



Alchemy Way

Air Quality Assessment

For Network Space Development

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1. INTRODUCTION

Hydrock have been commissioned by Network Space Development ('the Client') to prepare an Air Quality Assessment (AQA) to support site wide proposals for the erection of 5 industrial units (the 'Proposed Development'), on land at Alchemy Way (the 'Site'). The Site is located within Knowsley Industrial Park, south-east of Kirkby within the administrative boundary of Knowsley Council (KC).

The Site is split into two development plots, referred to as Land Parcel 1 which comprises two industrial units and Land Parcel 2 which for the purposes of this Assessment includes 3 industrial units.

Both development plots are covered by this AQA, however the Planning Application relates to Parcel 01 (North West Plot). The development site is located on land to the northwest of Alchemy Business Park. The development plot, known as 'Land Parcel 1', comprises the northern and western parts of the wider development site and covers an area of approximately 3.55ha."

The total Site (including Land Parcel 1 and 2) is centred on the National Grid Reference (NGR); x342688, y396959 and is shown below in Figure 1. The Site is located north of the East Lancashire Road, off Alchemy Way within Knowsley Industrial Estate. The closest residential dwellings are located to the north-west, approximately 305m from the Site boundary. Beyond Knowsley Industrial Estate to the south and east is open agricultural land.



Figure 1 - Site Location

1.1 Proposed Development

Proposals for 'Land Parcel 1' site comprise the construction of two large industrial buildings, with external yard and car parking areas.

Whilst 'Land Parcel 2' comprising 3 smaller units will be developed at later stage as part of a separate phase it has still been assessed as part of this AQA.

The Planning Application description for Land Parcel 1 (Plot 1) is as follows:

"FULL APPLICATION FOR EMPLOYMENT DEVELOPMENT COMPRISING TWO UNITS (USE CLASS E (G) (II) (III) / B2 / B8 USE) WITH ANCILLARY E (G) (I) OFFICE SPACE, CAR PARKING AND VEHICULAR, PEDESTRIAN CIRCULATION WITH ACCESS ONTO ALCHEMY WAY"

1.2 Purpose of Air Quality Assessment

The purpose of this AQA is to provide the following:

- Review of baseline air quality to assess the risk of exceedance of Air Quality Assessment Levels (AQALs) at the Site and surrounding area;
- Construction Phase Assessment to conclude on the requirements for mitigation to reduce the significance of impacts to negligible during this phase; and
- Consideration of potential impacts during the operational phase, in terms of vehicle emissions.

2. RELEVANT LEGISLATION

2.1 Air Quality Regulations and Objectives

There are two sets of air quality legislation which include ambient air quality thresholds for the protection of public health that apply in England, these include legally binding limit values originally set by the European Union (EU) Directive 2008/50/EC¹ on ambient air quality and cleaner air for Europe; and regulations implementing national air quality objectives as set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)² which local authorities are required to work towards achieving.

The EU (Withdrawal Agreement) Act 2020 sets out arrangement for implementing air quality limit values that are included in the EU Directive on ambient air quality and cleaner air for Europe (2008/50/EC) included in the following:

- Air Quality Regulations (SI 2010 No.1001)³ and amended (SI 2016 No.1184)⁴ ;
- The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (SI 2019 74)⁵ ;
- The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (SI 2020 1313)⁶ amend the Air Quality Regulations (SI 2010 No.1001) to account for EU withdrawal; and
- The AQS objectives are implemented in the Air Quality (England) Regulations 2000 (SI 2000/928)⁷ and Air Quality (England) (Amendment) Regulations 2002 (SI 2002/3043)⁸.

The Air Quality Strategy 2007 Volume 1² sets out the government's policies and framework for improving air quality in the UK with the aim of meeting the requirements of above legislation The Air Quality Strategy also outlines the Limit Values, Target Values, Standards, Objectives, Critical Levels and Exposure Reduction Targets for the protection of human health and the environment (collectively termed AQALs throughout this report). Those relevant to this assessment is provided below, in Table 1:

Table 1 - UK Air Quality Assessment Levels

Pollutant	Averaging Period	AQALs	
NO ₂	1 Hour Mean	200µg/m ³	Not to be exceeded more than 18 times in a year.
	Annual Mean	40µg/m ³	
PM ₁₀	24 Hour Mean	50µg/m ³	Not to be exceeded more than 35 times in a year.
	Annual Mean	40µg/m ³	
PM _{2.5}	Annual Mean	20µg/m ³	

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 Available at: <https://eur-lex.europa.eu/legal-content/en/ALL/?uri=CELEX%3A32008L0050>

2 Defra. "The Air Quality Strategy for England, Scotland, Wales and Northern Ireland". Available at: <https://www.gov.uk/government/publications/2010-to-2015-government-policy-environmental-quality/2010-to-2015-government-policy-environmental-quality#appendix-5-international-european-and-national-standards-for-air-quality>

3 The National Archives. "The Air Quality Standards Regulations 2010". Available at: <http://www.legislation.gov.uk/uksi/2010/1001/contents/made>

4 The National Archives (2016). "The Air Quality Standards (Amendment) Regulations 2016". Available at:

<https://www.legislation.gov.uk/uksi/2016/1184/contents/made>

5 The Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 (legislation.gov.uk). Available at:

<https://www.legislation.gov.uk/uksi/2019/74/contents/made>

6 The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020 (legislation.gov.uk). Available at:

<https://www.legislation.gov.uk/uksi/2020/1313/contents/made>

7 The National Archives. "The Air Quality (England) Regulations 2000". Available at: <http://www.legislation.gov.uk/uksi/2000/928/contents/made>

8 The National Archives. "The Air Quality (England) (Amended) Regulations 2002". Available at: <http://www.legislation.gov.uk/uksi/2002/3043/contents>

Defra's Local Air Quality Management Technical Guidance 2016 (LAQM.TG (22))⁹ provides guidance on where the above AQAL's should apply. This is summarised below, in Table 2:

Table 2 - Summary of where AQALs should apply:

Averaging Period	Objectives should apply at:	Objectives should generally NOT apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.
24-hour mean and 8-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties	Kerbside sites (as opposed to other locations at the building façade) or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual Mean and: 24 and 8-hour mean objectives apply. Kerbside site (for example, pavements of busy shopping streets). Those parts of car parks, bus stations and railways stations etc. which are not fully enclosed, where members of the public might be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expect to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where member of the public might reasonably be exposed for a period of 15 minutes	

2.2 Local Air Quality Management

Obligations under the Environment Act 2021¹⁰ (which provides an amendment to the Environment Act 1995¹¹) requires local authorities to review and assess air quality in their administrative boundaries. Where AQALs are predicted to be exceeded, the local authority must declare an Air Quality Management Area (AQMA) at sensitive receptor locations and formulate an Air Quality Action Plan (AQAP) to reduce pollution concentrations to values below AQALs.

KC currently does not have any AQMAs and therefore no AQAP has been introduced. However, the neighbouring Liverpool City Council (LCC) declared a city-wide AQMA, which is approximately 1.3km south-west of the Site at its closest point. Further information on the AQMA and associated AQAP is detailed in Section 4.1.

⁹ Defra, "LAQM Technical Guidance (TG22)" (Department for Food, Environment and Rural Affairs (Defra), August 2022), <https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf>

¹⁰ <https://bills.parliament.uk/bills/2593/publications>

¹¹ Environment Agency, "Environment Act 1995" (The Environment Agency, 2002), <http://www.legislation.gov.uk/ukpga/1995/25/contents>.

2.3 National Planning Policy Framework

The National Planning Policy Framework (NPPF)¹² sets out the Government's planning policy for England. It requires planning decisions for any new development to prevent new and existing development from contributing to, or being put at risk from, unacceptable levels of air pollution (paragraph 174). It also states that planning decisions should sustain and contribute towards compliance with relevant limit values or national objectives for air pollutants, taking into account the presence of AQMAs and Clean Air Zones (CAZ)s (paragraph 186), and the cumulative impacts from other sites (paragraph 185).

Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. Furthermore, planning decisions should ensure that any new development in AQMAs and CAZs is consistent with the local air quality action plan.

Also, to help reduce congestion and emissions, to improve air quality and public health, significant development should be focused on locations which are / can be made sustainable through limiting the need to travel (paragraph 105).

2.4 Planning Practice Guidance

Reference ID 32 (Air Quality) of the National Planning Practice Guidance (NPPG)¹³, which was updated in November 2019, provides guiding principles on how planning can take account of the impact of new development on air quality. The NPPG summarises the importance of air quality in planning and the key legislation relating to it.

2.5 Local Planning Policy

The Knowsley Local Plan Core Strategy¹⁴ was adopted in January 2016. The Local Plan Core Strategy will guide development within Knowsley until 2028. The following policies relate to air quality:

"Policy CS2 Development Principles

[...]

Principle 4 Recognise environmental limits, protect and enhance environmental assets, enhance local character and promote quality of place by:

[...]

*e) Mitigating potential negative impacts of traffic growth and road traffic on highway safety, **air quality**, noise and health;*

[...]

*j) Minimising negative impact upon flood risk, **air quality**, water quality, land quality, soil quality, and noise or vibration levels and ensuring any negative impacts are appropriately mitigated[...]"*

"Policy CS7 Transport Networks

12 Ministry of Housing, Communities and Local Government, "National Planning Policy Framework," July 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1004408/NPPF_JULY_2021.pdf.

13 Ministry of Housing, Communities & Local Government, "Reference ID (32) Air Quality" (Ministry of Housing, Communities & Local Government, 2019), <https://www.gov.uk/guidance/air-quality--3>.

14 Knowsley Council, Knowsley Local Plan Core Strategy, January 2016.

[...]

Location, Design and Management of New Development

2) New Development will be required to be: [...]

*e) Inclusive of measures that will mitigate carbon emissions and improve **air quality** where appropriate; [...]"*

"Policy CS23 Renewable and Low Carbon Infrastructure

1) The Council will support proposals that will produce and distribute decentralised, low carbon and renewable energy, provided that they do not cause significant harm (in terms of their number, scale, siting or cumulative impacts) to:

*a) Natural resources, biodiversity, geodiversity, water and **air quality** and, landscape character; [...]"*

3. METHODOLOGY

3.1 Consultation

Full details of the AQA approach were sent via email to the Environmental Health Officer (EHO) at KC in July 2022 with a request for further comment / guidance. The following response was received on 21st July 2022:

*"Please see attached the latest ASR report (2021), and data for 2022, our report is currently being prepared.
The Air Quality assessment methodology is acceptable."*

The above comments have been taken into consideration. The approved methodology is outlined below.

3.2 Guidance

The following guidance has been used to undertake this Air Quality Assessment:

- Defra's LAQM.TG (22)⁹;
- EPUK & IAQM Land-use Planning & Development Control: Planning for Air Quality¹⁵;
- The IAQM's guidance on assessing impacts from construction¹⁶; and
- Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites¹⁷.

3.3 Baseline Air Quality

The baseline air quality conditions in the vicinity of the Site have been established through the compilation and review of the following sources. The Baseline Assessment can be found in Section 4.

- Data from the National Atmospheric Emissions Inventory (NAEI)¹⁸, Environment Agency (EA) data¹⁹ and Defra's PRTR²⁰;
- Defra's modelled background concentrations of pollutants (UK-AIR)²¹. These estimates are produced using detailed modelling tools and are available as concentrations at central 1km² National Grid square locations across the UK;
- Defra's modelled roadside concentrations of pollutants, including NO₂ (pollution climate mapping (PCM))²²;
- Natural England's Multi-Agency Geographic Information for the Countryside (MAGIC)²³ data;
- KC's latest available air quality monitoring data, derived from the latest available air quality annual status report published in 2021²⁴. At the time of writing, these data were from 2020. However, 2021 data was supplied by the EHO at KC; and

15 EPUK & IAQM, "Land-Use Planning & Development Control: Planning for Air Quality" (Institute for Air Quality Management (IAQM), January 2017), <http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf>.

16 IAQM, "Guidance on the Assessment of Dust from Demolition and Construction" (Institute of Air Quality Management (IAQM)), February 2014), <http://www.iaqm.co.uk/text/guidance/construction-dust-2014.pdf>.

17 IAQM, "A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites" (Institute for Air Quality Management (IAQM), June 2019), <https://iaqm.co.uk/text/guidance/air-quality-impacts-on-nature-sites-2019.pdf>.

18 NAEI <https://naei.beis.gov.uk/data/map-large-source>, accessed July 2022

19 Environmental Permitting Regulations – Waste Operations (data.gov.uk), accessed July 2022.

20 Public registers (data.gov.uk), accessed July 2022.

21 UK-AIR, "Background Mapping Data for Local Authorities - 2018," n.d., <https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018>.

22 UK Ambient Air Quality Interactive Map (defra.gov.uk)

23 Natural England and MAGIC partnership organisations., "Multi Agency Geographic Information for the Countryside.," 2020, <https://magic.defra.gov.uk/MagicMap.aspx>, accessed May 2021.

24 Knowsley Council, "2021 Air Quality Annual Status Report (ASR)," December 2021, na.

- LCC's latest available air quality monitoring data, derived from the latest publicly available air quality annual status report published in 2020²⁵. At the time of writing these data were from 2019.

3.4 Construction Phase Assessment

A construction dust risk assessment is provided in Section 5 which has been undertaken in line with IAQM guidance. This considers the risk of impacts during the construction phase in terms of nuisance dust, human health (PM₁₀ exposure) and ecological impacts.

With regard to ecological receptors, risk assessment should be taken where high-sensitivity receptors are located within 50m of a Site boundary. The MAGIC website, which incorporates Natural England's interactive maps²³, has been reviewed to identify whether any statutory ecological sensitive receptors are situated within 50m of the site boundary or within 50m of any routes used by construction vehicles on the public highway, up to 500m from the site entrance.

Whilst Acornfield Plantation Local Nature Reserve (LNR) is within close proximity to the Site, it is not within 50m. Additionally, it is greater than 50m from a potential construction route (approximately 90m from South Boundary Road). Therefore, it has not been considered further within the construction phase assessment.

With regard to nuisance dust soiling and human health impacts, within distances of 20m of the Site boundary there is a high risk of dust impacts. Up to 100m from the construction site, there may still be a high risk, particularly if the receptor is downwind of the prevailing wind direction in relation to the dust source. It is considered that for receptors more than 350m from the site boundary, the risk is negligible.

Sensitive receptors were identified within 350m of the site boundary. Based on the IAQM guidance residential dwellings, museums, car parks and car show room are indicative examples of high sensitivity receptors in relation to both dust soiling and health effects of PM₁₀. Indicative examples of medium sensitivity receptors include places of work, such as offices.

The IAQM guidance states that the potential dust emission magnitude from Demolition, Earthworks, Construction and Trackout should all be assessed individually. In addition, the sensitivity of the area to adverse dust impacts should also be defined.

The overall significance of the risk of adverse impacts during the construction phase can then be defined using the 'risk of impacts matrix' for each stage of the construction phase described above.

3.5 Operational Phase Assessment

3.5.1 Scope of Impact Assessment

The scope of assessment has been determined against the EPUK and IAQM's two stage checklist criteria¹⁵. The Stage 1 Criteria identifies whether a development requires an air quality assessment. As the proposals include more than 1,000m² floor space, consideration of Stage 2 is required.

Stage 2 includes some criteria which are not directly relevant to the Proposed Development, such as those related to the realignment of roads within an AQMA, introduction of a new bus station, new road junctions and underground car parks. These have been excluded from this assessment and only relevant screening criteria have been included. The relevant checklist criteria shown in Table 3 identifies whether a detailed assessment of potential air quality impacts is required.

²⁵ Liverpool City Council, "2020 Air Quality Annual Status Report (ASR)," June 2020, na.

Table 3 – EPUK & IAQM detailed assessment criteria

Criteria	The development will:	Indicative criteria to proceed to a detailed AQA:
1	Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV - cars and small vans <3.5t gross vehicle weight)	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2	Cause a significant change in Heavy Duty (HDV) flows on local roads with relevant receptors (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3	Have one of more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. This includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO _x emission rate is less than 5mg/sec is unlikely to give rise to impacts, provided that the emissions are released from a vent stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situation where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emissions rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

With regard to screening criteria 1 and 2, the Transport Consultants on the scheme are Pell Frischmann who have confirmed the Proposed Development is expected to cause an increase in traffic flows above the defined threshold levels for detailed assessment.

With regard to screening criteria 3, the client has provided the following information with regards to the heating / energy strategy for both plots. With specific regard to Plot 01, *“A gas supply connection shall not be provided. The tenant shall be responsible for procuring a new gas supply from the offsite local gas distribution network, if required.”* Additionally, office areas shall be heated and cooled via split / multi split heating and cooling systems. Core areas will be heated via electrical panel heaters. Hot water for core services shall be generated via local electric water heaters. Finally, a structural load allowance shall be included to accommodate the future installation of PV panels to provide 100% coverage of the roof area. As such, no combustion plant is proposed as part of the development and therefore further assessment is not required with regards to combustion processes.

Based on the above, a detailed assessment of air quality impacts from scheme-generated traffic has been undertaken, in accordance with EPUK & IAQM guidance, according to the methodology outlined below.

3.5.2 ADMS-Urban Dispersion Model

A detailed AQA has been undertaken using the air dispersion model ADMS-Urban v5.1 to establish the current and future air quality situation in the area. The software is commercially available, has been validated for this type of assessment by Defra and is used extensively for AQA's.

ADMS-Urban is able to provide an estimate of air quality both before and after development, considering important input data such as background pollutant concentrations, variable emissions, meteorological data, and traffic flows.

3.5.3 Assessment Scenarios

The following assessment scenarios have been modelled:

- Baseline/verification 2019;
- 2024 Do Minimum (2024 DM) – Proposed Development opening year traffic flows, including committed developments; and
- 2024 Do Something (2024 DS) – 2024 DM scenario flows in addition to Proposed Development traffic.

3.5.4 Model Inputs

3.5.4.1 Traffic Data

Traffic data used in the model was provided by Pell Frischmann, the Transport Consultants for the Proposed Development. Road links have been modelled where development trips exceed the EPUK & IAQM criteria for links within an AQMA as a worst-case. The modelled road links are shown in Figure 2 below, with full details of traffic data used in the modelling provided in Appendix A.

It should be noted that both development plots (North Western and Frontage) are covered by Proposed Development traffic, however the Planning Application only relates to Parcel 01 (North West Plot). As such, this AQA is considered worst-case.

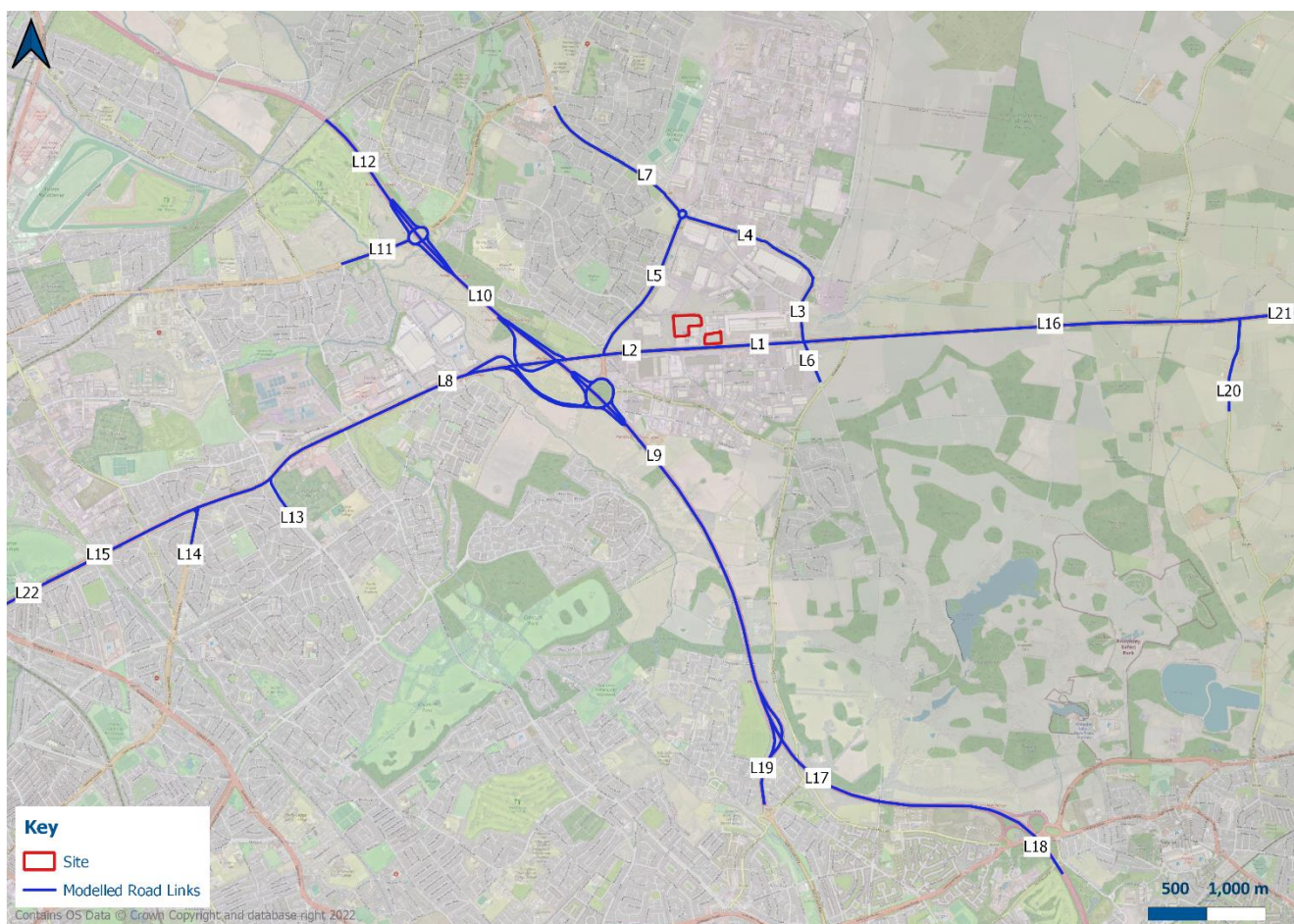


Figure 2 – Links modelled

3.5.4.2 Emission Factors

Emission rates for NO_x , PM_{10} and $\text{PM}_{2.5}$ used for the dispersion modelling assessment were calculated from the latest Emissions Factor Toolkit (EFT)(v.11) which was released by Defra in November 2021.

Most modern vehicles on the road in the UK meet a particular Euro emissions standard from 1 – 6, with 6 being the newest. Different parts of the country have newer or older vehicles than others. This is defined as the “fleet”. The EFT estimates this primarily based on whether the location is within or outside London or in England, Wales or Scotland. In the case of this model the vehicle fleet used was “England (urban) and England (motorway)”.

When predicting future year emissions, the toolkit includes forecasts such as anticipated advances in vehicle technology and changes in vehicle fleet composition, which assumes that vehicle emissions will reduce over time. However, there is some uncertainty over the accuracy of the future predictions. Details on how this uncertainty has been addressed is detailed in Section 3.7.

3.5.4.3 Speed Data

For each road link, vehicle speeds were obtained from the speed limit for each road derived from the OpenStreet Browser v4.10²⁶, which has been used as a proxy for average speeds on the network. Vehicle speeds were reduced to 20kmph within 50m of junctions to account for queuing and congestion in the average speed profile, in

²⁶ https://www.openstreetbrowser.org/#map=15/53.7033/-1.2698&categories=car_maxspeed, accessed July 2022

accordance with LAQM.TG (22). Google typical traffic was used to assist with determining appropriate slow down speeds across the study area.

3.5.4.4 Temporal Variation (Diurnal Traffic Profile)

Temporal variation in traffic flows along roads have been included in the dispersion model to account for the realistic differences that would occur between weekdays and weekends. Accordingly, a time varying profile was included in the model.

The diurnal profile used in the model has been calculated based on DfT Road traffic statistics (TRA) dataset. TRA0307 provides 'Motor vehicle traffic distribution by time of day and day of the week on all roads, Great Britain: 2019'²⁷, which shows the average hourly traffic flow in each combination of weekday and hour, relative to the average hour across the whole year for main roads in England. Figure 3 shows the diurnal traffic profile included in the model.

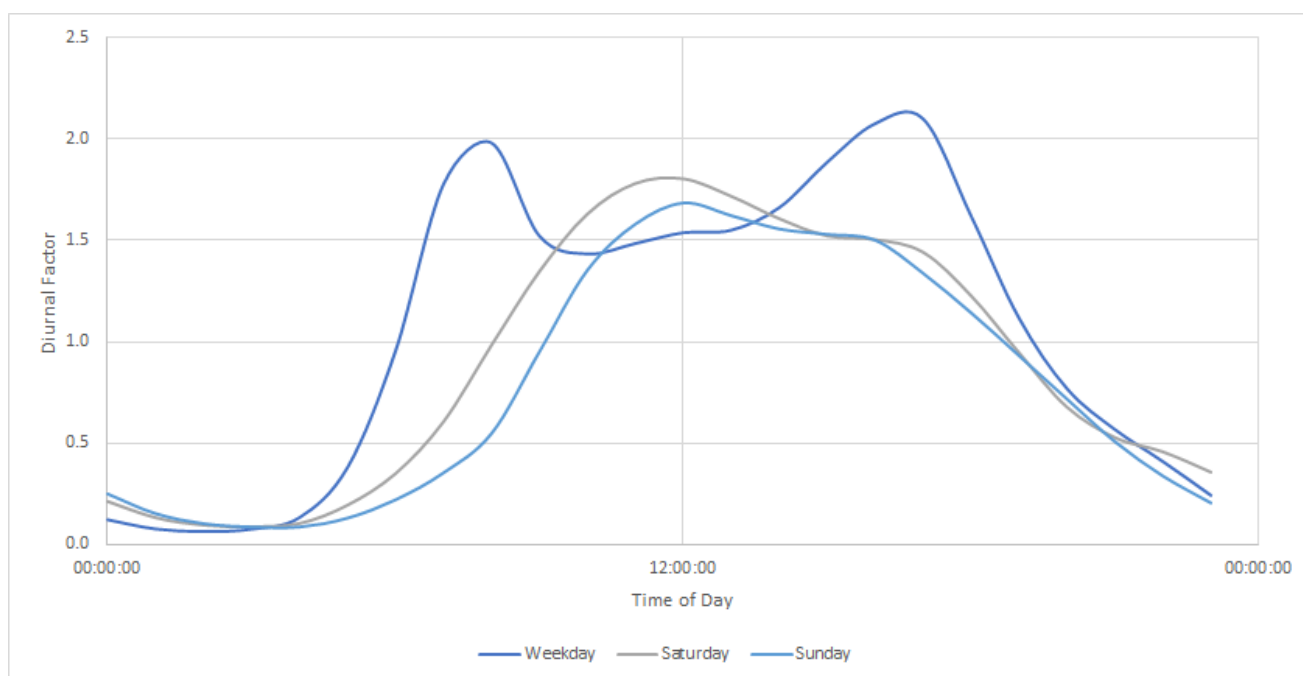


Figure 3 – Diurnal traffic profile included in the dispersion model

3.5.4.5 Meteorological Parameters

To calculate pollutant concentrations at identified sensitive receptor locations the dispersion model uses hourly sequential meteorological data, including wind direction, wind speed, temperature, cloud cover and stability, which exert significant influence over atmospheric dispersion.

The dispersion modelling has been undertaken using 2019 data from Crosby Meteorological Station. This site is located approximately 13.2km north west of the Site. It is also the closest and most relevant meteorological station that records all of the parameters necessary for dispersion modelling. A windrose is presented in Appendix B.

3.5.4.6 Surface Characteristics

The following surface roughness parameters have been applied in the model:

²⁷ DfT, "Average Annual Daily Flow and Temporal Traffic Distributions (TRA03) - Statistical Data Sets - GOV.UK," 2015, <https://www.gov.uk/government/statistical-data-sets/tra03-motor-vehicle-flow>.

- Dispersion site surface roughness = 0.75m (between ADMS pre-sets for 'parkland open suburbia' and 'cities and woodlands');
- Met site surface roughness = 0.02m(ADMS pre-set for 'open grassland');

The following Minimum Monin-Obukhov (MO) lengths were applied:

- Dispersion site = 10m (ADMS pre-set 'small towns');
- Met site = 10m (ADMS pre-set 'small towns').

3.5.5 Receptors Included in Dispersion Model

3.5.5.1 Human Receptors

Sensitive receptor locations included in the dispersion model are shown below in Figure 4 and Table 4. These are considered to be worst-case locations within the development locale based upon their proximity to the surrounding road links. Receptors have been modelled at relative breathing height above ground level to represent exposure relevant to that specific receptor. Educational receptors have been modelled at a lower height of 1m to represent pupils of primary school age.

Table 4 – Receptor Locations

Receptor ID	Location	NGR (m)		Z (m)
		X	Y	
R1	Residential - Houghtons Lane	347772	397099	1.5
R2	Residential - Sadlers Lane	347310	397105	1.5
R3	Residential - East Lancashire Road	347011	397078	1.5
R4	Residential - Moss Cottage, East Lancashire Road	344627	396970	1.5
R5	Residential - Old Farm Road	341964	397022	1.5
R6	Residential - Sedburn Road	342265	397407	1.5
R7	Residential - Moorgate Road North (K10)	342419	397761	1.5
R8	Educational - Park Brow Community Primary School	342351	398001	1
R9	Residential - Park Brow Drive	342027	398371	1.5
R10	Residential - Thistly Hay Road	341706	398557	1.5
R11	Residential - Croxteth View	341801	396857	1.5
R12	Residential - Shroggs Farm	341273	396771	1.5
R13	Residential - Randles bridge Farm	341614	396176	1.5
R14	Residential - Credition Close	340506	396506	1.5
R15	Educational - Our Lady's & St Swithin R C Primary School	340319	396171	1
R16	Residential - Eaglehall Road	338885	395659	1.5
R17	Residential - East Lancashire Road	338461	395466	1.5
R18	Educational - Ranworth Primary School	338539	395407	1
R19	Residential - East Lancashire Road	337715	395171	1.5
R20	Residential - East Lancashire Road	337098	394790	1.5
R21	Residential - Burtons Way	340217	397690	1.5
R22	Residential - Oxtons Close	339987	397716	1.5
R23	Residential - Eastfield Walk	340145	398115	1.5

Receptor ID	Location	NGR (m)		Z (m)
		X	Y	
R24	Residential - Thunderbolt Cottages	342635	395160	1.5
R25	Residential - Country Road	341811	398534	1.5
R26	Proposed Development ^(A)	342793	396860	1.5
R27	Proposed Development ^(A)	342498	396928	1.5
Note: (A) Only Short Term AQALS apply				



Figure 4 – Receptor Locations

3.5.5.2 Ecological receptors

The area surrounding the Site was assessed for the designations listed below, The MAGIC website, which incorporates Natural England's interactive maps²³:

- Special Protection Areas (SPAs);
- Special Areas of Conservation (SACs);
- Ramsar sites (protected wetlands);
- Sites of Special Scientific Interest (SSSIs); and
- Local nature sites (ancient woods, local wildlife sites and national and local nature reserves).

There are no ecological sites that are expected to be affected by vehicle trips from the Site.

3.5.6 Model Verification

A verification study has been undertaken in accordance with LAQM.TG (22) using KC monitoring data from four locations (K7, K10, N5 and N6). An adjustment factor of **3.609** was subsequently applied to modelled road NO_x concentrations.

Due to insufficient PM monitoring in the study area, the modelled road-PM₁₀ and road-PM_{2.5} components have been adjusted by the NO_x verification factor obtained before adding to the appropriate background concentration, in accordance with LAQM.TG (22). This approach is considered likely to provide a conservative estimate of the contribution of modelled roads to ambient PM₁₀ and PM_{2.5} concentrations.

Full details of the model verification procedure are included in Appendix C.

3.5.7 NO_x to NO₂ conversion

Ambient NO_x concentrations have been predicted through dispersion modelling. Annual NO_x concentrations have been converted using Defra's NO_x to NO₂ conversion tool²⁸, in the first instance to match the roadside NO_x from the diffusion tubes with modelling outputs and secondly to convert corrected model outputs to NO₂ estimations.

3.6 Assessment of Significance

The long-term modelled annual average concentrations for NO₂, PM₁₀ and PM_{2.5} have been compared against the applicable AQALs (Table 1).

In the area surrounding the development it is not expected that annual average concentrations will exceed 60µg/m³. In accordance with LAQM.TG (22)⁹, if annual mean concentrations of NO₂ do not exceed 60µg/m³, it is unlikely hourly mean concentrations would exceed the relevant 1-hour mean objective, which allows for 18 exceedances of the hourly standard (200µg/m³) in a calendar year.

The correlation between the annual and short-term concentrations for PM₁₀ are based on the EPUK & IAQM construction guidance¹⁶, which states 32µg/m³ is the annual mean concentration at which an exceedance of the 24-hour objective is likely to occur.

The significance of impacts has been determined against the following threshold criteria, from the EPUK & IAQM guidance, see Table 5.

²⁸ Defra, "NO_x to NO₂ Calculator" (Defra, 2019), <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc>.

Table 5 - Impact Significance Criteria

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 - 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 - 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
Notes: In accordance with EPUK & IAQM planning guidance any change less than 0.5% will be considered as Negligible				

For the purposes of this assessment, impacts >Slight Adverse are considered to potentially be significant, whereas impacts <Slight Adverse are considered not significant. Additional factors are also included in the assessment of significance, including the spatial extent of adverse impacts, in accordance with IAQM guidance, which states:

“An individual property exposed to a moderately adverse impact might not be considered a significant, but many hundreds of properties exposed to a slight adverse impact could be.”

3.7 Model Limitations

There are inherent uncertainties associated with the model (ADMS Urban) used in this assessment, including the uncertainties associated with the input data such as predicted traffic flows. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS model will not take into account.

To account for uncertainty in future emission factors and pollutant concentrations, a precautionary principle has been undertaken in the assessment a sensitivity assessment comprises:

- Emission Factors held at 2019 (no future improvements assumed);
- Background pollutant concentrations held at 2019 (no future improvements assumed); and
- Traffic flow forecasts are based on 2024 development opening year and were obtained from Pell Frischmann, the Transport Consultants.

The above assumptions ensure a conservative approach has been considered in the assessment. The results of the sensitivity test are presented in Appendix E.

Root Mean Square Error (RMSE) is used to define the average error or uncertainty of the model. According to LAQM.TG (22), the RMSE is acceptable where it is within 25%. The model verification process in Appendix C calculated a post-adjusted RMSE of **4.2µg/m³**, which equates to **10.6%** of the annual mean AQAL for NO₂ and is therefore considered to be acceptable.

4. BASELINE AIR QUALITY CONDITIONS

Baseline air quality conditions in the study area have been established through compilation and review of appropriately sourced monitoring and modelling data.

4.1 Air Quality Management Areas

KC does not currently have an AQMA with their area of jurisdiction. However, Liverpool AQMA is located approximately 1.3km south-west of the Site, as shown in Figure 5.

LCC have an Air Quality Action Plan²⁹ to help reduce pollutants within this designated area. Actions include promoting sustainable transport including buses, cycling and car clubs. In addition to providing resources to increase raise awareness and education. Various traffic management actions are also included, such as better signage and a city parking strategy.



Figure 5 – Liverpool AQMA

4.2 Local Emissions Sources

Emissions from road vehicles travelling along East Lancashire Road (A580), which abuts the Site to the south, are considered to be the main pollutant sources affecting local ambient air quality at the Site.

²⁹ Liverpool City Council, Liverpool's Air Quality Action Plan: Final Document, June 2007.

A review of the NAEI¹⁸, EA¹⁹ and Defra's PRTR²⁰ data indicates the following point sources within 1km of the Proposed Development, as shown in Table 6 and Figure 6.

Table 6 – NAEI Large Point Sources within 1km of the Proposed Development

Plant ID and Operator	Authorisation / Permit Number	Sector	NGR (m)		Distance / Direction from Proposed Development
			X	Y	
12212 Contract Chemicals (Knowsley) Limited	EPR/BL8619IA	Chemical Industry	343030	396680	250m south-east
14352 Dairy Crest Limited	VP3234NX	Food Drink and Tobacco Industry	342020	397040	400m west

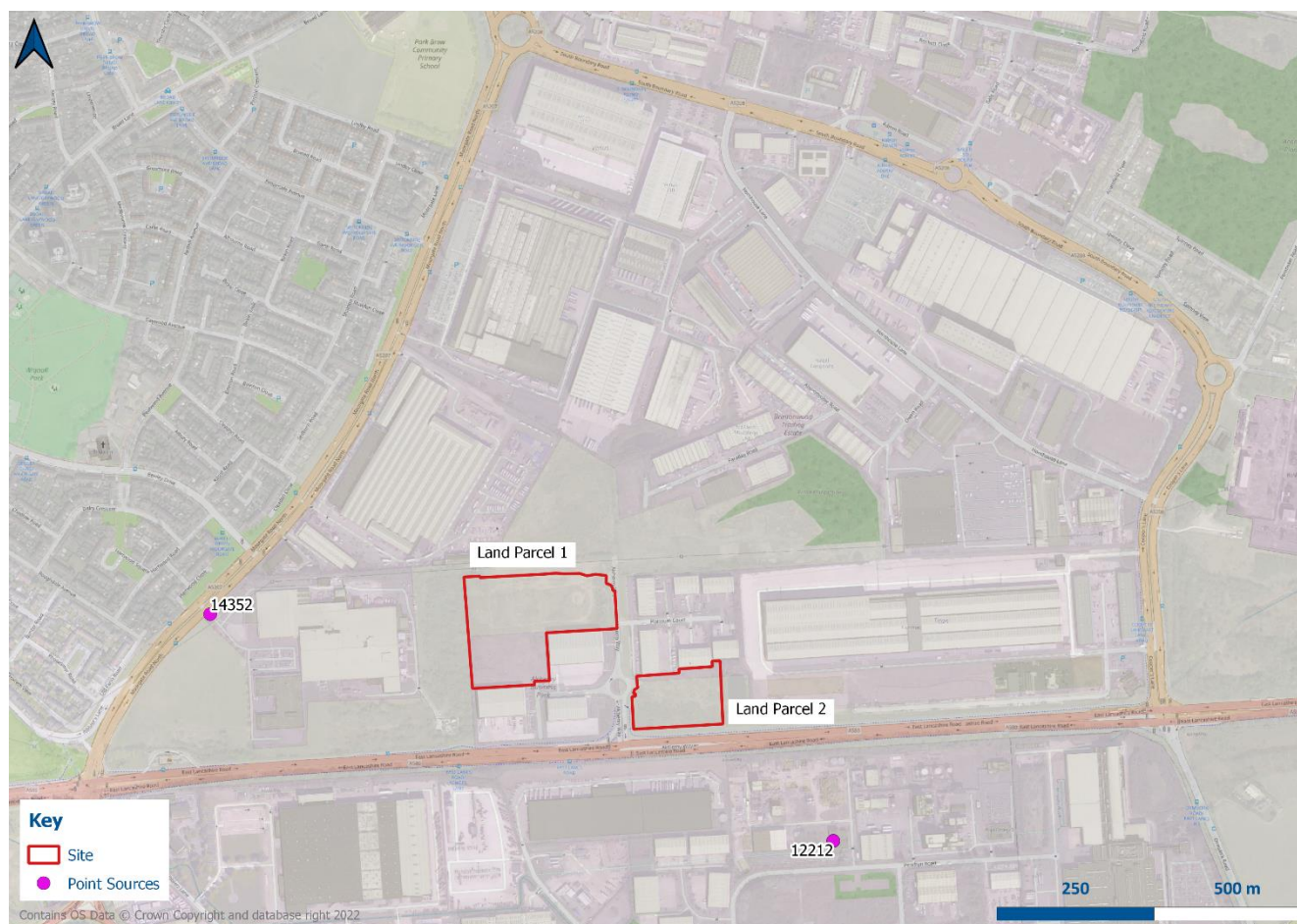


Figure 6 – Local Emission Point Sources

It is understood that the above facilities have the necessary Environmental Permits for potentially polluting activities (emissions to Air) which include provisions to reduce emissions to air. It has been reasonably assumed that emissions from the facilities contribute to background concentrations, as detailed below. Therefore, the contribution from these sources is taken into account within the background concentrations used in the assessment.

4.3 Defra Mapped Background Concentrations

Mapped background concentrations of NO₂, PM₁₀ and PM_{2.5} were downloaded for the grid squares containing the Site and for the modelled receptors presented within Table 4. Mapped background concentrations have been obtained based upon the 2018 base year DEFRA update (August 2020 publication)²¹.

Background pollutant concentrations for 2019 (the verification year), 2022 (the current year) and for 2024 (the completed opening year of the Proposed Development) for the Site are displayed in Table 7.

Table 7 – Defra Mapped Background Concentrations

Grid Square (x,y)	Pollutant	AQAL (µg/m³)	Annual Mean Concentration (µg/m³)		
			2019	2022	2024
342500, 396500	NO ₂	40	18.9	16.7	15.5
	PM ₁₀	40	14.0	13.5	13.3
	PM _{2.5}	20	9.0	8.6	8.4

The data show that annual mean background concentrations of NO₂, PM₁₀ and PM_{2.5} at the grid squares within which the Site is located are below the AQALs in all years.

Concentrations of all pollutants are predicted to decline incrementally each year. These reductions are principally due to the forecast effect of the roll out of cleaner vehicles and strategies to reduce emissions across all sectors.

Defra UK-AIR modelled background concentrations from 2019 and 2024 for relevant grid squares were considered to be the appropriate source of background concentrations in the dispersion model for the assessment of human health receptors. NO₂, PM₁₀ and PM_{2.5} backgrounds were therefore derived from this data.

To avoid double counting of potential source contributions already contained within the ADMS-Roads dispersion model, 'Primary A Road in' and 'Motorway in' sectors were removed from each grid square. As the relationship between NO₂ and NO_x is not linear, the NO₂ Adjustment for NO_x Sector Removal Tool³⁰ has been used – in accordance with LAQM.TG (22). Adjusted background concentrations for each modelled receptor location are shown in Appendix D.

4.4 Defra Roadside Modelled Concentrations

Defra have modelled roadside concentrations of various pollutants²², including NO₂ using PCM. The closest roads for which data is available, is shown below in Figure 7. It is noted that the East Lancashire Road (A580) does not have any data available and it is considered a main source of pollution in the area, in terms of vehicle emissions.

³⁰ Defra NO₂ Adjustment for NO_x Sector Removal Tool version 7.0 (2018), available at <https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxsector>.

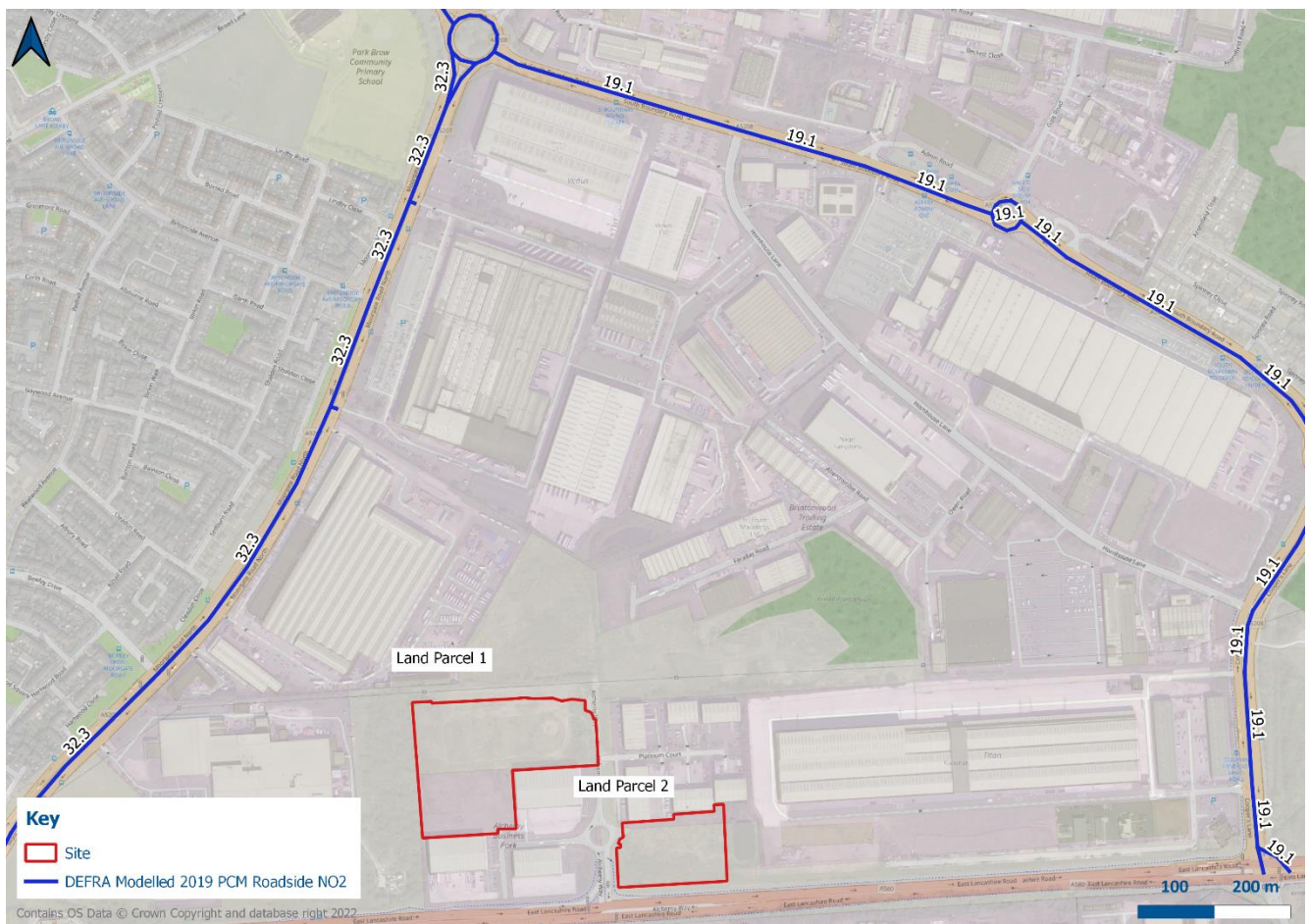


Figure 7 - Defra Modelled PCM 2019 Roadside NO₂ Concentrations (Approximate Site Boundary in Red)

Figure 7 illustrates 2019 modelled roadside NO₂ concentrations on the A5207 and A5208 of 32.3µg/m³ and 19.1µg/m³ respectively. These concentrations are 20% and 52% below the annual mean NO₂ AQL. It is recognised there are uncertainties associated with these modelled concentrations; therefore, further analysis of local air quality monitoring is provided below.

4.5 Air Quality Monitoring Data

4.5.1 Automatic Air Quality Monitoring

The UK Automatic Urban and Rural Network (AURN) is a countrywide network of air quality monitoring stations operated on behalf of the DEFRA. Monitoring data for AURN sites is available from the UK Air website³¹.

The closest AURN monitor to the Site is the St Helens Linkway AURN (NGR: x350813, y395264) located approximately 8.3km east from the Site. The St Helens Linkway AURN is classified as an 'urban traffic' monitor, defined by LAQM.TG (22) as: "Located such that its pollution level is determined predominantly by the emissions from nearby traffic (roads, motorways, highways)". Given the distance between the AURN and the Site, monitored concentrations at the AURN are not considered to be representative of the Site. Therefore, this type of monitoring data has not been considered in this assessment.

In 2019 KC undertook continuous air quality monitoring at 3 locations within the Council's area. The closest of these continuous air quality monitors to the Site is located at Old Rough Lane, Kirkby (NGR: x341414, y398991).

³¹ Automatic Urban and Rural Network (AURN) - Defra, UK, accessed July 2022

The monitor is located approximately 2km north-west of the Site and is classified as ‘roadside’ defined as, “A site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases)”. Monitoring began at the new Kirkby monitor in 2019. Recent monitoring data is presented in Table 8 below and Figure 8.

Table 8 – Automatic Monitoring Concentrations

Monitor	Pollutant	AQAL	AQAL (µg/m³)	Concentration (µg/m³)	
				2019	2020
Kirkby	NO ₂	Annual Mean	40	24.8	25.8
		1-hour Mean	200 ^(A)	0 ^(C)	0 ^(C)
	PM ₁₀	Annual Mean	40	37.6	33.3
		24-Hour Mean	50 ^(B)	9 ^(D)	35 ^(D)
Notes: ^(A) 200µg/m³ not to be exceeded more than 18 times/year ^(B) 50µg/m³ not to be exceeded more than 35 times/year ^(C) Number of 1-hour means >200µg/m³ ^(D) Number of 24-hour means >50µg/m³					

As shown in Table 8 above, the annual mean NO₂ AQAL was not breached in 2019 at the Kirkby monitor with concentrations 38% below the annual mean AQAL. Whilst concentrations reduced significantly in 2020, results should be treated with caution due to the effects of the COVID 19 pandemic on traffic flows.

With regard to PM₁₀, measured concentrations were below the relevant AQALs during 2019 at the Kirkby monitor. The monitored PM₁₀ concentration was 6% below the annual mean AQAL.

The short-term concentrations of NO₂ and PM₁₀ also remained below the relevant AQALs.

4.5.2 Passive Diffusion Tube Monitoring

Passive diffusion tube monitoring is currently undertaken by KC at numerous locations throughout the Council’s area as part of their commitment to LAQM. The diffusion tubes are located in areas which are deemed to require further assessment of NO₂ concentrations. The latest Annual Status Report²⁴ states that in 2020, the monitoring network consisted of 32 NO₂ diffusion tubes. Monitoring locations within 2km of the Site are detailed below. The location of these monitoring sites in relation to the Site are shown in Figure 8. Monitoring at all sites began in 2019.

LCC also undertake passive diffusion tube monitoring and in 2019 the monitoring network consisted of 145 locations. Monitoring locations within 5km of the Site are detailed below and shown in Figure 8. Monitoring data for LCC was only available up to 2019.

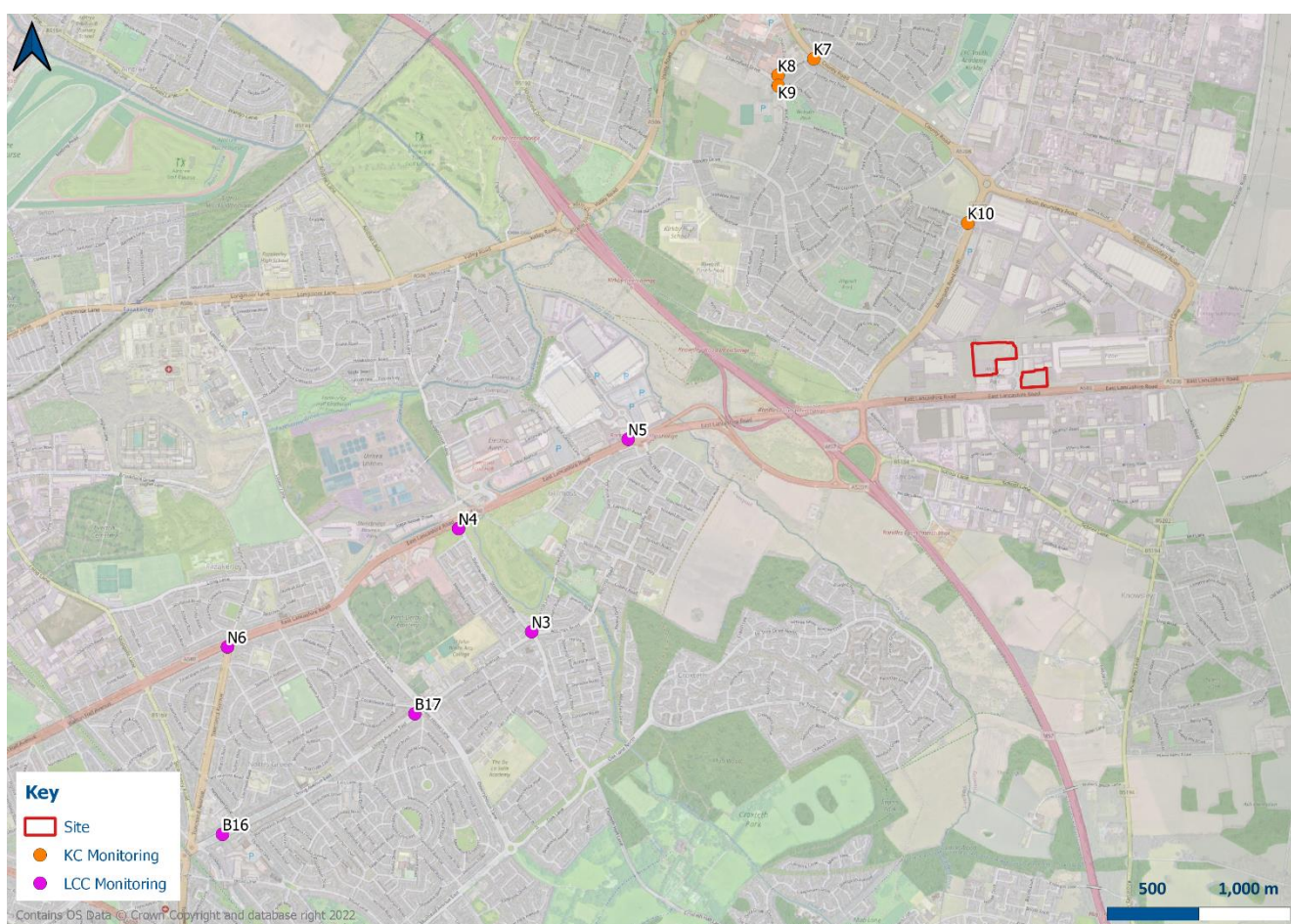


Figure 8 –Local Monitoring Sites

The data for the monitoring sites shown in Figure 8 are reported in in Table 9 below. Monitoring data for LCC was only available up to 2019.

Table 9 – Passive Diffusion Tube Monitoring Concentrations

Site ID	Site Name	Site Type	X	Y	In AQMA	Annual Mean NO ₂ Concentrations (µg/m ³)			
						2018	2019	2020	2021
K7	LC067 Corner of County Road and Webster	Roadside	341581	398650	No	-	29.6	24.1	25.6
K8	LC002 Outside Webster Drive	Roadside	341386	398560	No	-	32.4	28.7	29.4
K9	LC 017 on Cherryfield Drive	Roadside	341387	398504	No	-	29.4	27.7	31.6
K10	Outside 19 Moorgate Road (A5207)	Roadside	342421	397755	No	-	29.4	24.1	28.4
N3	Storrington Ave/Stonebridge Ln (on lamp post by traffic lights)	Roadside	340043	395528	Yes	33	37.6	-	-
N4	Stonebridge Ln, East Lancs. Rd junction. Lamppost before pedestrian crossing	Roadside	339644	396090	Yes	34	35.3	-	-
N5	East Lancs Rd filter lane to Portal Way. Lamppost half way down filter lane.	Roadside	340569	396577	Yes	50	50.5	-	-
N6	East Lancs Rd, Townsend Ave junction. Central triangular island. Lamppost with Stop sign	Roadside	338384	395445	Yes	39	39.5	-	-

Site ID	Site Name	Site Type	X	Y	In AQMA	Annual Mean NO ₂ Concentrations (µg/m ³)			
						2018	2019	2020	2021
B16	Lamp on central reserve opposite Surestart Utting Ave East	Roadside	338357	394424	Yes	31	30.7	-	-
B17	Traffic Lt in cntrl reserve jct of Lowerhouse / Utting Ave East	Kerbside	339406	395081	Yes	27	27.7	-	-

The data in Table 9 shows that the highest concentrations of NO₂ in recent years have been recorded Webster Drive at diffusion K8. In 2019 the annual mean concentration of NO₂ at site K8 was 19% below the AQAL for NO₂. The other monitoring locations all monitored lower annual mean concentrations of NO₂ for the years for which data is available for review. Monitoring location K10 is considered to be most representative of the Site. In 2019 K10 monitored concentrations 27% below the annual mean AQAL.

KC data from both 2020 and 2021 should be treated with caution due to the impact on road traffic as a result of the COVID 19 pandemic.

The KC 2020 ASR states the following with regards to monitoring trends:

“trends in annual mean concentrations have continued to decrease in 2020 at all diffusion tube sites. It is likely that the reduction in traffic flows as a result of the COVID-19 lockdown measures has had an impact, with a 15% reduction in NO₂ observed on average across the borough.”

The LCC 2020 ASR states the following with regards to monitoring trends between 2016 and 2019:

“There has been a slight downward trend between 2015 and 2019 at most monitoring locations. The most significant decrease in NO₂ levels occurred between 2016 and 2017. The latest data from 2019 shows that NO₂ levels increased in 81 out of 86 locations for which a direct comparison is possible with 2018 levels. The increases were mostly marginal and this follows a noticeable decline in levels from previous years. The NO₂ concentrations in 2019 were still below 2016 levels for all except one of the 56 sites for which a comparison was possible.”

5. CONSTRUCTION PHASE ASSESSMENT

5.1 Overview

The construction phase of the Proposed Development will involve a number of activities that will release polluting emissions to air. Predominantly, these will be emissions of dust. As such, a qualitative construction dust risk assessment has been carried out in accordance with IAQM Guidance.

Construction activities will include:

- material export and import;
- temporary stockpiling of materials;
- groundwork for foundations and services;
- construction of buildings;
- landscaping works; and
- vehicle movements (with the potential to track-out material from site).

The risks of impact and the significance of each stage of the construction phase is classified as Negligible, Low, Medium or High, determined against a matrix which considers the distance from source, receptor sensitivity, background pollution concentrations and the potential dust emission magnitude of the works.

5.2 Construction Traffic Emissions

The IAQM's guidance states that, from experience of assessing exhaust emissions from site traffic, it is unlikely that any significant adverse impacts on local air quality would be caused and in the vast majority of cases, quantitative assessment is not needed. As such, short term effects of construction traffic emissions have not been assessed, as they are also likely to be well below the IAQM traffic criteria outlined in Table 3.

5.3 Dust Emission Magnitude

5.3.1 Demolition

There are no existing buildings on Site and no demolition will take place. Therefore, the potential dust emission magnitude from demolition has not been considered further.

5.3.2 Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. This may also involve levelling the site and landscaping. The total area of the Site is within the IAQM's 'Large' criteria (>10,000m²) with both the Frontage Plot and the Western Plot measuring 14,078m² each.

The underlying soil texture is "Naturally wet very acid sandy and loamy soils"³² which have a reasonably high potential for dust release when due to the small particle size.

The total amount of material proposed to be moved during earthworks is 6,439m³.

Based on the above, the potential dust emission magnitude for earthworks is considered to be '**Large**'.

³² Cranfield University, "Cranfield Soil and Agrifood Institute," n.d., <http://www.landis.org.uk/soilscapes/>. accessed August 2022.

5.3.3 Construction

The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build.

The total volume of proposed buildings is predicted to be within the IAQM's Large category ($> 100,000\text{m}^3$). The duration of the construction works is proposed as follows:

- Frontage Plot – 36 weeks; and
- Western Plot – 40 weeks.

The construction materials comprise, steel, concrete, glass, aluminium and aluminium cladding, all of which are considered to have low potential for dust emissions.

There is no concrete batching or sandblasting proposed on Site.

Based on the above, the potential dust emission magnitude for construction is considered to be '**Large**'.

5.3.4 Trackout

The risk of impacts occurring during Trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size, speed and the duration of activities are also factors which are used to determine the risk of impacts.

It is expected that there would be between 5 – 10 HDVs outwards movements from the Site each day. No unpaved surfaces over 50m would be utilised as site traffic would be routed along the existing road network.

Based on the above, the potential dust emission magnitude during Trackout is considered to be '**Medium**'.

5.3.5 Summary

Table 10 below shows a summary of the potential dust emission magnitudes from each activity:

Table 10 - Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Earthworks	Large
Construction	Large
Trackout	Medium

5.4 Sensitivity of Area

The prevailing wind direction for the closest regionally representative meteorological measurement station to the Site, at Crosby Airport, is shown in Appendix C. The wind rose shows that the prevailing winds during 2019 are from the west and south-east. As such, receptors downwind (i.e. east and north-west) of the Site are considered to be more at risk of exposure to dust impacts than those located upwind.

Figure 9 shows the construction phase distance buffers (20m, 50m, 100m and 350m) from the Site boundary, as well as identified high sensitivity receptor locations within these buffers.

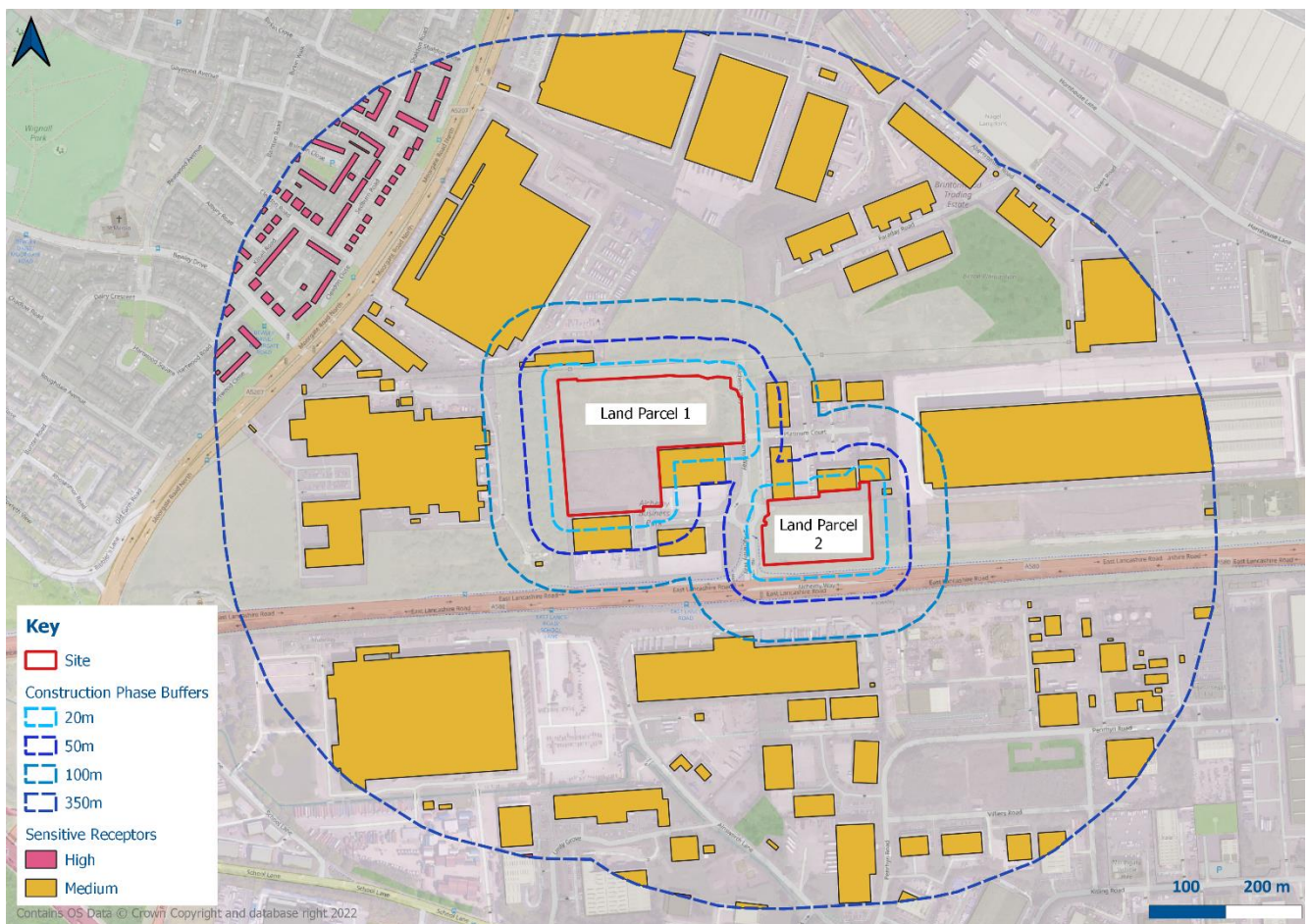


Figure 9 – Construction Phase Receptors

5.4.1 Dust Soiling Impacts

As shown in Figure 9, there are between 10 - 100 high sensitivity human receptors within 350m of the Site boundary. Additionally, there are >1 medium sensitivity receptors within 20m of the Site boundary. As such, the overall sensitivity of the surrounding area to nuisance dust soiling effects during Earthworks and Construction, according to IAQM guidance, is defined as 'Medium'.

With regard to Trackout, the sensitivity for Medium size sites is assessed where receptors are located within 50m from Trackout routes up to 200m from the Site. As there are no high-sensitivity receptors within 50m of potential Trackout routes from the Site but >1 medium sensitivity receptors within 50m of Trackout routes, the sensitivity to dust soiling impacts from Trackout is also defined as 'Medium'.

5.4.2 Human Health Impacts

Defra mapped background predictions (Table 7) show that annual mean concentrations of PM₁₀ are well below 32µg/m³ in the vicinity of the Site (the concentration at which exceedance of the 24-hour AQAL is likely), and are not likely to exceed 24µg/m³, based on 2019 estimates. According to IAQM guidance, where PM₁₀ concentrations are <24µg/m³ and there are fewer than 100 high sensitivity receptors within 20m of the Site boundary, the overall sensitivity of the surrounding area to human health impacts is defined as 'Low' for all stages.

5.4.3 Summary

The sensitivity of the surrounding area for the potential impacts discussed above are shown in Table 11 below.

Table 11 - Sensitivity of Local Area

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium
Human Health	Low	Low	Low

5.5 Risk of Impacts

Using the methodology prescribed in the IAQM guidance, the overall risk of impacts can be defined by combining the sensitivity of the area with the potential dust emission magnitude of each stage of the construction phase as described above.

Table 12 provides a summary of the construction dust risk assessment. Overall, the development is considered to be **Medium Risk** for nuisance dust soiling effects and a **Low Risk** for PM₁₀ health effects, in the absence of mitigation.

Table 12 - Risk of adverse impacts during construction phase

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Medium Risk	Low Risk
Human Health	Low Risk	Low Risk	Low Risk

Section 7.1 provides site specific mitigation measures to be adopted. The IAQM guidance states that implementing these measures should effectively reduce the risk of impacts to *Negligible* during this phase. On this basis, the residual construction phase effects are considered to be 'not significant'.

6. OPERATIONAL PHASE ASSESSMENT

6.1 Impact Assessment

The results of the operational phase dispersion modelling assessment are shown below in Table 13, Table 14 and Table 15.

6.1.1 Annual Mean NO₂

Predicted annual mean NO₂ concentrations were assessed against the AQAL of 40µg/m³ as presented in Table 13.

Table 13 – Modelled Annual Mean NO₂ Results

Receptor	Modelled NO ₂ (µg/m ³)				
	2024 DM	2024 DS	Change	% Change relative to AQAL	Significance
R1	14.6	14.7	0.1	0	Negligible
R2	17.7	17.8	0.1	0	Negligible
R3	17.9	18.0	0.1	0	Negligible
R4	19.9	20.0	0.1	0	Negligible
R5	23.5	23.5	0.1	0	Negligible
R6	21.1	21.2	0.1	0	Negligible
R7	22.5	22.5	0.1	0	Negligible
R8	15.8	15.8	<0.1	0	Negligible
R9	18.7	18.8	<0.1	0	Negligible
R10	17.4	17.4	<0.1	0	Negligible
R11	21.8	22.0	0.2	0	Negligible
R12	29.0	29.1	0.1	0	Negligible
R13	18.8	18.8	<0.1	0	Negligible
R14	24.9	25.0	0.1	0	Negligible
R15	14.3	14.3	<0.1	0	Negligible
R16	30.4	30.5	0.1	0	Negligible
R17	25.1	25.2	0.1	0	Negligible
R18	16.0	16.0	<0.1	0	Negligible
R19	22.4	22.6	0.2	1	Negligible
R20	19.9	20.0	0.1	0	Negligible
R21	34.4	34.4	0.1	0	Negligible
R22	23.0	23.0	<0.1	0	Negligible
R23	25.2	25.3	<0.1	0	Negligible
R24	22.1	22.1	<0.1	0	Negligible
R25	17.5	17.6	<0.1	0	Negligible
R26 (A) (B)	-	24.2	-	-	-
R27 (A) (B)	-	18.7	-	-	-
(A) Locations not relevant to the Long Term AQALs					
(B) Locations on present within the DS scenario					

Table 13 shows that there are no predicted exceedances of the annual mean NO₂ AQAL at any receptor in either the DM or DS scenarios associated with the 2024 opening year.

The maximum increase in annual mean NO₂ is 0.2µg/m³ at R11, a residential property on Croxteth View.

The predicted changes in annual mean NO₂ at all existing receptors were <1% of the relevant AQAL, with total concentrations below 75% of the objective. Therefore, in accordance with the EPUK & IAQM guidance, the impact of the Proposed Development on annual mean NO₂ concentrations is considered to be negligible.

6.1.2 1-hour Mean NO₂

With regard to the 1-hour NO₂ objective, Defra's LAQM.TG (22) states where the annual means are below 60µg/m³, it is unlikely that exceedances of the 1-hour mean will occur. As all modelled results are below this threshold, it is unlikely that the 1-hour NO₂ AQAL is exceeded at any of the receptor locations. As such, the impact of the Proposed Development on short term NO₂ concentrations at existing sensitive receptors is considered to be negligible.

6.1.3 Annual Mean PM₁₀

Predicted annual mean PM₁₀ concentrations were assessed against the AQAL of 40µg/m³ as presented in Table 14.

Table 14 – Modelled Annual Mean PM₁₀ Results

Receptor	Modelled PM ₁₀ (µg/m ³)				
	2024 DM	2024 DS	Change	% Change relative to AQAL	Significance
R1	12.4	12.4	<0.1	0	Negligible
R2	12.9	13.0	<0.1	0	Negligible
R3	13.0	13.0	<0.1	0	Negligible
R4	13.5	13.5	<0.1	0	Negligible
R5	14.7	14.7	<0.1	0	Negligible
R6	15.3	15.4	<0.1	0	Negligible
R7	15.7	15.7	<0.1	0	Negligible
R8	12.8	12.8	<0.1	0	Negligible
R9	13.3	13.3	<0.1	0	Negligible
R10	12.9	12.9	<0.1	0	Negligible
R11	16.0	16.0	<0.1	0	Negligible
R12	17.0	17.0	<0.1	0	Negligible
R13	15.4	15.4	<0.1	0	Negligible
R14	14.6	14.6	<0.1	0	Negligible
R15	12.5	12.6	<0.1	0	Negligible
R16	15.8	15.8	<0.1	0	Negligible
R17	14.6	14.7	<0.1	0	Negligible
R18	13.1	13.1	<0.1	0	Negligible
R19	13.9	14.0	0.1	0	Negligible
R20	14.4	14.4	<0.1	0	Negligible
R21	15.8	15.8	<0.1	0	Negligible
R22	13.3	13.3	<0.1	0	Negligible
R23	13.6	13.6	<0.1	0	Negligible
R24	14.8	14.8	<0.1	0	Negligible
R25	14.7	14.7	<0.1	0	Negligible
R26 (A) (B)	-	14.7	-	-	-
R27 (A) (B)	-	13.9	-	-	-
Notes:					

Receptor	Modelled PM ₁₀ (µg/m ³)				
	2024 DM	2024 DS	Change	% Change relative to AQAL	Significance
(A)	Locations not relevant to the Long Term AQALs				
(B)	Locations on present within the DS scenario				

Table 14 shows that there are no predicted exceedances of the annual mean PM₁₀ AQAL at any receptor in either the DM or DS scenarios associated with the 2024 opening year.

The highest concentration is at R17, where a concentration of 17.0µg/m³ is predicted in the DM and DS scenarios. The predicted changes in annual mean PM₁₀ concentrations are all <0.5% of the relevant AQAL. Based on the EPUK & IAQM guidance, the impact the Proposed Development on annual mean PM₁₀ concentrations is considered to be negligible.

6.1.4 24-hour Mean PM₁₀

The AQAL for 24-hour mean PM₁₀ concentrations is 50µg/m³ not be exceeded more than 35 times a year. The results illustrate that the maximum annual mean PM₁₀ concentration is 17.0µg/m³, predicted at receptor R17 in the DS scenario.

The predicted concentrations are well below 32µg/m³ which in accordance with EPUK & IAQM guidance indicates that 24-hour mean PM₁₀ concentrations greater than 50µg/m³ are unlikely to occur.

Therefore, in accordance with the guidance there is no predicted risk of exceedances of the 24-hour mean PM₁₀ AQAL as a result of incremental concentrations associated with Proposed Development trips.

6.1.5 Annual Mean PM_{2.5}

Predicted annual mean PM_{2.5} concentrations were assessed against the AQAL of 25µg/m³ as presented in Table 15.

Table 15 – Modelled Annual Mean PM_{2.5} Results

Receptor	Modelled PM _{2.5} (µg/m ³)				
	2024 DM	2024 DS	Change	% Change relative to AQAL	Significance
R1	9.0	9.0	<0.1	0	Negligible
R2	10.1	10.1	<0.1	0	Negligible
R3	10.2	10.2	<0.1	0	Negligible
R4	10.7	10.7	<0.1	0	Negligible
R5	12.2	12.3	<0.1	0	Negligible
R6	12.2	12.2	<0.1	0	Negligible
R7	12.9	12.9	<0.1	0	Negligible
R8	9.1	9.1	<0.1	0	Negligible
R9	9.8	9.8	<0.1	0	Negligible
R10	9.9	9.9	<0.1	0	Negligible
R11	11.5	11.5	<0.1	0	Negligible
R12	13.2	13.2	<0.1	0	Negligible
R13	10.4	10.4	<0.1	0	Negligible
R14	12.6	12.6	<0.1	0	Negligible
R15	8.9	8.9	<0.1	0	Negligible
R16	14.6	14.6	<0.1	0	Negligible
R17	12.5	12.5	<0.1	0	Negligible
R18	9.8	9.8	<0.1	0	Negligible
R19	11.8	11.9	0.1	1	Negligible
R20	11.6	11.7	0.1	0	Negligible
R21	12.8	12.8	<0.1	0	Negligible
R22	10.7	10.7	<0.1	0	Negligible
R23	10.5	10.5	<0.1	0	Negligible
R24	10.3	10.3	<0.1	0	Negligible
R25	10.3	10.3	<0.1	0	Negligible
R26 (A) (B)	-	10.8	-	-	-
R27 (A) (B)	-	9.5	-	-	-
Notes:					
(A) Locations not relevant to the Long Term AQALs					
(B) Locations on present within the DS scenario					

Table 15 shows that there are no predicted exceedances of the annual mean PM_{2.5} AQAL at any receptor in either the 2024 DM or 2024 DS scenarios associated with the 2024 opening year.

The highest concentration is at Receptor R16, where a concentration of 14.6µg/m³ is predicted in the DM and DS scenarios.

The predicted changes in annual mean PM_{2.5} concentrations are all <1% of the relevant AQAL. Based on the EPUK & IAQM guidance, the impact the Proposed Development on annual mean PM_{2.5} concentrations is considered to be negligible.

6.2 Sensitivity Analysis

A sensitivity analysis was also undertaken whereby the model inputs for the DM and DS scenarios assume no improvement in Emissions Factors or background concentrations of NO₂, PM₁₀ and PM_{2.5} beyond 2019. This

analysis therefore accounts for the worst-case scenario whereby traffic emissions do not improve in line with those in Defra's EFT and background concentrations do not decrease in line with UK-AIR predictions.

The results of this analysis show that the impact of the Proposed Development was also **Negligible** at all receptor locations for NO₂, PM₁₀ and PM_{2.5}. The full results of the sensitivity analysis are shown in Appendix E.

6.3 Significance of Air Quality Impacts

The EPUK & IAQM guidance considers a number of factors for the determination of significance of predicted air quality impacts. Such factors include:

- the existing and future air quality in the absence of the development;
- the extent of current and future population exposure to the impacts;
- the worst-case assumptions adopted when undertaking the prediction of impacts; and
- the extent to which the development has adopted best practice to eliminate and minimise emissions.

The unmitigated impact associated with the scheme has been predicted in accordance with the stated assessment methodology. The following factors have been taken into account:

- there are no predicted exceedances of the annual mean NO₂, PM₁₀ or PM_{2.5} AQALs as a result of the Proposed Development;
- a negligible impact on annual mean NO₂, PM₁₀ or PM_{2.5} concentrations has been predicted at all considered sensitive receptor locations;
- the Proposed Development will not introduce any new receptors into an area of exceedance of any relevant AQAL, including at new receptor locations of relevant exposure introduced within the Site;
- exceedances of the 1-hour mean NO₂ and 24-hour mean PM₁₀ AQALs are considered unlikely, based upon the marginal change in concentrations and absolute concentrations predicted through the dispersion modelling study; and
- all modelled concentrations have been verified against KC and LCC monitoring data.

A sensitivity assessment of the model input variables (emission factors and background concentrations) has been considered and is presented in Appendix E. However, the overall conclusion over the significance of the effect has been based upon the main body of the assessment, utilising 2024 as the development opening year. Notwithstanding, it is noted that the sensitivity assessment presented within Appendix E does not predict any new exceedances of the AQALs as a result of the Proposed Development.

Therefore, on the basis of the above, the overall effect on air quality as a result of the additional development trips on sensitive receptors is considered to be 'not significant'.

7. MITIGATION MEASURES

7.1 Construction Phase

The qualitative construction dust risk assessment shows that the Site is **Medium Risk** for adverse impacts during construction, as a worst-case, in the absence of mitigation. The IAQM's highly recommended mitigation measures for Medium risk sites is provided at Appendix F of this report. Implementing these measures should effectively reduce the risks of construction phase impacts on the local area to Negligible.

7.2 Operational Phase – Road Sources

7.2.1 Electric Vehicle Charging Infrastructure

From the 15th June onwards, Approved Document S 2021³³ came into force, which states;

"Where a new building which is not a residential building or a mixed-use building has more than 10 parking spaces—

(a) one of those parking spaces must have access to one electric vehicle charge point; and

(b) cable routes for electric vehicle charge points must be installed in a minimum of one fifth of the total number of remaining parking spaces."

7.2.2 Travel Plan Measures

The Travel Plan (TP)³⁴ has been prepared by Pell Frischmann. One of the main targets for the TP is:

"The development will promote the opportunities and benefits of sustainable modes of travel, with the aim to achieve a 10% reduction in the car driver modal share for staff, within five years of occupation. This will be complimented by an increase in the proportion of walking, cycling, public transport and car sharing travel modes."

The TP outlines measures that will seek to encourage sustainable modes of transport and discourage the use of car travel to help achieve this target, such as;

- Appointing a Travel Plan Co-ordinator to oversee measures and incentives;
- Welcome Packs for all staff with detailed information regarding transport facilities;
- Travel information boards highlighting information including cycle and pedestrian route maps;
- Provision of motorcycle and cycle parking;
- Cycle to work scheme;
- Personalised travel planning;
- Car sharing and Car club initiatives; and
- Where possible provide technology so that staff can work from home.

These measures provide an opportunity to promote and establish sustainable modes of transport which will also help to improve air quality.

³³ The Building Regulations 2010, Approved Document S: Infrastructure for the charging of electric vehicles, HM Government, 15 June 2022.

³⁴ Pell Frischmann Travel Plan, report Ref: 106636.PEF-ZZ-XX-DR-TP-000002, 8/8/2022.

7.3 Ventilation Strategy

The ventilation strategy for the Western Plot is mechanical heat recovery ventilation systems, which shall be installed in the office to provide a ventilation rate of 12l/s/person.

This is considered appropriate based on the results of the AQA.

8. DISCUSSION AND CONCLUSION

Hydrock were commissioned by Network Space Development to prepare an AQA to support site wide proposals for the erection of 5 industrial units on land at Alchemy Way. Both development plots are covered by this AQA, however this Planning Application relates to Land Parcel 01 (North West Plot).

A qualitative construction phase assessment has been undertaken in line with IAQM guidance. Through good practice and implementation of appropriate mitigation measures as recommended, it is expected that the release of dust would be effectively controlled and mitigated, with resulting effects considered to be 'not significant'. All dust impacts are considered to be temporary and short-term in nature.

In line with EPUK & IAQM guidance, detailed dispersion modelling using ADMS-Urban has been performed to assess the significance of potential impacts of the Proposed Development on local air quality. The modelling assessment has shown that the impact of the Proposed Development (including proposals for Land Parcel 1 and 2) on local air quality is Negligible for NO₂, PM₁₀ and PM_{2.5}. No exceedances of the relevant AQALs were identified. As such, the overall effect arising from change in operational phase trips is considered to be 'not significant'.

The proposed heating strategy will not involve any new combustion sources and therefore is beneficial in terms of air quality.

From the evidence presented, and by following the guidance provided herein, the Proposed Development will comply with all relevant air quality policy. As such, air quality should not pose any significant obstacles to the planning process.

Appendix A - Traffic Data

The traffic data, supplied by Pell Frischmann is shown in below in Table 16. Data was provided for the following scenarios:

- 2019 AADT;
- 2024 DM AADT (this scenario includes committed development);
- 2024 DS (this scenario includes committed development and generated traffic associated with the Proposed Development).

Table 16 - Traffic Data

Link ID	Road Link	Speed (kmph)	2019 Model Verification			2024 DM			2024 DS		
			AADT	LDV	HDV	AADT	LDV	HDV	AADT	LDV	HDV
L1	A580 East of Site Access	80	15,995	14,506	1,489	16,952	15,374	1,578	17,289	15,702	1,587
L2	A580 West of Site Access	80, 48	15,995	14,506	1,489	16,952	15,374	1,578	17,944	16,287	1,657
L3	A5208 Coopers Ln	64	8,846	8,267	579	9,375	8,762	614	9,414	8,801	614
L4	A5208 Boundary Rd	64	8,846	8,267	579	9,375	8,762	614	9,414	8,801	614
L5	A5207 Moorgate Rd	64	19,250	17,074	2,176	20,402	18,095	2,306	20,540	18,229	2,310
L6	B5202 Knowsley Ln	80	0	0	0	0	0	0	22	22	0
L7	A5208 Country Rd	64	10,181	9,822	359	10,790	10,410	380	10,871	10,487	384
L8	A580 West	80, 48	39,370	37,147	2,223	41,725	39,369	2,356	42,038	39,669	2,369
L9	M57 South of J4	112, 32	99,521	91,650	7,871	105,474	97,133	8,342	10,5784	97,399	8,386
L10	M57 North of J4	112, 32	65,144	58,317	6,827	69,041	61,806	7,235	69,213	61,960	7,253
L11	A506	64	25,939	25,665	274	27,491	27,200	290	27,521	27,230	290
L12	M57 North of J6	112, 32	74,777	69,368	5,409	79,250	73,518	5,733	79,447	73,697	5,751
L13	Lower House Ln	48	14,939	14,774	165	15,833	15,658	175	15,919	15,744	175
L14	Townsend Ave	48	10,352	10,229	123	10,971	10,841	130	11,034	10,904	130

Link ID	Road Link	Speed (kmph)	2019 Model Verification			2024 DM			2024 DS		
			AADT	LDV	HDV	AADT	LDV	HDV	AADT	LDV	HDV
L15	A580 West Walton Hall Ave	64	32,100	30,434	1,666	34,020	32,255	1,766	34,134	32,356	1,779
L16	A580 East Lancashire Rd	96	23,643	21,671	1,972	25,057	22,967	2,090	25,304	23,205	2,099
L17	M57 South of J3	112	84,476	76,798	7,678	89,529	81,392	8,137	89,761	81,580	8,181
L18	M57 South of J2	112	85,305	77,170	8,135	90,408	81,786	8,622	90,615	81,949	8,666
L19	Seth Powell Way	112, 48	14,945	14,786	159	15,839	15,671	169	15,908	15,740	169
L20	Catchdale Moss Ln	80	7,475	7,152	323	7,922	7,580	342	8,030	7,688	342
L21	A580 East Lancashire Rd	20	27,518	25,706	1,812	29,164	27,244	1,920	29,269	27,340	1,929
L22	A580 West Walton Ln	20	23,372	22,576	796	24,770	23,927	844	24,824	23,968	857

Appendix B – Meteorological data

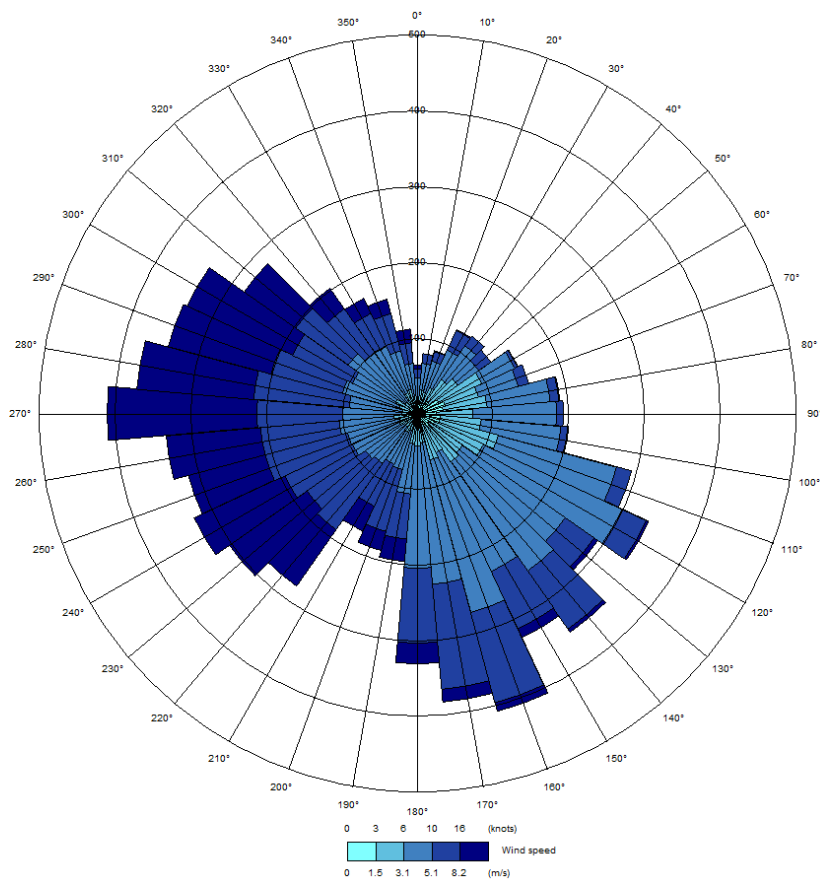


Figure 10 – 2019 Meteorological Data from Crosby Airport

- Data capture for wind speed: 99.9 %
- Data capture for wind direction: 99.4 %
- Data capture for temperature: 99.8 %
- Data capture for cloud cover: 85.2 %

Appendix C – Model Verification

An important stage in the modelling process is model verification, which involves comparing the model output with measured concentrations in order to increase confidence in modelled predictions.

According to LAQM.TG (22), the difference between modelled results and monitored concentrations is acceptable where it is within 25% (10% is preferable).

Monitoring Locations used for Verification:

The following KC and LCC monitoring locations were selected for model verification, due to being highly representative of the study area and where appropriate traffic data was available:

- K7;
- K10;
- N5; and
- N6.

Model Verification

It is most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$). The model output of road- NO_x (i.e., the component of total NO_x coming from road traffic) has been compared with the ‘measured’ road- NO_x . Measured road- NO_x has been calculated from the measured NO_2 concentrations using the NO_x from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website³⁵.

The pre-adjusted modelled and monitored verification results are given in Table 17.

Table 17 - 2019 Modelled and monitored results

Monitoring ID	Modelled NO_x ($\mu\text{g}/\text{m}^3$)	Monitored NO_x ($\mu\text{g}/\text{m}^3$)	Ratio Modelled/ Monitored	Modelled NO_2 ($\mu\text{g}/\text{m}^3$)	Monitored NO_2 ($\mu\text{g}/\text{m}^3$)	Difference (%)
K7	5.2	29.3	5.7	17.4	29.6	-41.3
K10	8.5	25.4	3.0	20.9	29.4	-28.8
N5	19.4	79.7	4.1	23.9	50.5	-52.7
N6	17.3	51.3	3.0	23.6	39.5	-40.3

The model was underpredicting at all locations. As such, an adjustment factor of **3.609** has been determined as the equation of the slope of the best-fit line between the ‘measured’ road contribution and the model derived road contribution of NO_x , as shown below:

³⁵ Defra, “NOx to NO2 Calculator” (Defra, 2019), <http://laqm.defra.gov.uk/documents/NOx-NO2-Calculator-v8.1.xls>.

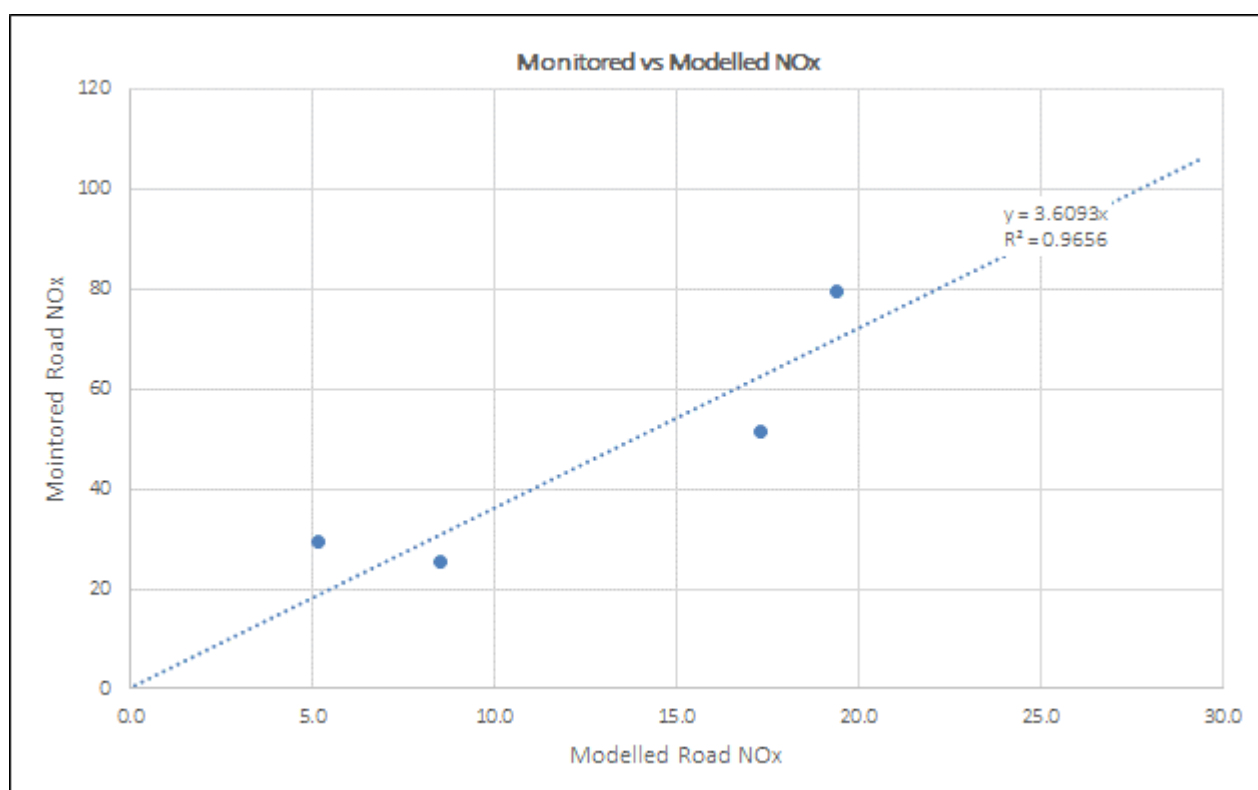


Figure 11 – Model Adjustment Factor (Monitored vs Modelled NO_x)

Table 18 shows total monitored versus modelled NO₂ following the adjustment of the road contribution of NO_x by this factor. The total NO₂ concentration was determined by adding the calculated background NO₂ concentration to the modelled road contribution.

Table 18 – Post-adjusted 2019 Modelled and monitored results

Monitoring ID	Adjusted Modelled NO ₂ (µg/m ³)	Monitored NO ₂ (µg/m ³)	Difference (%)
K7	24.4	29.6	-17.7%
K10	32.0	29.4	8.7%
N5	46.7	50.5	-7.5%
N6	44.3	39.5	12.1%

Following adjustment of NO_x by a factor of **3.609**, modelled concentrations of NO₂ were within the ideal +/-10% range of monitored concentrations at K10 and N5 and within the acceptable +/-25% range of monitored concentrations at K7 and N6:

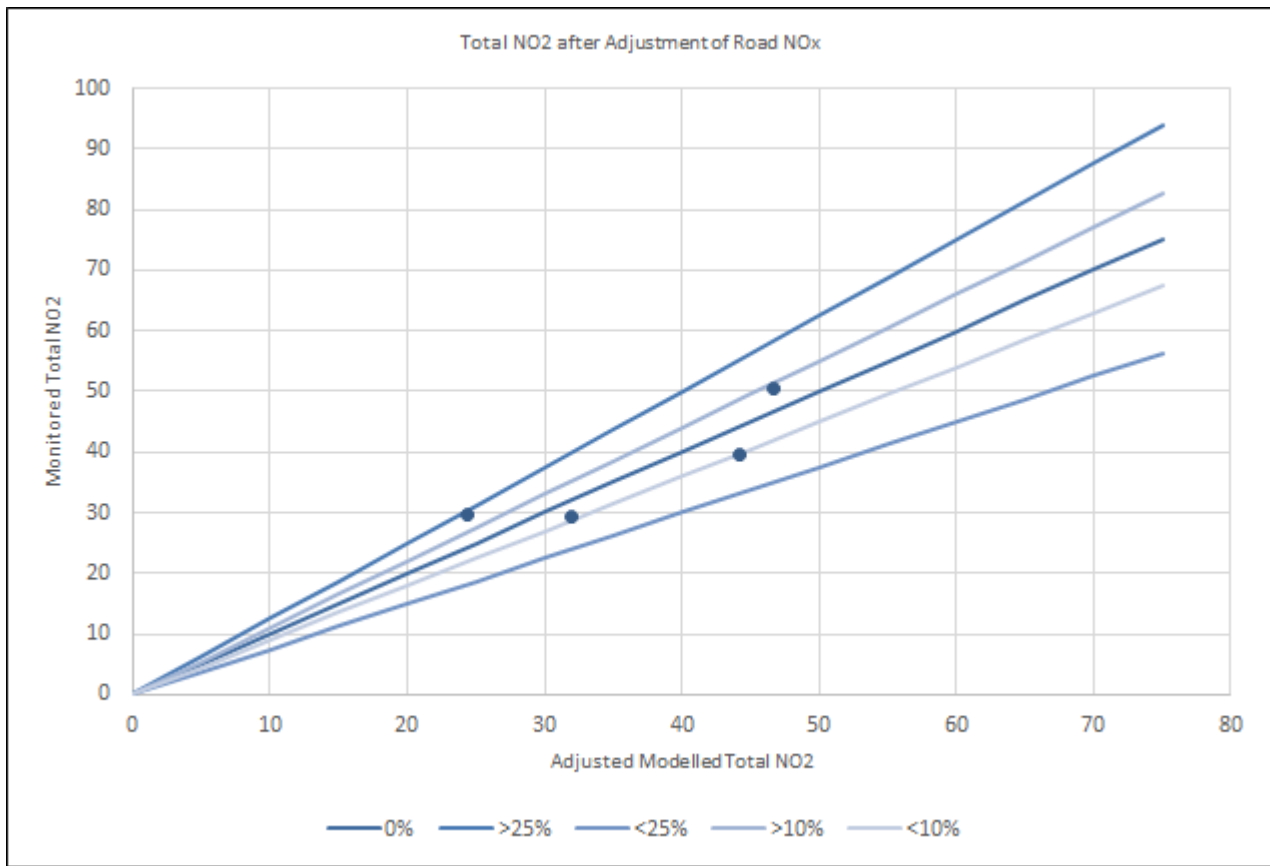


Figure 12 – Post-adjusted Monitored vs Modelled NO₂

In addition, the overall post-adjusted uncertainty (RMSE) for annual mean NO₂ was 10.6%, which is well within acceptable 25% range of uncertainty and just above the ideal 10% range of uncertainty. As such, the factor was considered to be acceptable.

As there is insufficient PM₁₀ or PM_{2.5} monitoring data in the study area, it was not possible to perform model verification for these pollutants. As such, the NO₂ adjustment factor has also been applied to PM₁₀ and PM_{2.5} model results, in accordance with LAQM.TG(22).

Appendix D – Background Concentrations

The adjusted background concentrations used in the modelling assessment, from Defra Mapped backgrounds, are shown below. Both the 2019 Base year and the 2024 Development Opening Year are shown.

Table 19 - Background Concentrations

Receptor	X	Y	2019			2024		
			NO ₂ Concentration (ug/m ³)	PM ₁₀ Concentration (ug/m ³)	PM _{2.5} Concentration (ug/m ³)	NO ₂ Concentration (ug/m ³)	PM ₁₀ Concentration (ug/m ³)	PM _{2.5} Concentration (ug/m ³)
R1	347772	397099	10.4	11.9	7.5	8.7	11.3	7.1
R2	347310	397105	10.4	11.9	7.5	8.7	11.3	7.1
R3	347011	397078	10.4	11.9	7.5	8.7	11.3	7.1
R4	344627	396970	12.1	12.3	7.9	10.0	11.6	7.4
R5	341964	397022	15.6	13.5	9.3	12.8	12.8	8.8
R6	342265	397407	16.4	14.8	10.5	13.9	14.1	9.9
R7	342419	397761	16.4	14.8	10.5	13.9	14.1	9.9
R8	342351	398001	14.8	13.1	8.8	12.4	12.4	8.2
R9	342027	398371	14.8	13.1	8.8	12.4	12.4	8.2
R10	341706	398557	14.6	12.7	8.8	12.0	12.0	8.3
R11	341801	396857	13.5	15.3	9.7	11.2	14.6	9.1
R12	341273	396771	13.5	15.3	9.7	11.2	14.6	9.1
R13	341614	396176	13.5	15.3	9.7	11.2	14.6	9.1
R14	340506	396506	13.7	12.8	8.7	11.3	12.2	8.2
R15	340319	396171	13.7	12.8	8.7	11.3	12.2	8.2
R16	338885	395660	14.5	13.2	9.2	12.2	12.5	8.7
R17	338461	395466	14.5	13.2	9.2	12.2	12.5	8.7
R18	338539	395407	14.5	13.2	9.2	12.2	12.5	8.7
R19	337715	395171	15.4	12.8	9.0	12.9	12.1	8.5
R20	337098	394790	15.3	13.8	9.7	12.9	13.0	9.2
R21	340217	397690	13.5	13.9	9.3	11.2	13.2	8.8
R22	339987	397716	14.8	12.6	8.8	12.4	11.9	8.3
R23	340145	398115	14.8	13.0	9.0	12.2	12.3	8.5
R24	342635	395160	13.2	14.4	9.1	10.9	13.7	8.6
R25	341811	398534	14.6	12.7	8.8	10.9	13.7	8.6
R26	342793	396860	17.3	14.0	9.0	14.4	13.3	8.4
R27	342498	396928	17.3	14.0	9.0	14.4	13.3	8.4

Appendix E – Results of Sensitivity analysis

The result of the sensitivity analysis performed of the ADSM-Urban modelling study are shown below. This used 2019 emission factors and 2019 UK-AIR background concentrations. Exceedances of the relevant AQAL are highlighted in bold. It should be noted that none of these exceedances occur as a result of the Proposed Development.

Table 20 – NO₂ Results of Sensitivity Analysis

Receptor	Modelled NO ₂ (µg/m ³)				
	2019 DM	2019 DS	Change	% Change relative to AQAL	Significance
R1	20.9	21.0	0.1	0	Negligible
R2	26.1	26.2	0.1	0	Negligible
R3	26.4	26.6	0.1	0	Negligible
R4	29.3	29.4	0.1	0	Negligible
R5	34.5	34.6	0.1	0	Negligible
R6	29.4	29.5	0.1	0	Negligible
R7	31.7	31.8	0.1	0	Negligible
R8	20.8	20.8	<0.1	0	Negligible
R9	25.5	25.6	0.1	0	Negligible
R10	23.5	23.6	0.1	0	Negligible
R11	32.2	32.5	0.3	1	Negligible
R12	43.3	43.5	0.2	0	Negligible
R13	26.6	26.7	0.1	0	Negligible
R14	36.5	36.6	0.1	0	Negligible
R15	19.0	19.0	<0.1	0	Negligible
R16	44.6	44.8	0.1	0	Negligible
R17	36.2	36.3	0.1	0	Negligible
R18	21.1	21.1	0.1	0	Negligible
R19	31.3	31.8	0.5	1	Negligible
R20	27.1	27.4	0.4	1	Negligible
R21	51.6	51.7	0.1	0	Negligible
R22	32.4	32.4	<0.1	0	Negligible
R23	36.7	36.8	0.1	0	Negligible
R24	32.1	32.1	0.1	0	Negligible
R25	23.8	23.8	<0.1	0	Negligible
R26 (A) (B)	-	34.7	-	-	-
R27 (A) (B)	-	24.9	-	-	-
(A) Locations not relevant to the Long Term AQALs					
(B) Locations on present within the DS scenario					

Table 21 - PM₁₀ Results of Sensitivity Analysis

Receptor	Modelled PM ₁₀ (µg/m ³)				
	2019 DM	2019 DS	Change	% Change relative to AQAL	Significance
R1	13.1	13.1	<0.1	0	Negligible
R2	13.8	13.8	<0.1	0	Negligible
R3	13.8	13.9	<0.1	0	Negligible
R4	14.3	14.4	<0.1	0	Negligible

Receptor	Modelled PM ₁₀ (µg/m ³)				
	2019 DM	2019 DS	Change	% Change relative to AQAL	Significance
R5	15.7	15.7	<0.1	0	Negligible
R6	16.3	16.3	<0.1	0	Negligible
R7	16.7	16.7	<0.1	0	Negligible
R8	13.6	13.6	<0.1	0	Negligible
R9	14.1	14.1	<0.1	0	Negligible
R10	13.7	13.7	<0.1	0	Negligible
R11	16.9	16.9	<0.1	0	Negligible
R12	18.1	18.1	<0.1	0	Negligible
R13	16.3	16.3	<0.1	0	Negligible
R14	15.5	15.6	<0.1	0	Negligible
R15	13.3	13.3	<0.1	0	Negligible
R16	16.9	16.9	<0.1	0	Negligible
R17	15.6	15.7	<0.1	0	Negligible
R18	13.9	13.9	<0.1	0	Negligible
R19	14.8	14.9	0.1	0	Negligible
R20	15.2	15.3	0.1	0	Negligible
R21	17.0	17.0	<0.1	0	Negligible
R22	14.2	14.2	<0.1	0	Negligible
R23	14.5	14.5	<0.1	0	Negligible
R24	15.7	15.7	<0.1	0	Negligible
R25	13.7	13.7	<0.1	0	Negligible
R26 ^(A) ^(B)	-	15.5	-	-	-
R27 ^(A) ^(B)	-	14.6	-	-	-
(A) Locations not relevant to the Long Term AQALs					
(B) Locations on present within the DS scenario					

Table 22 - PM_{2.5} Results of Sensitivity Analysis

Receptor	Modelled PM _{2.5} (µg/m ³)				
	2019 DM	2019 DS	Change	% Change relative to AQAL	Significance
R1	9.6	9.7	<0.1	0	Negligible
R2	10.7	10.8	<0.1	0	Negligible
R3	10.9	10.9	<0.1	0	Negligible
R4	11.4	11.4	<0.1	0	Negligible
R5	13.0	13.0	<0.1	0	Negligible
R6	12.9	13.0	<0.1	0	Negligible
R7	13.7	13.7	<0.1	0	Negligible
R8	9.6	9.6	<0.1	0	Negligible
R9	10.4	10.4	<0.1	0	Negligible
R10	10.5	10.5	<0.1	0	Negligible
R11	12.2	12.3	<0.1	0	Negligible
R12	14.1	14.1	<0.1	0	Negligible
R13	11.1	11.1	<0.1	0	Negligible
R14	13.4	13.4	<0.1	0	Negligible
R15	9.5	9.5	<0.1	0	Negligible
R16	15.5	15.5	<0.1	0	Negligible
R17	13.3	13.3	<0.1	0	Negligible

Receptor	Modelled PM _{2.5} (µg/m ³)				
	2019 DM	2019 DS	Change	% Change relative to AQAL	Significance
R18	10.4	10.4	<0.1	0	Negligible
R19	12.5	12.6	0.1	1	Negligible
R20	12.3	12.4	0.1	0	Negligible
R21	13.8	13.8	<0.1	0	Negligible
R22	11.4	11.4	<0.1	0	Negligible
R23	11.3	11.3	<0.1	0	Negligible
R24	11.0	11.0	<0.1	0	Negligible
R25	10.6	10.6	<0.1	0	Negligible
R26 ^(A) ^(B)	-	11.6	-	-	-
R27 ^(A) ^(B)	-	10.1	-	-	-
(A) Locations not relevant to the Long Term AQALs					
(B) Locations on present within the DS scenario					

Appendix F - Construction Dust Mitigation for Medium Risk sites

In order to mitigate the worst-case dust impacts the following general mitigation measures are highly recommended by the IAQM for Medium Risk construction sites. Highly recommended mitigation measures applicable specifically to Demolition, Earthworks, Construction and Trackout are provided based on the respective risk of adverse impact.

Highly Recommended

Communications:

- Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
- 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 (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM₁₀ continuous monitoring and/or visual inspections.

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 DMP, 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.
- Agree dust deposition, dust flux, or real-time PM₁₀ continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and maintaining the site:

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.

- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel:

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable
- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.

Operations:

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up.

Waste Management:

- Avoid bonfires and burning of waste materials.

Measures specific to Construction (Medium risk)

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

Measures specific to Trackout (Medium risk)

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Record all inspections of haul routes and any subsequent action in a site log book.

- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10 m from receptors where possible.