7 to Figure 10, which include the process contribution from the on-site combustion plant as well as background pollutant concentrations. Figure 7 to Figure 9 shows predicted annual mean NO_2 concentrations at heights of 1.5m, 10m and 110m. Figure 10 shows predicted hourly mean NO_2 concentrations at 110m representative of roof level at the proposed development.

Modelling was undertaken assuming an absolute worst case whereby the two boilers and CHP are fully operational for a full year.

As shown in Figure 7 to Figure 10, predicted annual and hourly mean NO_2 concentrations meet the annual mean NO_2 objective (40µg/m^3) and hourly mean NO_2 objective (200µg/m^3).

Figure 7: Predicted Annual Mean NO_2 Concentrations at ground level, 1.5m

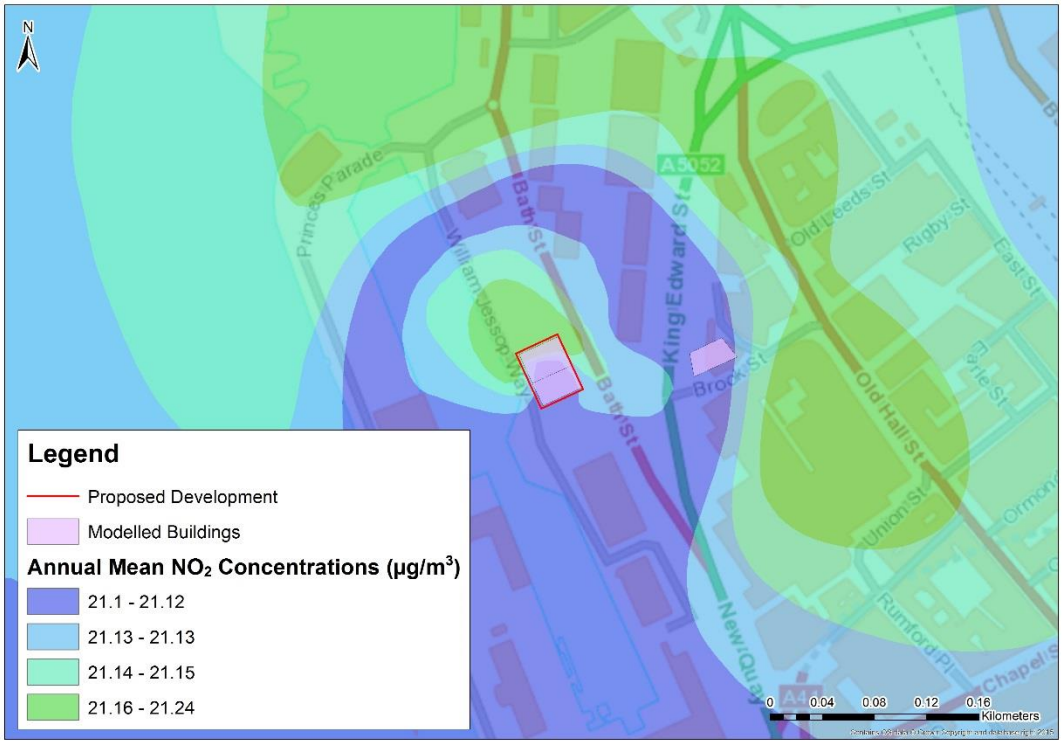


Figure 8: Predicted Annual Mean NO_2 Concentrations at height of proposed communal terrace, 10m

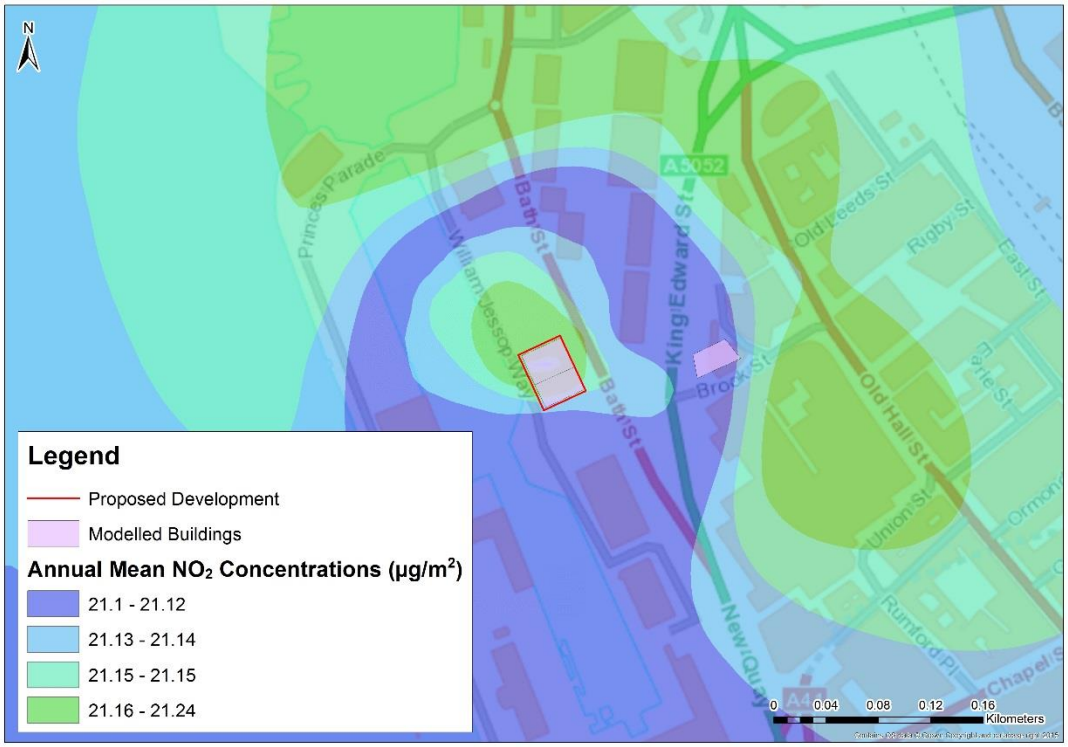
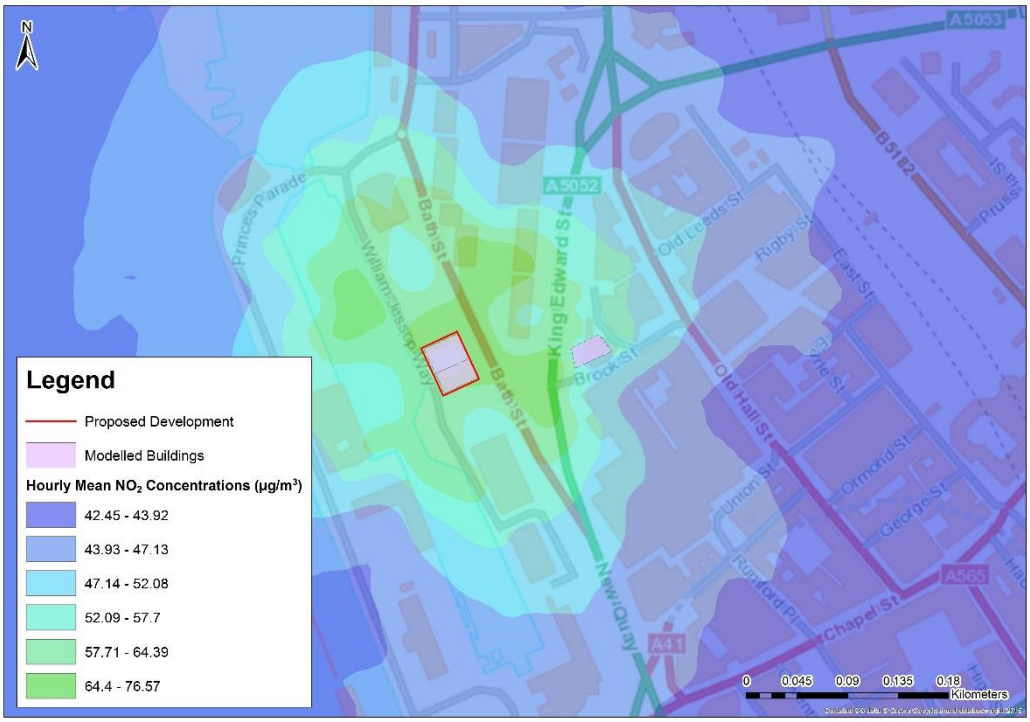


Figure 9: Predicted Annual Mean NO_2 Concentrations at roof level, 110m

Figure 10: Predicted Hourly Mean NO_2 Concentrations at roof level, 110m



Assessed Receptors

Specific receptors have been assessed as well as the modelled grid discussed above. Receptors have been included at the façade of the proposed development and at 8-10 Brook Street. The maximum predicted process contribution at each location as well as the total annual and hourly mean NO_2 concentrations is shown in Table 13.

Table 13: Predicted Concentrations at Assessed Receptors

Receptor Building ID	Height above ground level (m)	Process Contribution (µg/m^3)		Total Pollutant Concentration (µg/m^3)	
		Annual Mean NO_2	Hourly Mean NO_2 (99.79th Percentile)	Annual Mean NO_2	Hourly Mean NO_2 (99.79th Percentile)
8-10 Brook Street	1.5	<0.1	0.2	21.1	42.4
8-10 Brook Street	25	<0.1	0.2	21.1	42.4
8-10 Brook Street	50	<0.1	0.6	21.1	42.8
8-10 Brook Street	75	0.1	1.5	21.2	43.7
8-10 Brook Street	100	0.6	4.6	21.7	46.8
8-10 Brook Street	125	0.3	4.1	21.4	46.3
8-10 Brook Street	134	0.1	2.0	21.2	44.2
Proposed Development	1.5	0.1	1.5	21.2	43.7
Proposed Development	25	0.1	1.5	21.2	43.7
Proposed Development	50	0.1	1.5	21.2	43.7
Proposed Development	75	0.1	1.5	21.2	43.7
Proposed Development	100	0.1	1.5	21.2	43.7
Proposed Development	110	2.9	34.9	24.0	77.1

Following the guidance outlined in Table 4 for determining the impact descriptor, the impact descriptor for each of the assessed receptors has been determined and is shown in Table 14. As the predicted increase is less than 4% of the annual mean NO_2 objective at all receptors assessed, with exception of roof level at the proposed development, the impact descriptor is negligible for annual mean NO_2 concentrations at the majority of receptor. At roof level of the proposed development the impact descriptor is slight adverse as the increase in annual mean NO_2 concentrations is 7% of the annual mean NO_2 objective.

Similar to annual mean NO_2 concentrations, the predicted increase in hourly mean NO_2 concentrations is higher at roof level of the proposed development and is greater than 10% of the hourly mean NO_2 objective. Therefore the magnitude of

change is small and the impact descriptor is slight adverse at this location. It is unlikely that this would be representative of an area where members of the public would spend more than one hour, notwithstanding this total pollutant concentrations are well below the hourly mean NO_2 threshold and no exceedences of the hourly mean NO_2 objective are predicted. The magnitude of change at all other receptors is imperceptible and the impact is considered to be negligible.

Table 14: Impact Descriptor at Assessed Receptors

Receptor Building ID	Height above ground level (m)	Impact Descriptor	
		Annual Mean NO_2	Hourly Mean NO_2 (99.79th Percentile)
8-10 Brook Street	1.5	Negligible	Negligible
8-10 Brook Street	25	Negligible	Negligible
8-10 Brook Street	50	Negligible	Negligible
8-10 Brook Street	75	Negligible	Negligible
8-10 Brook Street	100	Negligible	Negligible
8-10 Brook Street	125	Negligible	Negligible
8-10 Brook Street	134	Negligible	Negligible
Proposed Development	1.5	Negligible	Negligible
Proposed Development	25	Negligible	Negligible
Proposed Development	50	Negligible	Negligible
Proposed Development	75	Negligible	Negligible
Proposed Development	100	Negligible	Negligible
Proposed Development	110	Slight	Slight

Assessment of Significance

Predicted annual and hourly mean NO_2 concentrations are less than the relevant air quality objectives with the proposed on-site combustion plant operational continuously. Predicted increases in concentrations at ground level are minimal, less than 1% of the relevant air quality objectives. The impact descriptor for annual mean NO_2 concentrations is negligible for annual mean NO_2 concentrations at all location, with the exception of roof level at the proposed development where the impact descriptor is slight adverse at worst. The impact on hourly mean NO_2 concentrations is slight adverse at worst which is representative of roof level at the proposed development. This location is unlikely to be an area representative of public exposure and hourly mean NO_2 concentrations are less than half of the hourly mean NO_2 threshold. At all other locations the impact on hourly mean NO_2 concentrations is negligible.

Following the guidance outlined in the EPUK/IAQM land-use planning guidance, the effect of the proposed development would be not significant on local air quality.

5 Mitigation Measures

Construction

The dust emitting activities assessed in section 4.1 can be greatly reduced or eliminated by applying the site specific mitigation measures for low risk sites according to the IAQM guidance. High risk mitigation measures are included as a precautionary measure and to ensure best practice is followed for all on site activities. The following measures from the guidance are relevant and should be included in the Construction Management Plan for the site.

General

- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.

Site management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.
- Make 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.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, 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 100m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results and make an inspection log available to the local authority, when asked.
- Increase the frequency of site inspections 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 dry or windy conditions.

Site maintenance

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.

- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out.

Operating vehicle/machinery and sustainable travel

- 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.
- Impose and signpost a maximum speed limit of 15mph on surfaced and 10mph on un-surfaced haul roads and work areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques, such as water sprays or local extraction.
- Ensure an adequate water supply on the 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 the fine water sprays on such equipment wherever appropriate.

Waste management

- Fires will not be held on site.

Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.

Trackout

- Regularly use water-assisted dust sweeper(s) on the access and local roads, to remove, as soon as practicable any material tracked out of the site.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport.

- Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Operation

As the operational phase is predicted to have a negligible effect on local air quality, no mitigation is required nor proposed.

6 Conclusion

An assessment of likely air quality effects arising as a result of the construction and operation of the proposed development has been undertaken.

The proposed development lies within an air quality management area designated for NO_2 by LCC. A review of air quality monitoring undertaken by LCC in the area of the proposed development indicates that annual mean NO_2 concentrations exceed the annual mean NO_2 objective at the roadside, however annual mean PM_{10} concentrations are well within the annual mean PM_{10} objective.

The assessment of effects indicates that the proposed development will have a negligible effect on local air quality during both the construction and operation phases. Mitigation measures to limit the impact of dust soiling and exposure to PM_{10} should be implemented during the construction phase as the proposed development has been assessed to be a high risk for dust generation. The effect of traffic movements associated with the proposed development have been predicted to negligible for local air quality in the surrounding area. The effect of on-site combustion plant on local pollutant concentrations have been predicted to be negligible to slight adverse, at areas where members of the public might be present for time periods consistent with the objective.

The effect of the proposed development on local air quality is predicted to be not significant.

Appendix A

Construction Dust Methodology

A1 Construction Dust Methodology

Table A.15: Dust emission magnitude

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

Table A.16: Sensitivity of the area to dust soiling effects

Receptor sensitivity	**Number of receptors**	**Distance from the source (m)**			
		< 20	**< 50**	**< 100**	**< 350**
High	> 100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	< 10	Medium	Low	Low	Low
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Table A.17: Sensitivity of the area to human health impacts

Background PM_{10} concentrations (annual mean)	Number of receptors	Distance from the source (m)				
		< 20	**< 50**	**< 100**	**< 200**	**< 350**
High receptor sensitivity						
> 32µg/m^3	> 100	High	High	High	Medium	Low
	10 – 100			Medium	Low	
	< 10		Medium	Low		
28 – 32µg/m^3	> 100	High	High	Medium	Low	Low
	10 – 100		Medium	Low		
	< 10					
24 – 28µg/m^3	> 100	High	Medium	Low	Low	Low
	10 – 100					
	< 10	Medium	Low			
< 24µg/m^3	> 100	Medium	Low	Low	Low	Low
	10 – 100	Low				
	< 10					
Medium receptor sensitivity						
–	> 10	High	Medium	Low	Low	Low
	< 10	Medium	Low			
Low receptor sensitivity						
–	> 1	Low	Low	Low	Low	Low

Table A.18: Sensitivity of the area for ecological impacts

Receptor sensitivity	Distance from the source (m)	
	< 20	**< 50**
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Table A.19: Risk of dust impacts

Sensitivity of area	Dust emission magnitude		
	Large	**Medium**	**Small**
Demolition			
High	High risk site	Medium risk site	Medium risk site
Medium	High risk site	Medium risk site	Low risk site
Low	Medium risk site	Low risk site	Negligible
Earthworks			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Construction			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Medium risk site	Low risk site
Low	Low risk site	Low risk site	Negligible
Trackout			
High	High risk site	Medium risk site	Low risk site
Medium	Medium risk site	Low risk site	Negligible
Low	Low risk site	Low risk site	Negligible

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