

9 Air Quality

Introduction

- 9.1 This Chapter of the ES assesses the likely significant effects of the Development with respect to air quality. This Chapter also describes the methods used to assess the effects; the baseline conditions currently existing at the Site and surrounding area; the mitigation measures required to prevent, reduce or offset any significant negative effects; and the likely residual effects after these measures have been adopted.

Legislative and Policy Context

Legislation

European Air Quality Management

- 9.2 In 1996 the European Commission published the Air Quality Framework Directive on ambient air quality assessment and management (96/62/EC)¹. This Directive defined the policy framework for 12 air pollutants, including NO₂, known to have harmful effects on human health and the environment. Limit values (pollutant concentrations not to be exceeded by a certain date) for each specified pollutant were set through a series of Daughter Directives, including Directive 1999/30/EC (the 1st Daughter Directive)² which sets limit values for nitrogen dioxide (NO₂) and particulate matter (amongst other pollutants) in ambient air.
- 9.3 In May 2008 the Directive 2008/50/EC³ on ambient air quality and cleaner air for Europe came into force. This Directive consolidates the above (apart from the 4th Daughter Directive) and makes provision for extended compliance deadlines for NO₂ and PM₁₀. The Directive has been transposed into national legislation in England by the Air Quality Standards Regulations 2010⁴. The Secretary of State for the Environment has the duty of ensuring the air quality limit values are complied with.

Environment Act 1995

- 9.4 Part IV of the Environment Act 1995⁵ 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 national air quality strategy (NAQS) for England, Scotland, Wales and Northern Ireland provides the framework for ensuring that air quality limit 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 (AQMAs) where necessary.

Air Quality Objectives and Limit Values

- 9.5 Air quality limit values and objectives are quality standards for clean air. Some pollutants have standards expressed as annual average concentrations due to the chronic way in which they affect health or the natural environment (i.e. effects occur (long term) after a prolonged period of exposure to elevated concentrations) and others have standards expressed as 24-hour, 1-hour or 15-minute average concentrations (short term)

¹ Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management

² Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

³ 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

⁴ The Air Quality Standards Regulations 2010, SI 2010/1001

⁵ Environment Act 1995, Chapter 25, Part IV Air Quality

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 9.1 sets out these EU air quality limit values and national air quality objectives for the pollutants relevant to this study (NO₂ and PM₁₀).

- 9.6 In the majority of cases the air quality limit values and air quality objectives have the same pollutant concentration threshold and date for compliance. The key difference is that the Secretary of State for the Environment is required under European Law to ensure the air quality limit values are complied with whereas local authorities are only obliged under national legislation to undertake best efforts to comply with the air quality objectives. To assist local authorities in demonstrating best efforts, the Environment Act 1995 requires that when carrying out their local air quality management functions, local authorities shall have regard to guidance issued by the Secretary of State.

Table 9.1 Air Quality Standards

Pollutant	Averaging Period	Limit Value/Objective	Date for compliance	
Nitrogen Dioxide (NO ₂)	Annual mean	40	31 Dec 2005	UK
			1 Jan 2010	EU
	1-hour mean	200 not to be exceeded more than 18 times a year (99.8 th percentile)	31 Dec 2005	UK
			1 Jan 2010	EU
Particulate matter (PM ₁₀)	Annual mean	40µg/m ³	31 Dec 2004	UK
			1 Jan 2010	EU
	24-hour mean	50µg/m ³ not to be exceeded more than 35 times a year (90.4 th percentile)	31 Dec 2004	UK
			1 Jan 2010	EU

National Planning Policy Framework (2012)

- 9.7 The National Planning Policy Framework⁶ (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.”

Planning Practice Guidance (2014)

- 9.8 As part of the NPPF, planning practice guidance on various topics was recently published⁷. In relation to air quality, the guidance refers to the significance of air quality assessments to determine the impacts of proposed developments in the area and describes the role of local and neighbourhood plans with regard to

⁶ Department for communities and local government (2012) National Planning Policy Framework

⁷ Department for communities and local government (2014) Planning Practice Guidance: Air Quality

air quality. It also provides a flowchart method to assist local authorities to determine how considerations of air quality fit into the development management process.

EPUK/IAQM Land-Use Planning & Development Control (2015)

- 9.9 The 2015 Land-Use Planning & Development Control guidance document⁸ produced by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) provides a framework for professionals operating within the planning system to provide a means of reaching sound decisions, having regard to the air quality implications of development proposals.
- 9.10 The document provides guidance on when air quality assessments are required by providing screening criteria regarding the size of a development, changes to traffic flows/composition energy facilities or combustion processes associated with the development.

Dust Nuisance

- 9.11 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, dust nuisance is defined as a statutory nuisance.
- 9.12 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).

Local Planning Policy

- 9.13 The Manchester City Council (MCC) Local Development Framework (LDF) consists of a series of planning documents of which the Core Strategy is most relevant to this assessment. The Core Strategy was adopted in 2012 and sets out the spatial vision, objectives, development strategy and a series of key policies that will guide the scale, location and type of development in the area. As such, the policies contained in the Core Strategy provide the current basis for the determination of planning applications within MCC area.
- 9.14 A review of the Core Strategy showed the following policy in relation to air quality, which is considered relevant to this assessment:

“Policy EN 16 Air Quality

The Council will seek to improve the air quality within Manchester, and particularly within Air Quality Management Areas, located along Manchester’s principal traffic routes and at Manchester Airport. Developers will be expected to take measures to minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself, including from Combined Heat and Power and biomass plant.

When assessing the appropriateness of locations for new development the Council will consider the impacts on air quality, alongside other plan objectives. This includes cumulative impacts, particularly in Air Quality Management Areas.”

⁸ IAQM, (2015) Land-Use Planning & Development Control: Planning for Air Quality, Institute of Air Quality Management, London

- 9.15 This policy has been considered throughout the report by assessing potential air quality impacts as a result of the operational phase of the Proposed Development.

Assessment Methodology and Significance Criteria

Baseline Methodology

- 9.16 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.
- 9.17 A desk-based review of the following data sources has been undertaken to determine baseline conditions of air quality in this assessment:
- MCC review and assessment reports and local air quality monitoring data;
 - The Defra UK Air Information Resource website ; and
 - The Environment Agency (EA) website.
- 9.18 The following sections outline the construction and operational phase assessment methodology. For the assessment of both phases it should be noted that an 'impact' is described as a change in pollutant concentration or dust deposition, while an 'effect' is described as the consequence of an impact.

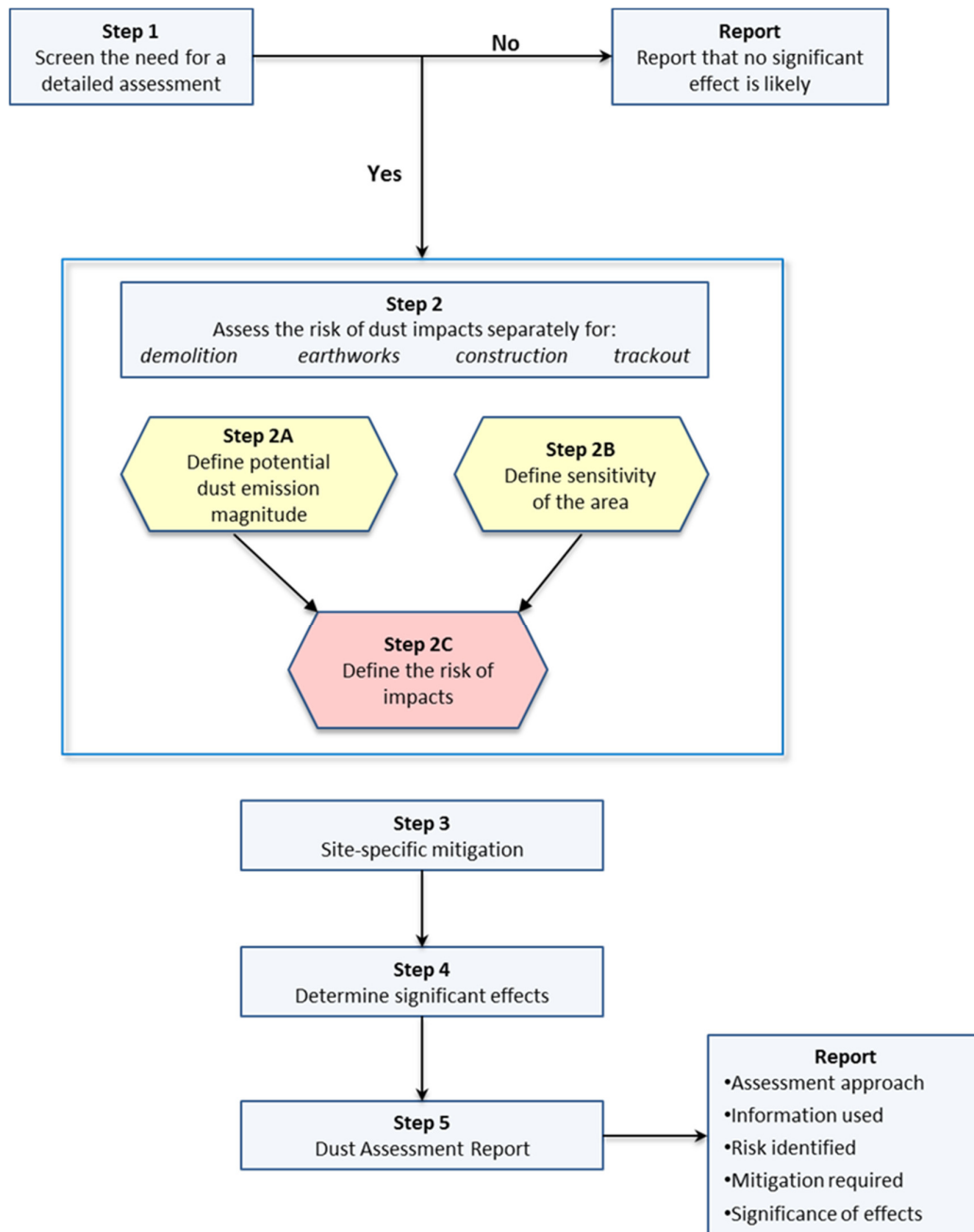
Assessment Methodology for Construction Effects

- 9.19 Potential construction effects have been assessed using the approach described in the latest IAQM guidance⁹. The guidance applies to the assessment of dust from construction/demolition activities. The main impacts that may arise during construction of the Proposed Development are:
- Dust deposition, resulting in the soiling of surfaces;
 - Visible dust plumes;
 - Elevated PM₁₀ concentrations as a result of dust generating activities on-site; and
 - An increase in NO₂ and PM₁₀ concentrations due to exhaust emissions from non-road mobile machinery (NRMM) and vehicles accessing the site.
- 9.20 The IAQM guidance considers the potential for dust emissions from dust-generating 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 dusty 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.
- 9.21 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 PM₁₀ exposure. The receptors can be human or ecological and are chosen based on their sensitivity to dust soiling and PM₁₀ exposure.
- 9.22 The methodology takes into account the scale to which the above effects are likely to be generated (classed as small, medium or large) as well as the local levels of background PM₁₀ 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 where necessary.

⁹ Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, January 2014

9.23 There are five steps in the assessment process described in the IAQM guidance. These are summarised in Figure 9.1.

Figure 9.1 IAQM Dust Assessment Methodology



Step 1: Need for Assessment

9.24 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 Risk of Dust Impacts

9.25 This step is split into three sections as follows:

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

9.26 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 9.2.

Table 9.2 Categorisation of Dust Emission Magnitude

Dust Emission Magnitude		
Small	Medium	Large
Demolition		
- total building volume <20,000m³ - 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 - 50,000m³ - potentially dusty construction material - demolition activities 10 - 20m above ground level	- total building volume >50,000m³ - potentially dusty construction material (e.g. concrete) - on-site crushing and screening - demolition activities >20m above ground level
Earthworks		
- total site area <2,500m² - 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 2,500m² - 10,000m² - 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 >10,000m² - 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 m³ - construction material with low potential for dust release (e.g. metal cladding or timber)	- total building volume 25,000 - 100,000m³ - potentially dusty construction material (e.g. concrete)	- total building volume >100,000m³ - on-site concrete batching - sandblasting

	• on-site concrete batching	
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

9.27 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. Table 9.3, Table 9.4 and Table 9.5 show the criteria for defining the sensitivity of the area to different dust effects.

Table 9.3 Sensitivity of the Area to Dust Soiling Effects 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
	<10	Medium	Low	Low	Low
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Table 9.4 Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Number of receptors	Distance from the source (m)				
		<20	<50	<100	<200	<350
High receptor sensitivity						
> 32µg/m³	> 100	High	High	High	Medium	Low
	10 – 100		Medium	Medium	Low	
	<10		Medium	Low		
28 - 32µg/m³	> 100	High	High	Medium	Low	Low
	10 – 100		Medium	Low		
	<10					

24 - 28µg/m³	> 100	High	Medium	Low	Low	Low
	10 – 100					
	<10	Medium	Low			
< 24µg/m³	> 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 9.5 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

9.28 The overall risk of the impacts for each activity is then determined (step 2C) prior to the application of any mitigation measures (Table 9.6) and an overall risk for the site derived.

Table 9.6 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

Step 3: Determine the Site-Specific Mitigation

9.29 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

9.30 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. Experience indicates that once mitigation measures are applied, in most cases the dust effects will be reduced to negligible levels.

Step 5: Prepare a Dust Assessment Report

9.31 The last step of the assessment is the preparation of a Dust Assessment Report which is covered within this report.

Assessment Methodology for Operational Effects

9.32 Operational air quality impacts from the Proposed Development arise principally as a result of traffic changes along the local road network and emissions from any on-site gas boilers and CHP units. Effects of traffic generated by the development and emissions from the gas boilers and CHP units have been assessed using the ADMS-Roads atmospheric dispersion model. The assessment follows the methodology set out in Defra's Local Air Quality Management Technical Guidance (LAQM TG(09))¹⁰.

9.33 Emissions from the Aquatics Centre energy provision, which is located adjacent to the MECD site, have also been modelled and the impact of these emissions on the MECD buildings has been assessed by modelling at future on-site buildings. While the impact of the Aquatics Centre energy provision is included in the

¹⁰ Defra, Local Air Quality Management Technical Guidance (TG09), 2009

background concentrations, the gridded background concentrations smooth out, and in this case, underestimate, the impact on the Proposed Development.

- 9.34 Box 1.4 of IAQM TG(0.9) defines where the air quality objectives should apply. The Proposed Development is not a sensitive receptor in respect of the annual mean objectives. It is a sensitive receptor in respect of the hourly mean NO₂ objective for the students and members of the public who may be on the site for time periods of an hour or more and therefore may be exposed to pollutant concentrations which exceed the short term averaging period of one hour. It is likely that emissions from the Aquatics Centre will impact pollutant concentrations at the MECD due to its proximity. As such, emissions from this source have been included in all modelling scenarios and on-site receptor locations have been assessed against short-term air quality objectives.
- 9.35 An assessment of road traffic emissions is required as there is a maximum increase in AADT of 111 predicted to be generated as a result of the scheme. This is more than the 100 AADT threshold outlined in the EPUK and IAQM Guidance¹¹ when the development is located within an AQMA as MECD is. It should be noted that the Proposed Development marginally exceeds the trips criteria below which the impact is considered insignificant.
- 9.36 Pollutant concentrations are forecast at locations that are close to the Proposed Development and the surrounding road network affected by the development. The model calculates one-hour average concentrations with results processed to calculate the annual mean concentration for comparison with the air quality standards. The following sections detail the inputs and processes used in this assessment.

Road Traffic Emissions

Assessment Scenarios

- 9.37 The assessment scenarios are as follows:

- 2014 baseline scenario;
- 2016 opening year Do-Minimum (DM) scenario; and,
- 2016 opening year Do-Something (DS) scenario.

- 9.38 The 2016 DM scenario represents the opening year scenario without the Proposed Development, while the 2016 DS scenario represents the opening year scenario (DM) including the impacts of any currently consented schemes plus traffic associated with the Proposed Development in place.

Assessment Extents

- 9.39 A desk-top study was undertaken in order to identify sensitive receptor locations in the vicinity of the site that required specific consideration during the assessment. These are summarised in Table 9.7. 'Ground' level receptor height was selected to be representative of the lowest point of human exposure, with residential properties above retail units taken into consideration. In order to assess fully the gas boiler and CHP unit emissions (further details below), the highest point of the residential unit was also assessed and a 400m by 400m grid with a resolution of 4m was modelled to produce data for contour map plotting in GIS.

Table 9.7 Off-Site Sensitive Receptors

Receptor		NGR (m)		
		X	Y	Z (m)
1	Oxford Road/Grosvenor Street (ground)	384357	397104	4.5

¹¹ EPUK & IAQM, Land-Use Planning & Development Control: Planning For Air Quality, 2015.

2	Oxford Road north (ground)	384330	397156	4.5
3	York Street (ground)	384424	397087	4.5
4	Grosvenor Street (ground)	384432	397133	4.5
5	Grosvenor Street east (ground)	384511	397174	4.5
6	Oxford Road south (ground)	384390	396981	1.5
7	Booth Street East (ground)	384516	396892	1.5
8	Oxford Road /Grosvenor Street	384357	397104	15
9	Oxford Road north	384330	397156	9
10	York Street	384424	397087	15
11	Grosvenor Street	384432	397133	9
12	Grosvenor Street east	384511	397174	9
13	Oxford Road south	384390	396981	12
14	Booth Street East	384516	396892	21

9.40 Additionally, as explained in paragraph 9.33, on-site receptors have been assessed against short-term air quality objectives at multiple floor heights as outlined in Table 9.8. The on-site receptors are located at future buildings.

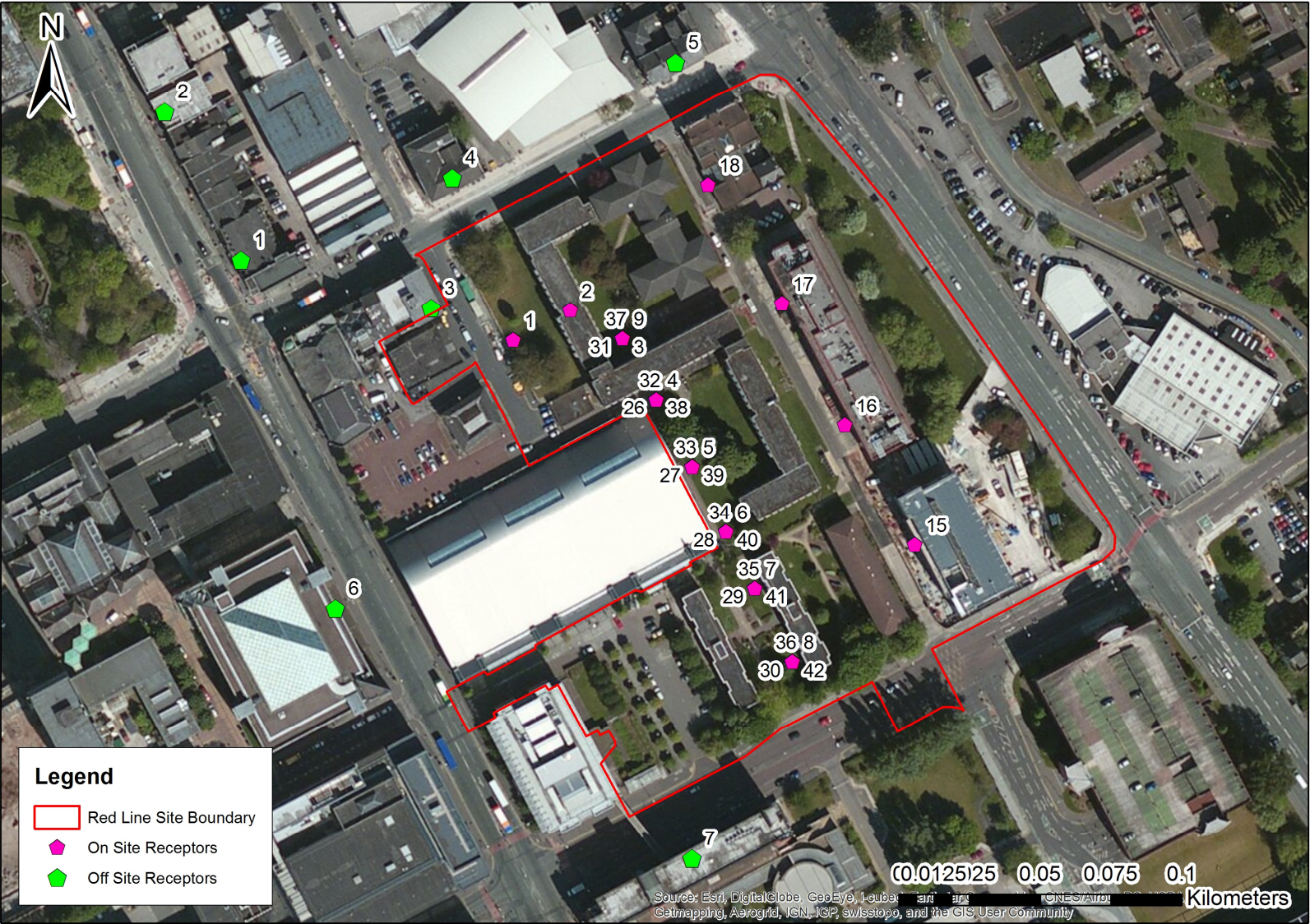
Table 9.8 On-Site Sensitive Receptors

	Receptor	NGR (m)		Z (m)
		X	Y	
1	York Street Building	384453	397076	14.2
2	York Street Building	384473	397087	14.2
3	Building A - Roof	384492	397076	37.8
4	Building A - Roof	384504	397055	37.8
5	Building A - Roof	384516	397031	37.8
6	Building A - Roof	384528	397008	37.8
7	Building A - Roof	384539	396988	37.8

8	Building A - Roof	384552	396962	37.8
9	Building A - Level 7	384492	397076	31.5
10	Building A - Level 7	384504	397055	31.5
11	Building A - Level 7	384516	397031	31.5
12	Building A - Level 7	384528	397008	31.5
13	Building A - Level 7	384539	396988	31.5
14	Building A - Level 7	384552	396962	31.5
15	Building D	384595	397003	19.5
16	Building C	384570	397046	17.0
17	Building C	384548	397089	17.0
18	Building B	384522	397131	17.5
19	Building A - Level 6	384492	397076	27.0
20	Building A - Level 6	384504	397055	27.0
21	Building A - Level 6	384516	397031	27.0
22	Building A - Level 6	384528	397008	27.0
23	Building A - Level 6	384539	396988	27.0
24	Building A - Level 6	384552	396962	27.0
25	Building A - Level 5	384492	397076	22.5
26	Building A - Level 5	384504	397055	22.5
27	Building A - Level 5	384516	397031	22.5
28	Building A - Level 5	384528	397008	22.5
29	Building A - Level 5	384539	396988	22.5
30	Building A - Level 5	384552	396962	22.5
31	Building A - Level 4	384492	397076	18.0
32	Building A - Level 4	384504	397055	18.0

33	Building A - Level 4	384516	397031	18.0
34	Building A - Level 4	384528	397008	18.0
35	Building A - Level 4	384539	396988	18.0
36	Building A - Level 4	384552	396962	18.0
37	Building A - Level 3	384492	397076	13.5
38	Building A - Level 3	384504	397055	13.5
39	Building A - Level 3	384516	397031	13.5
40	Building A - Level 3	384528	397008	13.5
41	Building A - Level 3	384539	396988	13.5
42	Building A - Level 3	3845 52	396962	13.5

Figure 9.2 Receptor Locations



Traffic Data

- 9.41 The traffic data for all scenarios was provided by Arup, the transport consultants for the project. The data consisted of 24-hour Annual Average Daily Traffic (AADT) flows and the percentage of Heavy Duty Vehicles (HDVs) on each road link.
- 9.42 Emission rates for all road sources were calculated using the UK Defra Emissions Factor Toolkit (EFT) v6.0.2¹². It should be noted that 2014 emissions were used for both the baseline and future year scenarios. This provides a worst-case assessment as, although vehicle emissions are predicted to improve in the future due to technological advancements, recent information suggests the improvements are not being realised on the timescales foreseen.
- 9.43 Speeds were reduced close to junctions following the Defra TG.09 guidance. Traffic data for the model road network is given in Table 9.9 and the location of these roads shown in Figure 9.3.

Table 9.9 Traffic Data

Road Link		Base 2014		DM 2016		DS		Speed (km/h)
		AADT	HGV %	AADT	HGV %	AADT	HGV %	
1	Oxford Road	14,054	27.2	5,694	28.0	5,805	28.2	16
2	Grosvenor Street	9,820	3.1	1,452	2.0	1,563	2.3	16
3	Sidney Street	103	-	30	-	30	-	16
4	Grosvenor Street	9,717	3.2	1,444	2.0	1,555	2.3	10
5	Grosvenor Street	9,717	3.2	1,444	2.0	1,555	2.3	40
6	Grosvenor Street	9,717	3.2	1,444	2.0	1,555	2.3	10
7	Grosvenor Street	4,440	1.4	4,588	1.8	4,588	1.8	8
8	Upper Brook Street	20,011	1.9	22,482	4.4	22,533	4.5	24
9	Upper Brook Street	23,684	2.8	25,515	5.0	25,575	5.1	48
10	Upper Brook Street	23,684	2.8	25,515	5.0	25,575	5.1	10
11	Upper Brook Street	31,308	2.4	34,640	4.8	34,700	4.9	10
12	Upper Brook Street	31,308	2.4	34,640	4.8	34,700	4.9	40
13	Oxford Road	13,509	26.4	4,264	27.7	4,264	27.7	10
14	Oxford Road	13,509	26.4	4,264	27.7	4,264	27.7	32
15	Oxford Road	13,509	26.4	4,264	27.7	4,264	27.7	10

¹² Defra, Emissions Factor Toolkit for Vehicle Emissions, Available from: <http://laqm.defra.gov.uk> [Accessed: December 2014]

16	Booth Street West	15,421	4.8	13,191	8.6	13,191	8.6	8
17	Oxford Road	11,803	24.5	3,822	25.8	3,822	25.8	10
18	Oxford Road	11,803	24.5	3,822	25.8	3,822	25.8	48
19	Booth Street East	11,234	0.4	12,180	4.4	12,180	4.4	10
20	Booth Street East	11,234	0.4	12,180	4.4	12,180	4.4	24
21	Booth Street East	11,234	0.4	12,180	4.4	12,180	4.4	10
22	Side Road	13,746	0.3	11,967	2.5	11,967	2.5	32
23	Booth Street East	10,673	0.7	12,559	5.0	12,559	5.0	8
24	Oxford Road	11,803	24.5	3,822	25.8	3,822	25.8	48

Legend

- Red Line Site Boundary
- Modelled Roads
- Building A
- MECD Stack
- Aquatics Centre Stack
- Aquatics Centre
- Modelled buildings

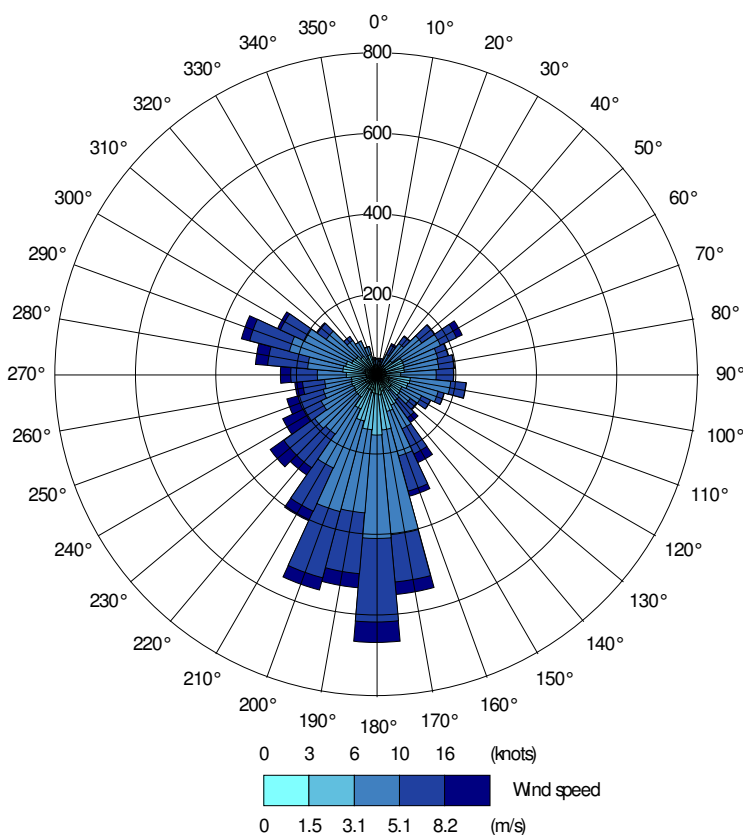
Source: Esri, DigitalGlobe, GeoEye, iSatellite, IGN, CNR, SVAirbus, USDA, AeroGRID, IGN, IGP, Swisstopo, Mapbox, OpenStreetMap contributors, and the GIS user community

0.00 0.015 0.03 0.06 0.09 0.12
Kilometers

Meteorological Data

- 9.44 Meteorological data used in this assessment was measured Manchester Airport meteorological station over the period 1st January 2014 to 31st December 2014 (inclusive). Manchester Airport is located at National Grid Reference: 382264, 384618, which is approximately 13km south of the Proposed Development. Defra guidance LAQM.TG(09) recommends meteorological stations within 30km of an assessment area as being suitable for detailed modelling. Figure 9.4 shows the wind rose derived from this data. This shows the predominantly southerly winds which are typical of data from Manchester Airport and reflects the influence of terrain on the wind direction.

Figure 9.4 Wind Rose for Manchester Airport, 2014



Other Model Parameters

- 9.45 The extent of mechanical turbulence (and hence, mixing) in the atmosphere is affected by the surface/ground over which the air is passing. Typical surface roughness values range from 1.5m (for cities, forests and industrial areas) to 0.0001m (for water or sandy deserts). In this assessment, the general land use in the local study area can be described as “cities, woodlands” with a corresponding surface roughness of 1m.
- 9.46 Another model parameter is the minimum Monin-Obukhov length, which describes to what extent the minimum stability of the atmosphere is limited due to the urban heat island effect. Typical values range from 2m to 10m for rural areas. In urban areas, where traffic and buildings cause the generation of more heat and mixing, these values are higher. For this model, a length of 30m was used representing ‘cities, large towns’ in ADMS Roads and ‘urban and industrial’ in ADMS 5.

Model Verification

- 9.47 Model verification refers to the comparison of modelled pollutant concentrations with measured concentrations at the same points to determine the performance of the model. There are number of uncertainties in both air quality monitoring and modelling therefore the process of verification is undertaken to ensure modelled results are robust and reflect reality. Should the model results for NO₂ be largely within $\pm 25\%$ of the measured values and there is no systematic over or under-prediction of concentrations, then no adjustment is necessary according to Defra's TG.09 guidance. If this is not the case, then the modelled values are adjusted based on the observed relationship between modelling and measured NO_x and PM₁₀ concentrations to provide a better agreement.
- 9.48 The Oxford Road continuous monitor is located approximately 270m to the north of the site. This has not been used for model verification because it is a kerbside site and TG.09 states that "Kerbside sites are not recommended for the adjustment of road traffic modelling results as the inclusion of these sites may lead to an over-adjustment of modelling at roadside sites"¹³.
- 9.49 As there are no suitable monitoring sites located in the vicinity of the development, model verification has not been possible for this assessment.

Gas Boiler and CHP Unit Emissions

- 9.50 Emissions associated with the gas boilers and CHP units have the potential to cause increases in pollutant concentrations in the vicinity of the site. These have been quantified through dispersion modelling in accordance with the methodology outlined in the following sections. It should be noted that the assessment extents, model parameters and meteorological data outlined above for the road traffic modelling, are the same as for the gas boilers and CHP units dispersion modelling.
- 9.51 It is proposed to install three 358kW thermal output CHP units and twelve 750kWth gas fired boilers.
- 9.52 An industry standard atmospheric dispersion model (ADMS), was used to calculate resulting concentrations of NO₂. It should be noted that emissions of PM₁₀ are negligible from gas boilers and natural gas CHPs and as such, were not included in the model. The modelling procedure was as follows:
- Information on stack dimensions and position, as well as boiler operating conditions and profile, were obtained from Arup;
 - Appropriate data to describe meteorological conditions in the vicinity of the site was obtained from Atmospheric Dispersion Modelling (ADM) Ltd;
 - A receptor grid of sensitive locations was identified in the vicinity of the installation using digital mapping;
 - 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 results interpretation was based on the highest modelled concentration at any specified sensitive receptor location; and
 - The study results were compared with the relevant assessment criteria.

Dispersion Model

- 9.53 Detailed dispersion modelling of NO_x and PM₁₀ emissions was undertaken using ADMS-Roads atmospheric dispersion model from Cambridge Environmental Research Consultants (CERC).

Building Effects

- 9.54 Buildings can have a significant effect on the dispersion of pollutants, particularly if they are at least 30-40% of the height of the stack. 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

¹³ Defra, Local Air Quality Management Technical Guidance (TG09), 2009

expected in the absence of buildings and can affect the dispersion of pollutants in the atmosphere. The building downwash and entrenchment effects are taken into account by the ADMS 5 dispersion model.

- 9.55 Analysis of the site layout indicated that a number of buildings should be included within the model in order to take account of effects on pollutant dispersion. Building input geometries are shown in Table 9.10.

Table 9.10 Building Geometries

Building	NGR (m)		Height (m)	Length (m)	Width (m)	Angle (°) ¹⁴
	X	Y				
Building A	384532	397048	37.5	195	44	153
Building B	384536	397143	20.5	32	37	153
Building C	384574	397083	20	77	40	153
Building D	384609	397003	22.5	47	24	153
York Street Building	384455	397097	17.2	36	29	153

- 9.56 A building sensitivity test was undertaken for the DS scenario in order to analyse deficiencies in the model which combines data from multiple buildings to make one effective building which is modelled. The details of a complex site are therefore not well represented by the model. The building sensitivity test showed that the exclusion of all buildings apart from building A was the realistic scenario which gave the worst case results. As such, the DS assessment only included building A, the location of which is shown in Figure 9.3 and the base and DM models included the Aquatics Centre building as the MECD buildings will not be operational in this scenario.

Process Conditions

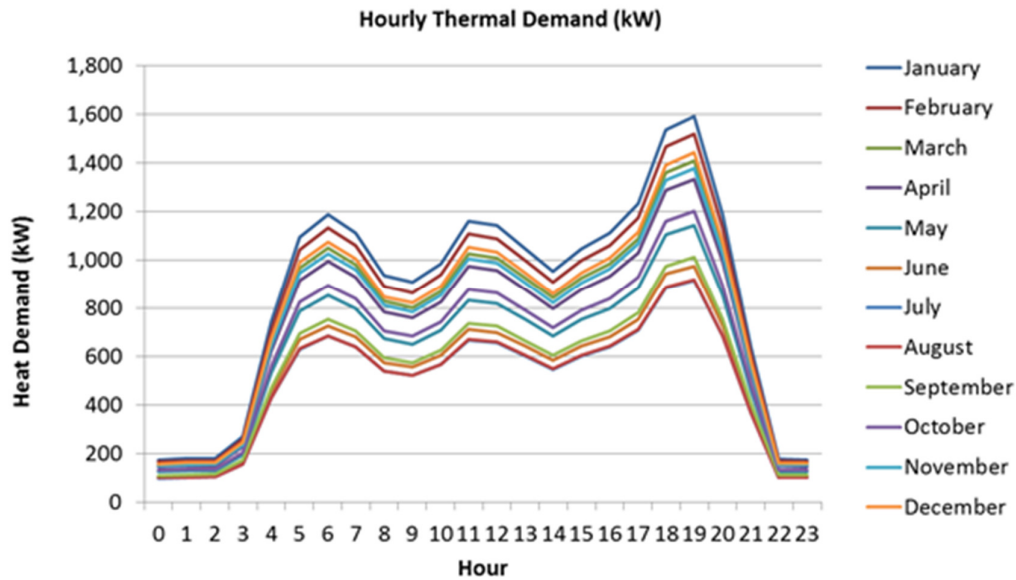
- 9.57 The current design of the development proposes the installation of three 358kW thermal output CHP units and twelve 750kWth gas fired boilers. The Aquatics Centre energy centre comprises two Hoval ST-Plus boilers (one 1.5MW thermal input, one 3MW thermal input) and one combined heat and power plant (CHP) of 428kWnominal heat output. The 1.5MW thermal boiler is a back-up and will only run if the 3MW boiler is not operational and therefore emissions from this have not been included in the model.

- 9.58 Emissions presented in this assessment are based on:

- The MECD CHP units and boilers being fully operational at full load for 24 hours a day, 52 weeks a year;
- The exclusion of the Aquatics Centre CHP unit as this is not operational at any time;
- One of the Aquatics Centre gas boilers operating at less than full load, up to approximately 60% load, on a diurnal profile provided by Arup. This diurnal profile has been included in the model through use of a time varying emission file based on the load profile outlined in Figure 9.5.

¹⁴ In ADMS 5, the 'angle' of building is defined as the angle between north and the previously defined length, measured clockwise from north.

Figure 9.5 Aquatics Centre Boiler Load Profile



9.59 Additional modelling has been undertaken which includes the Aquatics Centre CHP unit. Emissions presented in this additional modelling are based on both the MECD and Aquatics Centre CHP units and boilers being operational at full load for 16 hours a day, 52 weeks a year. The assumptions of operation at full load and for 52 weeks are conservative (pessimistic) assumptions as the plant will not operate during annual maintenance which may be several weeks. These results are detailed in Appendix 9.1.

9.60 The location of the stacks are shown in Figure 9.3.

9.61 Stack and emission parameters for the gas boilers and CHP anticipated to be installed at the development have been provided by Arup. Parameters used within the model are presented in Table 9.11. It should be noted that subsequent to this assessment being undertaken, the design of the MECD energy centre has been amended and includes two CHP units rather than three. This will reduce energy emissions from the development. The results presented in Identification and Evaluation of Significant Effects section include the emissions from three CHP units, rather than two and as such are worst case.

9.62 The fuel type for the gas boilers and CHP is natural gas, therefore there are no significant emissions of PM₁₀ expected.

Table 9.11 Process Conditions

Parameter	Unit	MECD					Aquatics Centre		
		Gas Boiler		CHP			CHP Boiler	Gas Boiler 1	Gas Boiler 2
Boiler capacity	kW	750		358 (thermal output)			955 (gross thermal input)	3,000	1,500
Stack location	NGR (X, Y)	384451, 397076	384452, 397076	384451, 397090	384455, 397092	384458, 397094	384516, 397000	384515, 397000	384515, 397001
Stack diameter	m	7		0.2			0.35	0.55	0.45
Flue gas efflux velocity	m/s	4.6		8.4			6.3	8.4	6.3
Temperature	°C	82		120			70	200	200
Stack height	m	20.2		20.2			27	27	27
Number of engines	-	12		3			1	1	1
Total NO _x emission rate	g/s	0.09475		0.02721			0.1502	0.1374	0.0687

Processing of Results

NO_x to NO₂

- 9.63 The model predicts NO_x concentrations which comprise nitrogen oxide (NO) and nitrogen dioxide (NO₂). NO_x is emitted from combustion processes, primarily as NO with a small percentage of NO₂. The emitted NO reacts with oxidants in the air (mainly ozone) to form NO₂. NO₂ is associated with effects on human health and therefore the air quality standards for the protection of human health are based on NO₂ rather than total NO_x or NO. Suitable NO_x:NO₂ conversion factors have been applied to the modelled NO_x concentrations from energy emissions in order to determine the impact of the NO_x emissions on ambient concentrations of NO₂. This assessment has followed the advice from the Environment Agency¹⁵ which recommends a tiered approach of: screening scenario, worst case scenario and case-specific scenario. For the worst case scenario the Environment Agency recommends conversion factors of 70% for long term average and 35% for short term average concentrations and these have been used for the off-site-receptors. For the on-site receptors, at which only the short-term air quality objective is relevant, the case-specific approach has been used. The on-site receptors are extremely close to the gas boilers' and CHP's stack exhausts, so a 10% conversion rate has been used as a realistic but still pessimistic conversion rate. The stack emissions are likely to contain 5% NO₂ and conversion NO_x to NO₂ in the plume will occur with time and distance¹⁶.
- 9.64 The Defra NO_x to NO₂ calculator has been used in the processing of annual PM₁₀ and NO₂ road traffic results.

Fume Cupboard

- 9.65 Emissions from the fume cupboards that are proposed as part of the development have been reviewed and their performance assessed against the relevant standard. Details of the fume cupboards are provided in the Identification and Evaluation of Significant Effects section.

Assessment of Significance

- 9.66 The method for the assessment of significance during the construction phase of the Proposed Development is outlined in the assessment methodology for construction effects section of this report.
- 9.67 The 2015 EPUK/IAQM guidance note 'Land-Use Planning & Development Control' provides an approach to determining the air quality impacts resulting from the operation of a Proposed Development on local air quality at individual receptors and the overall significance of local air quality effects arising from a Proposed Development.
- 9.68 Firstly, impact descriptors are determined based on the magnitude of incremental change as a proportion of the relevant assessment level, in this instance the relevant annual mean air quality objectives, at each of the assessed receptors. The change is then examined in relation to the predicted total pollutant concentrations in the assessment year and its relationship with the relevant annual mean air quality objective. Where there is a decrease in pollutant concentrations as a result of the Proposed Development predicted total pollutant concentration in the 'without development' scenario should be considered, where there is an increase the predicted total pollutant concentration in the 'with development' scenario should be considered.
- 9.69 The assessment framework for determining impact descriptors at each of the assessed receptors is shown in Table 9.12.

Table 9.12 Impact Descriptors

¹⁵ Environment Agency, Air Quality Modelling and Assessment Unit, Conversion ratios for NO_x and NO₂

¹⁶ https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/290985/scho0907bnhi-e-e.pdf

Annual average concentrations at receptor in the assessment year	% Change in concentrations relative to annual mean NO ₂ and PM ₁₀ 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% or more of objective	Moderate	Substantial	Substantial	Substantial
Note: Changes in pollutant concentrations of less than 0% i.e. <0.5% would be described as negligible.				

9.70 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 be 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.

9.71 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.

Assumptions and Limitations

9.72 In the course of undertaking this assessment, no limitations to the assessment process were encountered. Assumptions have been made regarding the number of construction HDV movements to and from the site per day during the construction phase, based on previous experience.

Baseline Conditions

Sources of Air Pollution

Industrial Processes

9.73 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. The larger more polluting processes are regulated by the Environment Agency (EA) and the smaller less polluting ones by the local authorities. Local authorities tend also to regulate only for emissions to air whereas the EA regulates emissions to air, water and land.

9.74 There are two Part A process within 2km of the development site listed on the EA website that have relevant emissions to air. Details are shown in Table 9.13. Due to the distance between the sites, it is considered unlikely that emissions from these sources will impact pollutant concentrations at the Proposed Development.

Table 9.13 Part A Processes within 2km of the Development

Site	Grid reference		Distance (direction) from Site
	X	Y	
Heineken UK Ltd	383944	395936	1.1km (south-west)
Ondeo Industrial Solutions Limited	383944	395936	1.1km (south-west)

9.75 Part B processes are regulated and reviewed by MCC and, given the nature of these processes, are unlikely to significantly affect ambient air quality in the vicinity of the Proposed Development.

9.76 Emissions from these sources will be included within the existing baseline at the Proposed Development site.

Road Traffic

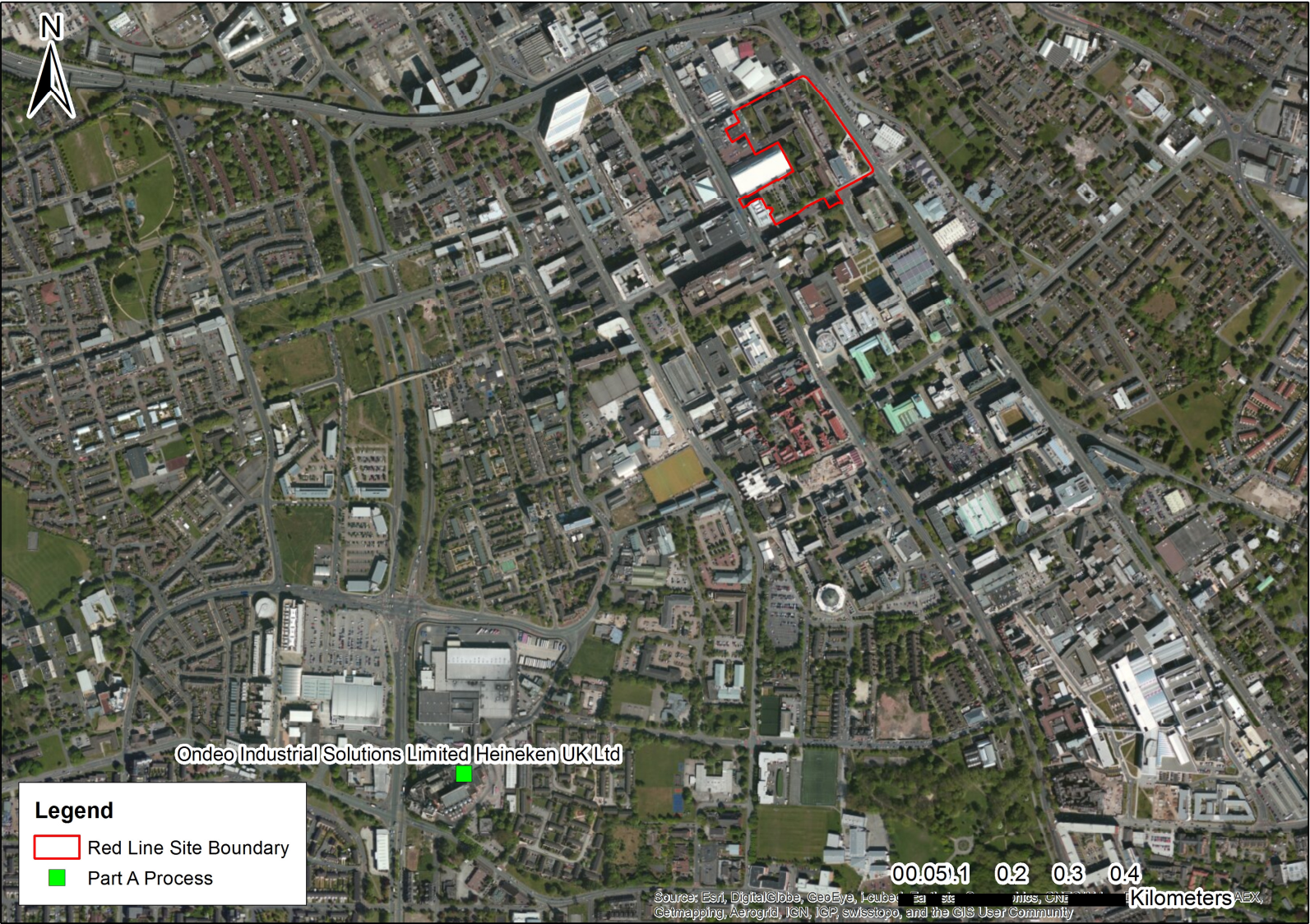
9.77 In recent decades, transport atmospheric emissions on a national basis have grown to match or exceed other sources in respect of many pollutants, particularly in urban areas. Vehicle emissions are likely to be the dominant source of air pollutants in the vicinity of the Proposed Development site.

9.78 Road traffic emissions from road links in the vicinity of the development have been assessed through dispersion modelling in the operational phase assessment. Modelled road links include:

- Upper Brook Street;
- Oxford Road;
- Grosvenor Street; and,
- Booth Street East.

9.79 Traffic data for these roads are given in Table 9.9.

Figure 9.6 Part A Processes within 2km



Local Air Quality

- 9.80 As discussed in Legislative and Policy Context section, 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 (USA) of their area every three years. If the USA identifies potential hotspot areas likely to exceed air quality objectives, then a 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 (AQAP) which includes measures to improve air quality within the AQMA.
- 9.81 The Proposed Development is located in the Manchester Air Quality Management Area (AQMA) declared in 2007 due to exceedences of the annual mean nitrogen dioxide (NO₂) objective. The AQMA is described as the “an area covering Manchester City Centre, the area around Manchester Airport and the main arterial traffic routes in the city.” which includes Booth Street East, where the Proposed Development is situated.

Local Monitoring

- 9.82 MCC undertakes both continuous and passive monitoring in the city. A review of the most recent LAQM report¹⁷ indicated that there are two continuous monitors in the vicinity of the Proposed Development. Details and recent monitoring results are shown in Table 9.14. Exceedences are highlighted in **bold**.

Table 9.14 Annual Mean Automatic Monitoring Results

Monitoring site	Distance (direction) to development	NO ₂ Concentration (µg/m ³)			PM ₁₀ Concentration (µg/m ³)		
		2012	2013	2014	2012	2013	2014
Manchester Oxford Road (Kerbisde)	270m (north-west)	107	88	98	30	31	28
Manchester Piccadilly (Urban centre)	1.2km (north)	40.9	38.8	40.5	-	-	-
Air Quality Objective		40			40		

- 9.83 As indicated, the relevant air quality objective has been exceeded at both the automatic monitoring locations in the vicinity of the site in recent years even at Manchester Piccadilly which is an urban background site.
- 9.84 There are no diffusion tube monitoring sites located within 1km of the Proposed Development.

Background Concentrations

- 9.85 Predicted background concentrations have been taken from the Defra maps and are presented in Table 9.15 for the grid square in which the development is located, for 2015 (baseline assessment year and current year). Background concentrations are below the air quality standards for both NO₂ and PM₁₀.

¹⁷ 2014 Air Quality Progress Report, City of York Council, 2014.

Table 9.15 Predicted background pollutant concentrations

OS Grid square		2015 Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)		
X	Y	NO _x	NO ₂	PM ₁₀
384500	397500	53.3	34.1	19.1
Air Quality Objective		-	40	40

- 9.86 The background concentrations from the Defra maps for NO₂ and PM₁₀ are predicted to achieve the relevant air quality objectives.

Identification and Evaluation of Significant Effects

Construction

- 9.87 The site of the Proposed Development covers an area of approximately 3.34ha and is comprised of existing university buildings.

Need for Assessment

- 9.88 An assessment is required due to the presence of sensitive receptors within 350m of the Proposed Development site and within 50m of the trackout routes as mentioned in the assessment methodology for construction effects section. There are no ecological designated sites sensitive to dust within 50m of the site and so this element of the assessment is not considered further.

Sensitive Receptors

- 9.89 Human receptors are defined as those residential 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. There are sensitive receptors located within 350m of the site boundary within 20m, 50m, 100m and 350m buffers of the site boundary (Figure 9.7). These are residential dwellings. Receptor sensitivity to dust soiling and PM₁₀ exposure has been classified as *high* according to the IAQM guidance. It should be noted that the Aquatics Centre is not classed as a sensitive receptor as it is a leisure centre facility not a residential property, school or hospital.
- 9.90 The sensitivity of the area to dust soiling and human health effects during the construction phase has been determined by identifying the number of receptors within 20m of the site boundary, the sensitivity of the area to human health effects also considered background PM₁₀ concentrations, which as shown in Table 9.15 are below the 24 $\mu\text{g}/\text{m}^3$ criterion presented in the IAQM guidance.

Table 9.16 Sensitivity of the Area

Activity	Sensitivity of the surrounding area			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	Medium	Medium	Medium	Medium
Human health	Low	Low	Low	Low

Dust Emission Magnitude

9.91 Following the methodology and criteria outlined in the construction assessment methodology section, each dust-generating activity has been assigned a dust emission magnitude as shown in Table 9.17. For earthworks, it has been assumed that these will occur in the whole site area as a worst case assumption. For trackout, it has been assumed that construction vehicles will use Oxford Road and Upper Brook Street from the north and south and Booth Street East and West to access the site.

Table 9.17 Dust Emission Magnitude for Construction Activities

Activity	Dust emission magnitude	Reasoning
Demolition	Large	➤ total building volume >50,000m³ ➤ potentially dusty construction material (e.g. concrete)
Earthworks	Large	➤ total site area >10,000m²
Construction	Large	➤ total building volume >100,000m³
Trackout	Large	➤ unpaved road length >100m

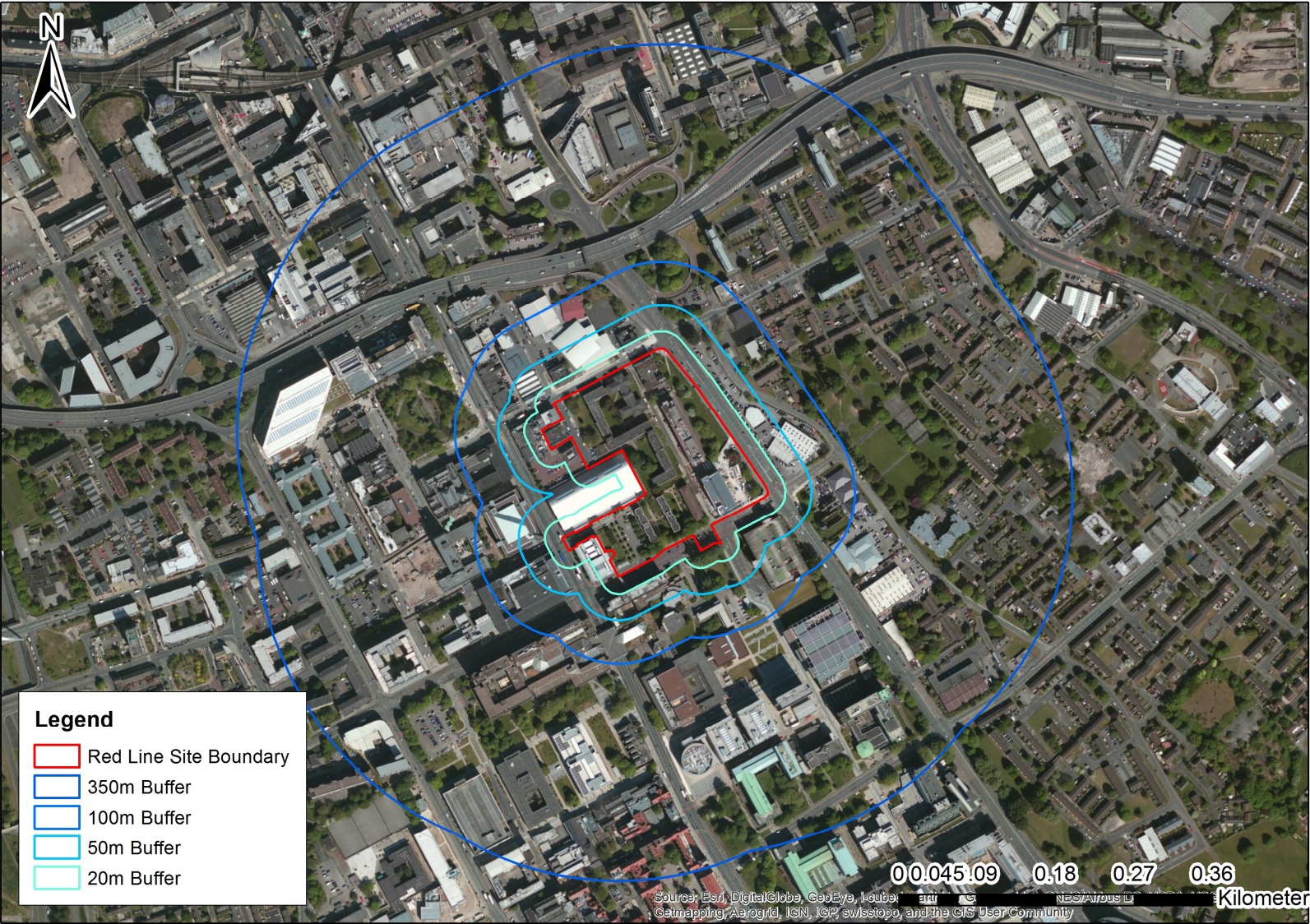
Risk of Impacts

9.92 Taking into consideration the dust emission magnitude and the sensitivity of the area, the site has been classified as high risk to dust soiling and medium risk to human health for all activities at worst (Table 9.18). Specific mitigation is described in the section below.

Table 9.18 Summary Dust Risk Table Prior to Mitigation

Activity	Dust Soiling	Human Health Risk
Demolition	High	Medium
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Medium	Low

Figure 9.7 Construction Dust Buffers



Operation – Off-Site Results

Road Traffic and Gas boiler and CHP unit Emissions – Nitrogen Dioxide

9.93 Dispersion modelling was undertaken of the road traffic, gas boilers and CHP units emissions. This includes traffic from committed developments. It should be noted that emissions from the Aquatics Centre CHP units and gas boilers have been included in all modelled scenarios. Predicted annual mean NO₂ concentrations at the identified receptor locations are summarised in Table 9.19, exceedences of the annual mean objective are highlighted in **bold**.

Table 9.19 Off-Site Predicted NO₂ concentrations

	Receptor	Hourly mean NO ₂ (99.8 th percentile) DS*	Annual Mean NO ₂ (µg/m ³)**			Impact descriptor Annual Mean
			Base	DM	DS	
1	Oxford Road/Grosvenor Street (ground)	99.6	44.8	43.3	43.4	Negligible
2	Oxford Road north (ground)	99.5	44.0	43.0	43.0	Negligible
3	York Street (ground)	103.5	38.6	37.8	38.1	Slight adverse
4	Grosvenor Street (ground)	106.4	39.1	37.6	37.9	Negligible
5	Grosvenor Street east (ground)	119.4	38.5	37.5	38.1	Slight adverse
6	Oxford Road south (ground)	102.7	33.5	32.6	32.8	Negligible
7	Booth Street East (ground)	81.5	30.1	30.7	30.7	Negligible
8	Oxford Road /Grosvenor Street	79.5	35.9	35.7	35.8	Negligible
9	Oxford Road north	84.7	38.5	38.1	38.1	Negligible
10	York Street	101.9	36.2	36.0	36.3	Negligible
11	Grosvenor Street	104.4	37.3	36.8	37.1	Negligible
12	Grosvenor Street east	118.8	36.8	36.5	37.1	Negligible
13	Oxford Road south	75.3	27.0	27.0	27.2	Negligible
14	Booth Street East	62.6	25.6	25.6	25.6	Negligible

* Air Quality Objective: 200µg/m³ not to be exceeded more than 18 times a year (99.8th percentile)

** Air Quality Objective: 40 µg/m³

9.94 As indicated in Table 9.19, the predicted impact of annual mean NO₂ concentrations is slight adverse at two receptors and negligible at the remaining locations. The slight adverse impact is due to increases of 0.3µg/m³ and 0.6µg/m³ in predicted concentrations at R3 and R5. Concentrations are below the air quality

objective in all scenarios at these two receptor locations. The relevant air quality limit value is predicted to be exceeded at R1 and R2, however, these exceedences exist in the base and DM scenarios as well as the DS scenario. As stated in the Assessment Methodology of Operational Effects section, the modelling includes emissions from three CHP units, rather than two and as such the results presented in Table 9.19 are worst case.

- 9.95 Overall the scheme's impact on air quality is judged to be not significant. At R3 and R5 where slight adverse impacts are predicted, the future year concentrations with the development in place are lower than the baseline concentration, which is below the air quality objective. The two exceedences predicted in the DS scenario are also present in the base and DM scenario which means the development is not responsible for any new exceedences. Considering the scheme as a whole the impacts negligible at the majority of receptor locations as such the scheme is considered to be not significant.
- 9.96 The hourly mean NO₂ objective is predicted to be met at all receptor locations. Therefore, the significance of the gas boiler and CHP unit will be negligible for hourly mean NO₂ concentrations at all assessed receptors.

Road Traffic Emissions – Particulate Matter

- 9.97 To determine PM₁₀ concentrations, dispersion modelling was undertaken of the road traffic emissions. Predicted annual mean PM₁₀ concentrations at the identified receptor locations are summarised in Table 9.20. It should be noted that due to the nature of operation, there are no PM₁₀ emissions from the gas boiler and CHP unit.

Table 9.20 Predicted PM₁₀ concentrations

	Receptor	Annual Mean PM ₁₀ (µg/m ³)*			Impact descriptor Annual Mean
		Base	DM	DS	
1	Oxford Street/Grosvenor Street	20.0	19.7	19.7	Negligible
2	Oxford Street north	19.9	19.7	19.7	Negligible
3	York Street	19.6	19.4	19.4	Negligible
4	Grosvenor Street	19.6	19.4	19.4	Negligible
5	Grosvenor Street east	19.6	19.5	19.5	Negligible
6	Oxford Street south	16.9	16.7	16.7	Negligible
7	Booth Street East	16.7	16.7	16.7	Negligible
8	Oxford Street/Grosvenor Street (ground)	19.3	19.3	19.3	Negligible
9	Oxford Street north (ground)	19.5	19.4	19.4	Negligible
10	York Street (ground)	19.3	19.3	19.3	Negligible
11	Grosvenor Street (ground)	19.4	19.3	19.3	Negligible
12	Grosvenor Street east (ground)	19.4	19.4	19.4	Negligible

13	Oxford Street south (ground)	16.3	16.3	16.3	Negligible
14	Booth Street East (ground)	16.2	16.2	16.2	Negligible

9.98 As indicated in Table 9.20, there are no exceedences of the PM₁₀ air quality objective predicted. The predicted magnitude of change of annual mean PM₁₀ concentrations is predicted to be negligible at all.

Operation – On-Site Results

9.99 Dispersion modelling was undertaken of the road traffic, gas boilers and CHP units emissions, as well as the Aquatics Centre boilers and CHP unit emissions. Short term concentrations were modelled at on-site receptor locations and results are summarised in Table 9.19 using a 10% NO_x to NO₂ conversion rate as outlined above.

Table 9.21 On-Site Predicted NO₂ concentrations

Receptor		No. of exceedences of 200µg/m ³ - 10% Nox to NO ₂ conversion rate
1	York Street Building	0
2	York Street Building	0
3	Building A - Roof	0
4	Building A - Roof	0
5	Building A - Roof	0
6	Building A - Roof	0
7	Building A - Roof	0
8	Building A - Roof	0
9	Building A - Level 7	0
10	Building A - Level 7	0
11	Building A - Level 7	0
12	Building A - Level 7	0
13	Building A - Level 7	0
14	Building A - Level 7	0
15	Building D	0
16	Building C	0
17	Building C	0
18	Building B	0
19	Building A - Level 6	0
20	Building A - Level 6	0
21	Building A - Level 6	0
22	Building A - Level 6	0
23	Building A - Level 6	0

24	Building A - Level 6	0
25	Building A - Level 5	0
26	Building A - Level 5	0
27	Building A - Level 5	0
28	Building A - Level 5	0
29	Building A - Level 5	0
30	Building A - Level 5	0
31	Building A - Level 4	0
32	Building A - Level 4	0
33	Building A - Level 4	0
34	Building A - Level 4	0
35	Building A - Level 4	0
36	Building A - Level 4	0
37	Building A - Level 3	0
38	Building A - Level 3	0
39	Building A - Level 3	0
40	Building A - Level 3	0
41	Building A - Level 3	0
42	Building A - Level 3	0

9.100 As shown in Table 9.19, no exceedences of the short term air quality objective are predicted using the Environment Agency's case-specific conversion rate approach. A 10% conversion was used due to the proximity of the on-site receptors to the stack exhausts which are likely to contain 5% NO₂. A conversion rate of 10% is a realistic, but still pessimistic, conversion rate for these receptors.

9.101 Figure 9.8 shows a contour plot of predicted annual mean roof level NO₂ concentrations with a 10% conversion rate, which includes road emissions and energy centre emissions from the MECD site and the a

9.102 Aquatics Centre in the DS scenario. Figure 9.8 shows a contour plot of the predicted 99.79th percentile of total NO₂. Both figures show that the relevant air quality objectives are achieved across the roof in the DS scenario. The maximum annual mean NO₂ concentration at roof level is 38.7ug/m³ compared with the limit value of 40ug/m³ and max 99.79th percentile of total NO₂ is 102.8ug/m³ compared to limit of 200ug/m³. As

such, the air intake inlet for ventilation purposes can be located at any point on Building A - except the lower levels near the road links.

Figure 9.8 Total Annual Mean NO₂ Concentration (µg/m³), Do-Something Scenario

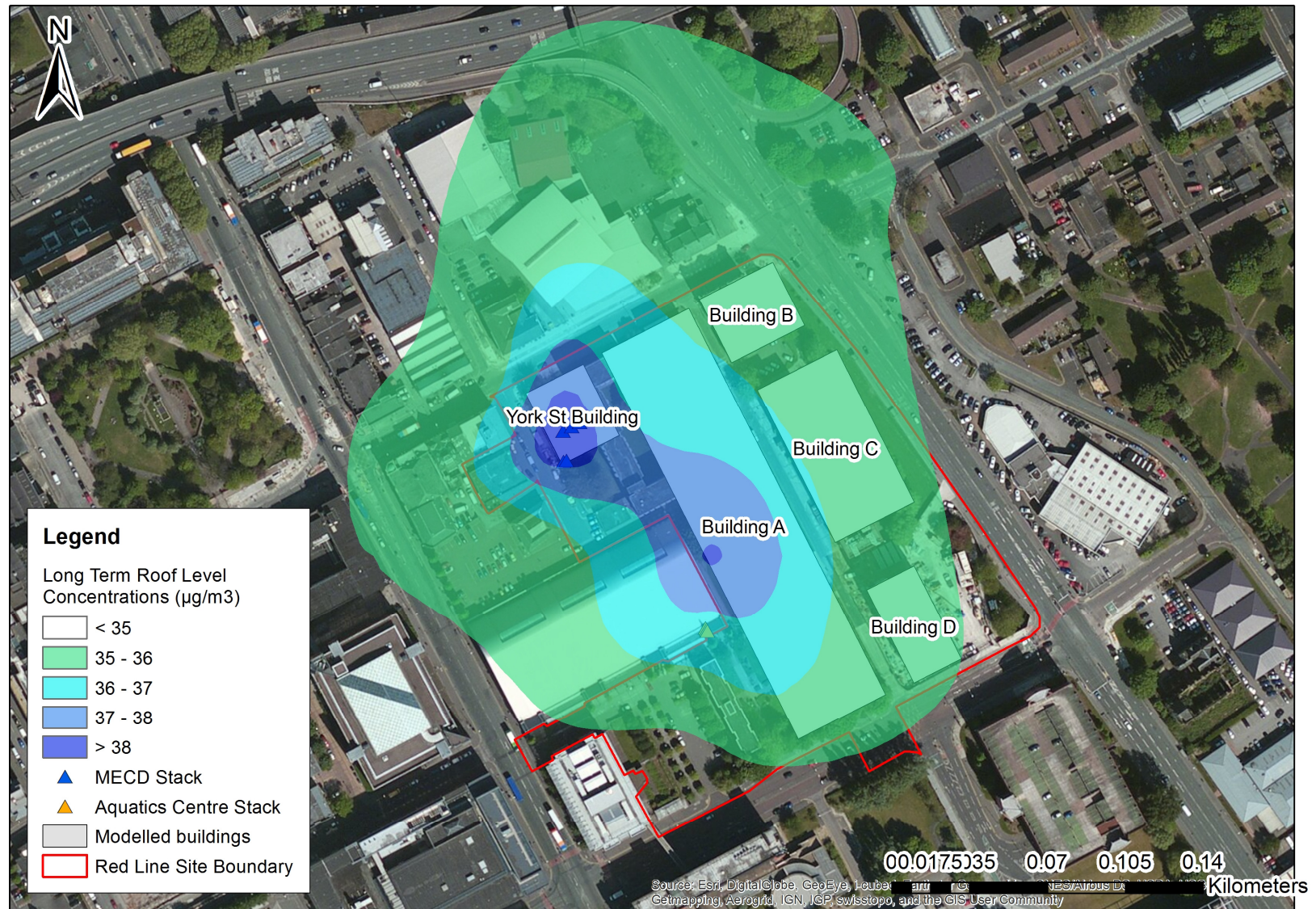


Figure 9.10 Total Mean NO₂ Concentration (µg/m³ Short Term), Do-Something Scenario



Fume Cupboards

9.103 Details of fume cupboard use cannot be clearly defined at this point, however the processes are likely to be small scale. There will approximately 170 fume cupboards installed across the site and the emission from these will be mitigated and controlled locally. Details of the mitigation and emissions controls can be found in the ventilation strategy for the development.

9.104 Although there is potential for odour nuisance from these processes, the activities would not deviate significantly from those already taking place in similar facilities in the locality in process or in scale. A list of chemicals regulated under Hazardous Substance Control, with quantities used over the last 10 years in a similar institution is provided in Table 9.22. Their use does not imply that some or all of the compounds mentioned are emitted from the fume cupboard extraction system.

Table 9.22 Range of Hazardous Substances Used in 10 Years in an Institution Similar to the Proposed Centre

Chemical	Quantity (tonnes)
Acrylonitrile	0.00015
Ammonia	0.06329
Bromine	0.00512
Chlorine	< 0.1
Ethylene oxide	< 0.1
Hydrogen cyanide	< 0.1
Liquid oxygen	< 0.1
Liquid petroleum gas	< 0.1
Phosgene – use thiophogene	0.00011
Sulphur dioxide	0.00250

9.105 The fume cupboards comply with British Standards EN 14175:2003. To ensure effective dispersion and compliance with this British Standard, fume cupboards are regularly inspected at least every 14 months. Exhaust of fume cupboard flues will terminate 3m above the maximum building height of building C with a minimum efflux velocity of 10 m/s. The amount of fume cupboard extract would not increase from the current Windeyer levels. To ensure no recirculation of emissions into the building, ventilation inlets will be separated from the fume cupboard exhaust by at least 10 m. As such, it is not considered likely that emissions from the fume cupboards would have a significant adverse effect on local air quality and the residual effects of the fume cupboards in EIA terms during operation would be negligible.

Mitigation Measures

Construction

9.106 The dust emitting activities assessed in the assessment methodology for construction effects section can be greatly reduced or eliminated by applying the site specific mitigation measures for high risk sites according to the IAQM guidance. The following measures from the guidance are relevant and should be included in the Construction Environmental Management Plan (CEMP) for the Proposed Development site. The residual effects in EIA terms during operation after mitigation would be negligible.

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.
- Develop and implement a Dust Management Plan, which will include measures to control other emissions, approved by the local authority

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

- 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.

- Implement a Travel Plan than supports and encourages sustainable travel (public transport, cycling, walking and car-sharing).
- 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.
- Avoid scabbling (roughening of concrete surfaces) if possible

Waste management

- Avoid bonfires and burning of waste materials.

Operation

9.107 The effect of the operation of the Proposed Development on existing receptors is negligible and no mitigation is required. However, as the Proposed Development is located within an area of poor air quality, during the operational phase as best practice sustainable modes of transport will be encouraged as best practice. The Travel Plan created for the scheme sets out 10 key aims for UoM to achieve through its travel plan. Each of these is reviewed in the Travel Plan with respect to the MECD development to promote sustainable travel. The 10 key aims include the following points which are related to improving air quality:

- Introduce a Staff Car Parking Policy focussed on reducing emissions, equality of access and encouraging more flexible travel arrangements;
- Establish an overall travel carbon emissions baseline based on HEFCE guidance;
- Promote videoconferencing as a sustainable and viable alternative option to travel;
- Implement initiatives and actively encourage cycling as a viable option for commuter journeys of both staff and students;
- Work with local and regional transport bodies and operators to improve public transport access and viability for staff, students and visitors;
- Reduce carbon emissions from fleet vehicles by investing in low emitting vehicles and improve the efficiency of their use; and,
- Actively inform visitors of sustainable transport options and encourage their use.

9.108 As indicated in Figure 9.8 and Figure 9.8 , the long term and short term air quality objectives are predicted not to be exceeded at roof level on Building A. As such, the air intake inlet for ventilation purposes can be located at any point on Building A - except the lower levels near the road links.

Cumulative Effects

9.109 Cumulative air quality effects have been considered in the assessment of the DM and DS scenarios. The changes in traffic as a result of the known developments in the area have been reflected in the traffic data provided by the transport consultants. As indicated in Table 9.19, the assessment predicts one moderate adverse impact and two slight adverse impacts at receptor locations. As discussed in paragraph 9.94, future year concentrations with the development in place are lower than baseline concentrations. As such, using professional judgement and considered the scheme as a whole, it is considered that the impact is not significant and the overall effect in EIA terms is negligible.

9.110 No interactive air quality effects are anticipated as a result of the Proposed Development.

Residual Effects

Construction

9.111 The Proposed Development site has been assessed as significant during demolition, earthworks, construction and trackout activities prior to implementation of mitigation as it was classified as high risk according to the IAQM construction dust guidance. Where mitigation measures outlined in the CEMP are implemented successfully, local air quality effects during construction would be insignificant. As such, the residual effects in EIA terms during operation after mitigation would be negligible.

Operation

9.112 As shown in Table 9.19 and explained in paragraph 9.94, with the scheme introduces no new exceedences of the annual mean NO₂ objective. The cumulative development assessment predicts one moderate adverse impact and two slight adverse impacts at receptor locations, but at these locations the annual mean objective is not exceeded. The hourly mean objective for NO₂ is predicted not to be exceeded off-site nor at on-site receptors.

9.113 Overall, the air quality impacts of the scheme are considered to be not significant and the overall effect in EIA terms is negligible.

9.114 The cumulative development assessment predicts two moderate adverse impacts and four slight adverse impacts at receptor locations, and would therefore be considered significant.

9.115 As the Proposed Development is located within an area of poor air quality, mitigation is proposed during the operational phase as best practice, to encourage sustainable modes of transport.

9.116 To ensure that emissions from fume cupboards or the combustion plant are not circulated back into the buildings, the ventilation air inlet will be located at height on Building A.

Table 9.23 Summary of Residual Effects

Likely Significant Effect	Receptor	Mitigation	Residual Effect
Construction Phase			
Dust Soiling and Human Health Effects	Local sensitive receptors	Appropriate mitigation measures have been recommended for inclusion in the CEMP	Negligible
Operational Phase			
Effects associated with changes in traffic	Local sensitive receptors	Not required	Negligible
Effects associated with emissions from MECD boilers and CHP emissions	Local sensitive receptors	Not required	Negligible
Fume cupboard	Local sensitive receptors	Ventilation air handling unit intakes located below the level of the emissions stacks and at least 10m from flue openings	Negligible

Non-Technical Summary

- 9.117 This Air Quality Assessment looks at MECD, Manchester. A review of the current legislation and planning policy was undertaken, along with a baseline assessment describing the current air quality conditions in the vicinity of the Proposed Development, and an assessment of the potential air quality impacts associated with the construction and operation of the scheme.
- 9.118 The site of the Proposed Development is located within the Manchester City Council Air Quality Management Area, designated due to exceedences in the relevant air quality standard for annual means nitrogen dioxide (NO₂) concentrations.
- 9.119 The construction effects have been assessed using a qualitative approach based on the guidance from the Institute of Air Quality Management (IAQM) and it was concluded that with appropriate mitigation measures in place, there is likely to be a negligible effect from the dust-generating activities on site.
- 9.120 Consideration was given to potential operational air quality impacts, as a result of traffic generated by the development and the emissions from the on-site gas boilers and CHP units and fume cupboards as well as operation of the boilers and CHP unit in the adjacent aquatics Centre. By using the relevant guidance, it was identified that impacts from the Proposed Development are predicted to be negligible.

As such, the construction and operational phases of the Proposed Development are expected to have an overall negligible impact on the surrounding area.

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