

Project

Hough End Sports Village
Detailed Air Quality Assessment

Prepared for

ISG
5th Floor, Tomorrow
MediaCityUK
Salford
M50 2AB

By

Nicole Asante BSc (Hons) MSc MEnvSc
AIAQM

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Client Address	5th Floor, Tomorrow MediaCityUK Salford M50 2AB
Author	Nicole Asante BSc (Hons) MEnvSc AIAQM
Checker	Ryan Thorpe BSc (Hons) AMEnvSc AIAQM
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1.0 Summary

The proposal is for the extension of the existing leisure centre on Princess Road in Manchester. The proposal also includes the demolition of an existing substation, construction of a new carpark, two artificial grass pitches, and refurbishment of the existing sports pitches, and potentially 278 Highways works.

The site is not within an Air Quality Management Area (AQMA). Although the site is not within an AQMA, Manchester City Council (MCC) and the Greater Manchester Combined Authority (GMCA) have established several AQMAs along the A5103 to the east of the site, as well as an AQMA to the west of the site, on Mauldeth Road West. These AQMAs were defined for annual mean exceedances of NO₂.

This air quality screening assessment has shown that:

- the IAQM threshold for construction HDVs is not expected to be exceeded
- the IAQM threshold for development generated LDVs is expected to be exceeded
- Construction activity associated with the proposed development is assessed to be:
 - **Medium** risk for dust soiling
 - **Low** risk for human health effects
 - **Low** risk for ecological effects.

Through good site practice and by adopting suitable mitigation measures, the residual effects are likely to be low. Recommended mitigation measures can be found in **Section 5.4**.

Although the IAQM/EPUK thresholds for construction have not been exceeded, the measures in **Section 8.3** must be adhered to where practicable.

A detailed air quality assessment has been completed following IAQM guidance due to the exceedance of the IAQM/EPUK threshold for LDV annual average daily traffic in an AQMA once the site is operational.

Occupants of the development will be exposed to acceptable levels of PM₁₀ and PM_{2.5} (approximately 33% and 35% of the air quality objective for each pollutant).

Occupants of the development close to roadside locations may be exposed to concentrations of NO₂, up to 63% of the relevant air quality objective limit for NO₂. Receptors outside of the development in roadside locations may be exposed to up to 78% of the air quality objective limit.

This assessment has found that the proposed development will have a **negligible** effect on local air quality once operational.

2.0 Introduction

The potential air quality impacts associated with the proposed development relate to:

- dust and particulate matter generated by construction activities
- increase in concentrations of nitrogen dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}) due to emissions generated by the emissions from construction traffic and additional road traffic once operational.

This initial assessment looks at the existing air quality conditions around the site, considers the local and national policy context, and describes the proposed assessment methodology.

3.0 Relevant Policy and Guidance

The Air Quality Strategy

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland¹ sets out air quality objectives and policy options to improve air quality in the UK. The main aim of the Strategy is to ensure that ambient air quality is of an acceptable level to protect human health and the environment. It takes account of the Limit Values set out in EU legislation.

Local Air Quality Management (LAQM)

The Environment Act 1995 introduced the LAQM system, whereby local authorities have a duty to review and assess air quality within their areas against the air quality objectives defined in the Air Quality Strategy. Where exceedances of the objectives are identified during this process, the authority must then declare an Air Quality Management Area (AQMA) and define the measures which will be implemented to improve air quality.

National Planning Policy Framework (NPPF)

The NPPF (2019)² sets out the Government's planning policies for England and outlines how they are expected to be applied to achieve the Government's aim of sustainable development. The NPPF states in paragraph 180 that:

“Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.”

¹ Department for Environment, Food and Rural Affairs (DEFRA) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)

² Ministry of Housing, Communities and Local Government (February 2019).

And at paragraph 181:

“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.”

Greater Manchester Air Quality Action Plan 2016 - 2021

The Greater Manchester Air Quality Action Plan³ was produced by the Greater Manchester Combined Authority (GMCA). The action plan describes the controls put in place to regulate the individual and cumulative impacts on air quality from new developments:

“GM (Greater Manchester) local authorities will adopt the most recent IAQM/EPUK guidance for air quality assessment as current best practice, to help ensure that planning applications consider potential local air quality impacts and opportunities to improve air quality are realised.”

GM local authorities to recommend mitigation controls in accordance with the most recent guidance and the other actions in this document for new developments that contribute to a deterioration of air quality in Air Quality Management Areas (AQMAs).”

Clean Air Plan 2020

The GMCA’s Clean Air Plan (2020) will supersede the 2016-2021 Air Quality Action Plan once published.

The plan includes the launch of the Clean Air Zone (CAZ), as well as funding opportunities to enable the Greater Manchester area to meet the 40 µg m⁻³ target for ambient NO₂ concentrations throughout the entirety of its area by 2024.

Guidance

The following guidance documents have also been used where appropriate, in this assessment:

- Local Air Quality Management Technical Guidance (LAQM.TG(16))⁴
- Land-Use Planning and Development Control: Planning for Air Quality. VI.2⁵
- National Planning Practice Guidance - Air Quality⁶
- Guidance on the Assessment of Dust from Demolition and Construction⁷

³ Greater Manchester Combined Authority and Transport for Greater Manchester (2016).

⁴ DEFRA (2018). Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance (TG16).

⁵ Environmental Protection UK / Institute of Air Quality Management (2017).

⁶ Department of Communities and Local Government (DCLG) (2014).

⁷ Institute of Air Quality Management (2014)

4.0 Existing Conditions

Existing air quality conditions near to the site have been defined after reviewing the following:

- Manchester City Council (MCC) and GMCA Review and Assessment reports and monitoring data;
- National Atmospheric Emissions Inventory (NAEI) data and maps;
- DEFRA's Local Air Quality Management (LAQM) Support Pages, including background maps; and
- Maps and plans of the site and surrounding area.

4.1 AQMAs

The site is not within an Air Quality Management Area (AQMA), however several AQMAs have been established along the A5103 to the east of the site, as well as an AQMA to the west of the site, on Mauldeth Road West. These AQMAs were defined for annual mean exceedances of NO₂.

Figure 1. Site Location



Legend



4.2 Wind Direction

The prevailing winds in Manchester are from the south⁸, therefore receptors to the north of the site are most likely to be affected by emissions from the proposed development.

4.3 Industrial Point Sources

A review of the NAEI point source inventory shows that there are a few large point source emitters of pollutants, specifically NO₂ and particulate matter (PM₁₀ and PM_{2.5}), near the site. The following sites emit all the specified pollutants:

- The Chorlton-cum-Hardy Crematorium is located approximately 700m to the southwest of the site,
- Spire Manchester Hospital to the approximately 1km south.

These point source emitters are upwind of the proposed development. These emitters are relatively close, and therefore there is potential for emissions from these sites to affect the proposed development, as the prevailing wind will push pollutants towards the site.

- United biscuits UK Ltd. located approximately 5km to the east of the site.

This point source emitter is in an area that will have little influence on the site (and not be influenced by emissions from the site in return).

- Heineken located approximately 2.3 km to the north of the site.

This emitter is downwind from the site most of the time, so it is unlikely that emissions from this point source will affect the site due to the direction of the prevailing wind.

While there are some nearby point source emitters that may affect concentrations of pollutants at the site, the localised nature of the nearby AQMAs imply that road traffic is likely the most important factor in pollutant concentrations at the proposed development.

⁸ Iowa Environmental Mesonet (IEM), accessed 17/03/2021, available at: <https://mesonet.agron.iastate.edu/>

4.4 Background Pollutant Concentrations

Table I summarises the background pollutant concentrations of NO₂, PM₁₀ and PM_{2.5} used in the assessment for the area encompassing the proposed development. Background concentrations of NO₂, PM₁₀ and PM_{2.5} have been taken from the most recent version of DEFRA's background maps. 2020 represents the base year; 2020 is the most recently reported monitoring dataset for the MCC/GMCA administrative area. 2023 represents the first year of operation. In each assessment year, the DEFRA annual mean background concentrations are well below the relevant objectives.

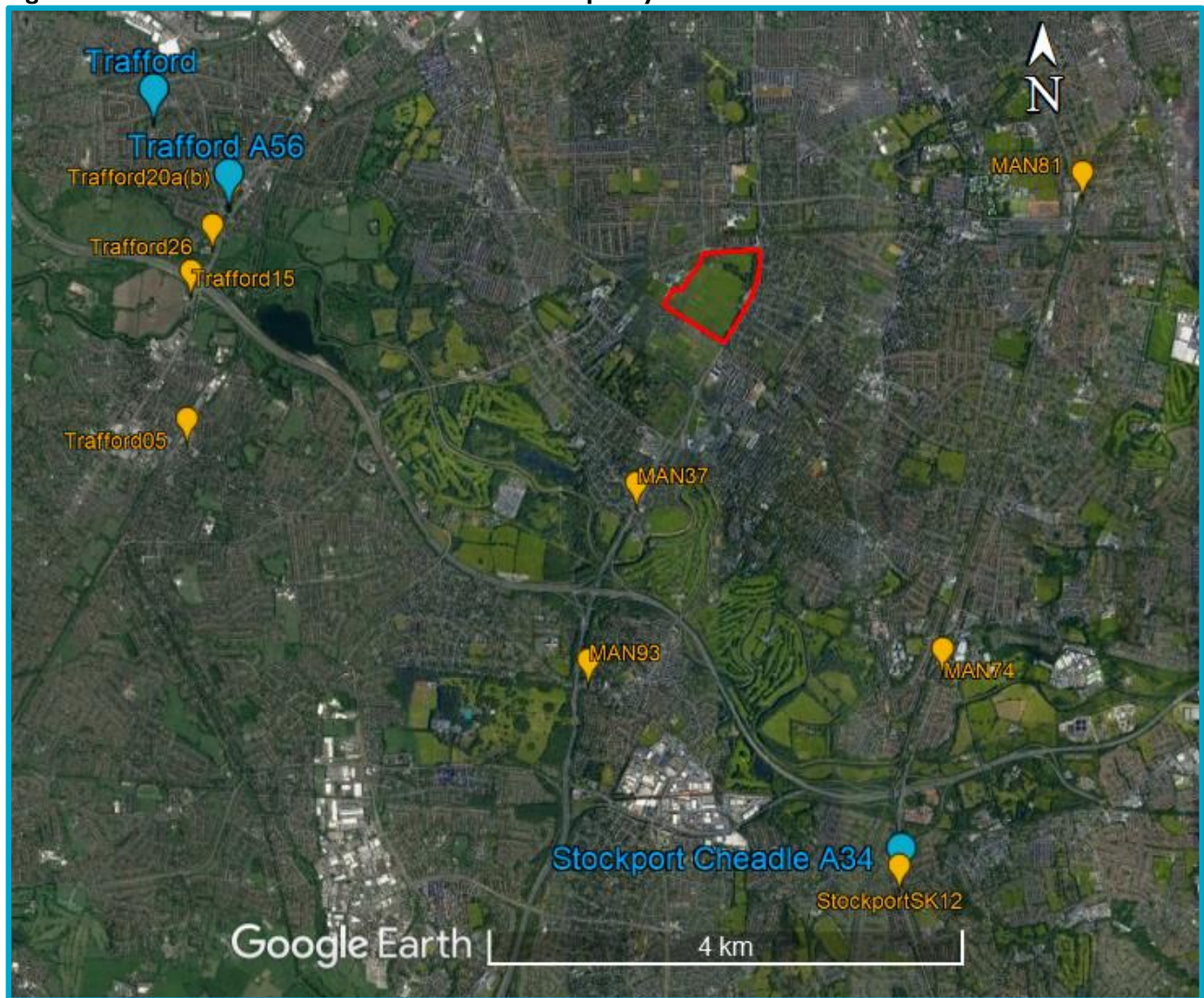
Table I. Background Pollutant Concentrations (µg/m³)

Grid Square	NO ₂		PM ₁₀		PM _{2.5}	
	2020	2023	2020	2023	2020	2023
383500, 393500	16.8	14.3	11.7	11.4	7.9	7.7
383500, 392500	16.8	14.9	11.8	11.5	7.9	7.6
382500, 393500	15.2	13.6	11.6	11.3	7.9	7.7

4.5 NO₂ Monitoring

Figure 2 shows the most relevant NO₂ monitoring locations to the site. Data for these monitors is shown in **Table 2**.

Figure 2. Site location in relation to relevant NO₂ quality monitors



Legend

-  Automatic Monitors
-  Diffusion Tube Monitors
-  Site

Table 2. NO₂ Monitoring Data

Monitoring Site ID	Site Type	OS Grid Ref.	Height (m)	Annual Mean NO ₂ Concentrations (µg/m ³)				
				2016	2017	2018	2019	2020
Automatic								
Trafford	Urban Background	378783, 394726	2.5	22.0	19.0	18.0	19.0	14.0
Trafford A56	Urban Traffic	379413, 394014	2.5	33.0	30.0	29.0	30.0	21.0
Stockport Cheadle A34	Roadside	385047, 388339	2.0	-	43.0	37.0	36.0	26.0
Diffusion Tube								
MAN37	Urban Traffic	382829, 391493	3.0	46.3	42.6	39.3	38.7	26.9
MAN74	Urban Traffic	385399, 390093	3.0	38.0	37.1	35.7	33.6	23.3
MAN81	Urban Background	386589, 394083	3.0	25.9	25.2	21.8	23.1	16.6
MAN93	Urban Traffic	382419, 390010	3.0	-	-	-	42.9	29.4
StockportSK12	Urban Traffic	392781, 387271	2.5	54.5	42.4	38.0	36.6	-
Trafford05	Urban Background	379052, 392043	4.0	25.5	24.1	24.0	24.3	16.3
Trafford15	Urban Traffic	379089, 393282	4.0	33.3	30.6	29.2	29.9	20.7
Trafford20a(b)	Urban Traffic	379418, 394009	3.0	-	32.2	29.5	29.8	-
Trafford26A	Urban Traffic	379272, 393667	3.0	-	44.2	40.1	39.3	-
Objective								
40µg/m ³								

Annual average NO₂ concentrations exceeding the NO₂ objective are shown in bold. NO₂ annual means exceeding 60µg/m³, indicating a potential exceedance of the NO₂ 1-hour mean objective are shown in bold and underlined.

The GMCA monitor over 400 locations in Manchester. In **Figure 4**, the locations most relevant to the site are shown. Most are chosen due to geographical proximity and others provide comparison for the closest automatic monitors.

Data for 2020 show a reduction in NO₂ concentrations from 2019 because of the Covid-19 pandemic. However, the data leading up to 2020 will give an indication of what NO₂ concentrations could be if they were to return to pre-pandemic levels.

Automatic monitors are some distance from the site; Trafford and Trafford A56 are to the west, approximately 4.2 km and 3.4 km away respectively. Stockport Cheadle is approximately 5.5 km south-east. Trafford A56 and Stockport Cheadle are located on a roundabout and junction respectively, therefore neither are particularly representative of the conditions at the proposed development due to traffic queues, or otherwise slow-moving traffic. Trafford is in an urban background location, which is in an area of green space, smaller than that of the proposed development, but still representative. It can be assumed that the conditions at this monitor are representative of those across the non-roadside locations at the site.

Urban Traffic diffusion tube monitors typically report an overall reduction in ambient NO₂ concentrations over the last five years of measurements. As shown in **Table 2**, exceedances of the air quality objective (AQO) for NO₂ were measured at MAN37, StockportSK12, Trafford 26A, and MAN93. MAN93 is the only monitor to have reported an exceedance in 2019; this appears to be a new monitoring location, as there were no measurements taken in previous years. NO₂ concentrations measured at StockportSK12 were the highest historically.

Urban Background monitors typically report stable results, with annual NO₂ concentrations varying by less than $\pm 3 \mu\text{g}/\text{m}^3$ annually. Neither of these monitors have reported an exceedance of the AQO in the last five years.

The closest diffusion tube monitors, MAN37 and MAN93, are in roadside locations; the former, on the A5103/Princess Road, like the site, and the latter on the B5167 close to the junction with the M60. The large junction for the M60 will likely influence the traffic (and therefore emissions experienced) at these monitoring locations. Furthermore, MAN93 is likely to be influenced by queues caused by the traffic lights, which makes this monitor less representative of conditions at the proposed development site.

The large junction where the A5103 meets the A5145, that is located between MAN37 and the stretch of road that the proposed development is on may have a similar effect. The A5103 is a main route, so it could be assumed that traffic joins it preferentially. Based on that assumption, it can also be assumed that emissions on the eastern boundary of the site are like those experienced at MAN37.

Mauldeth Road West, running along the northern boundary of the site, also crosses the A5103, and has a direct link to the A6010, which may result in the road being well trafficked. The junction of Mauldeth Road and the A5103 is traffic light controlled, which will lead to traffic queues, and may in turn affect the north-eastern corner of the site. This area is shielded by trees so these effects may be dampened. The other parts of the site adjacent to Mauldeth Road are expected to have NO₂ concentrations like those at MAN37 as a worst case.

The proposed development is predominantly a large green site, with open fields/pitches. None of the monitors in **Table 2** are placed in locations that mirror this exactly. However, MAN81 is located by a

smaller area of green land, in a primarily residential area; its location in a cul-de-sac means that it will not see any significant amount of traffic. This urban background monitor consistently reported NO₂ concentrations below 26 µg/m³ (65 % of the AQO) over the past five years. Therefore, given that both locations experience little to no traffic it is reasonable to assume that the parts of the proposed development that are not influenced by road traffic will have ambient NO₂ concentrations similar or less than what has been reported at MAN81.

Overall, it is not expected that the AQO for ambient NO₂ concentrations will be exceeded at the site, although, the parts of the site close to roads may be within 90 % (36 µg/m³) of the AQO.

4.6 PM₁₀ Monitoring

MCC/GMCA monitor PM₁₀ at several locations within their administrative area. Data for the monitors most relevant to the site are shown in **Table 3**.

Table 3. PM₁₀ Monitoring Data

Monitoring Site ID	Site Type	OS Grid Ref.	Height (m)	Annual Mean PM ₁₀ Concentrations (µg/m³)				
				2016	2017	2018	2019	2020
Automatic								
Trafford	Urban Background	378783, 394726	2.5	15.0	13.0	14.0	15.0	13.0
Trafford A56	Urban Traffic	379413, 394014	2.5	17.0	15.0	18.0	17.0	14.0
Stockport Cheadle A34	Roadside	385047, 388339	2.0	-	18.0	19.0	17.0	15.0
Objective								
40µg/m³								

As described in **Section 4.5**, the Trafford monitor is the most representative of conditions at the site due to its surroundings. As such it is reasonable to assume that concentrations of PM₁₀ at the site are similar in non-roadside locations. The other monitors, while less representative give an indication of what conditions may be like along the site boundary. Concentrations at site are not likely to exceed the AQO for PM₁₀ (40 µg/m³).

Data for 2020 show a reduction in PM₁₀ concentrations because of the Covid-19 pandemic. However, the data leading up to 2020 will give an indication of what PM₁₀ concentrations could be if they were to return to pre-pandemic levels.

4.7 PM_{2.5} Monitoring

MCC/GMCA monitors PM_{2.5} at several locations within their administrative area. None of these monitors are suitable for use in this assessment, due to the distance between their locations and the site. DEFRA background data will be used for the purpose of continuing the assessment.

DEFRA background concentrations for PM_{2.5} at the site in 2019 were approximately 7.8 µg/m³, which is below the AQO of 25 µg/m³ for PM_{2.5}.

5.0 Dust Risk Assessment

5.1 Dust Emission Magnitude

During the construction phase, activities may generate dust and particulate matter, as well as exhaust emissions from construction vehicles and plant, which could result in complaints of nuisance and human health effects.

The likely level of risk has therefore been assessed following guidance published by the Institute of Air Quality Management (IAQM). The assessment considers the nature and scale of the activities undertaken and the sensitivity of the surrounding area. Mitigation measures proportionate to the level of risk identified are then set out.

Additionally, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the site and near the site itself. As precise information on the number of vehicles and plant associated with each part of the construction phase is not yet known, a qualitative assessment of their impact on local air quality has been done using professional judgement and by considering the following:

- The likely number and type of construction traffic and plant
- The number and proximity of sensitive receptors to the site
- The likely duration of the construction period; and
- The nature of the activities undertaken.

The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM₁₀ sources: demolition, earthworks, construction, and trackout.

5.1.1 Demolition

The existing changing block is scheduled to be demolished. The maximum demolitions height is approximately 5m. The approximate building area is 655 m². With these dimensions, the approximate building demolition volume is 3,275 m³.

The substation at the northern edge of the site is also scheduled to be demolished. The approximately building volume to be demolished is 40m³.

Following IAQM guidance, the potential dust emission magnitude from demolition is judged to be **small**, as this volume is below the 20,000 m³ assessment threshold.

5.1.2 Earthworks

Earthworks onsite include breaking out areas of hard landscaping, reduced level excavation, and groundwork for the foundation and slab. The soil texture over most of the site is sandy to sandy loam, with very small areas of clay to sandy loam soil⁹. Sandy soils are less prone to mobilisation into the air than clayey soils due to their larger particle sizes. The approximate area of earthworks includes the area dedicated to new sports pitches and is approximately 23 ha. Following IAQM guidance, the potential dust emission magnitude from earthworks is judged to be **large** due to the size of the potential earthworks area.

5.1.3 Construction

One 2-storey building is to be constructed on site. All other construction works will be internal to the existing building. The dimensions of the new block are approximately 31 m x 25 m x 10.5 m, which equates to an overall construction volume of approximately 8140 m³. Construction materials include brick, concrete, cladding (aluminium, masonry), and steel (steel framing system). Brick and concrete are potentially dusty materials; concrete is especially dusty if being batched on site. The risk of dust emissions from these are reduced if these are precast and/or cladding components (i.e., can be slotted into position). Other listed materials are not particularly dusty.

Following IAQM guidance, the potential dust emission magnitude from construction is judged to be **small**, as the total construction volume is far below the 25,000 m³ assessment threshold.

5.1.4 Trackout

Six vehicles are planned to be associated with the site during the construction phase. If each vehicle makes two trips per day, then there will be 12 outward movements from site daily. The proposed development is well connected by road; however, the internal area of the site has little in the way of paving/tarmac. There will be works occurring on the grass area so it is likely that vehicles will have to travel over unpaved areas over 100 m in length.

Following IAQM guidance, the potential dust emission magnitude from trackout is judged to be **medium**.

5.1.5 Summary of Dust Emission Magnitude

Table 4. Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Large
Construction	Small
Trackout	Medium

⁹ British Geological Society (BGS), UK Soil Observatory (UKSO) available at: <http://mapapps2.bgs.ac.uk/ukso/home.html>, accessed: 19/03/2021

5.2 Sensitivity of the Study Area

5.2.1 Dust Soiling Effects

The proposed development is located in an area which is primarily residential; the north and east boundaries of the site are adjacent to roads; the southern boundary is adjacent to a rail line serving the Withington tram stop. The roads and rail line are bordered by residential dwellings. On the western boundary of the site is the Hough End Centre, which is a sports and social club, often also used for events and conventions. There is an allotment adjacent to the railway on the southern boundary of the site located east of the southern residential dwellings, and further east is the Withington tram stop.

All residential receptors are classed as high sensitivity; they experience greater impacts to dust emissions. Impacts can be based on aspects of comfort, monetary value, cultural value, and potential exposure time. St Bernadette's Catholic church may also be considered a high sensitivity receptor.

The allotment is a medium sensitivity receptor, along with the Hough End Centre, Hough End Leisure Centre itself, and there is a small parade of shops on Princess Road, the petrol filling station on Mauldeth Road, and the Withington tram stop. Hough End Leisure Centre is counted as a receptor as it is scheduled be open for public use while works are occurring.

Surrounding footpaths, and fields are classed as low sensitivity, along with Hough End Leisure Centre's car park.

Of these receptors, those located to the north of the site are most likely to be affected by fugitive dust emissions from construction works occurring at the proposed development site due to the direction of the prevailing wind.

1) Demolition

Two buildings are scheduled for demolition. The changing facility (shown in red in **figure 3**), which has been condemned as structurally unsound has only receptor within 50 m of the demolition boundary. This is the Hough End Leisure Centre itself: specifically, the carpark, and the playing fields. The current extent of the main leisure centre building is within 100 m of the demolition boundary, as are residential properties on Princess Road. Approximately 20 dwellings are located within 100 m.

Figure 3. Demolition boundary of changing facility with 20 m, 50 m, and 100 m buffers

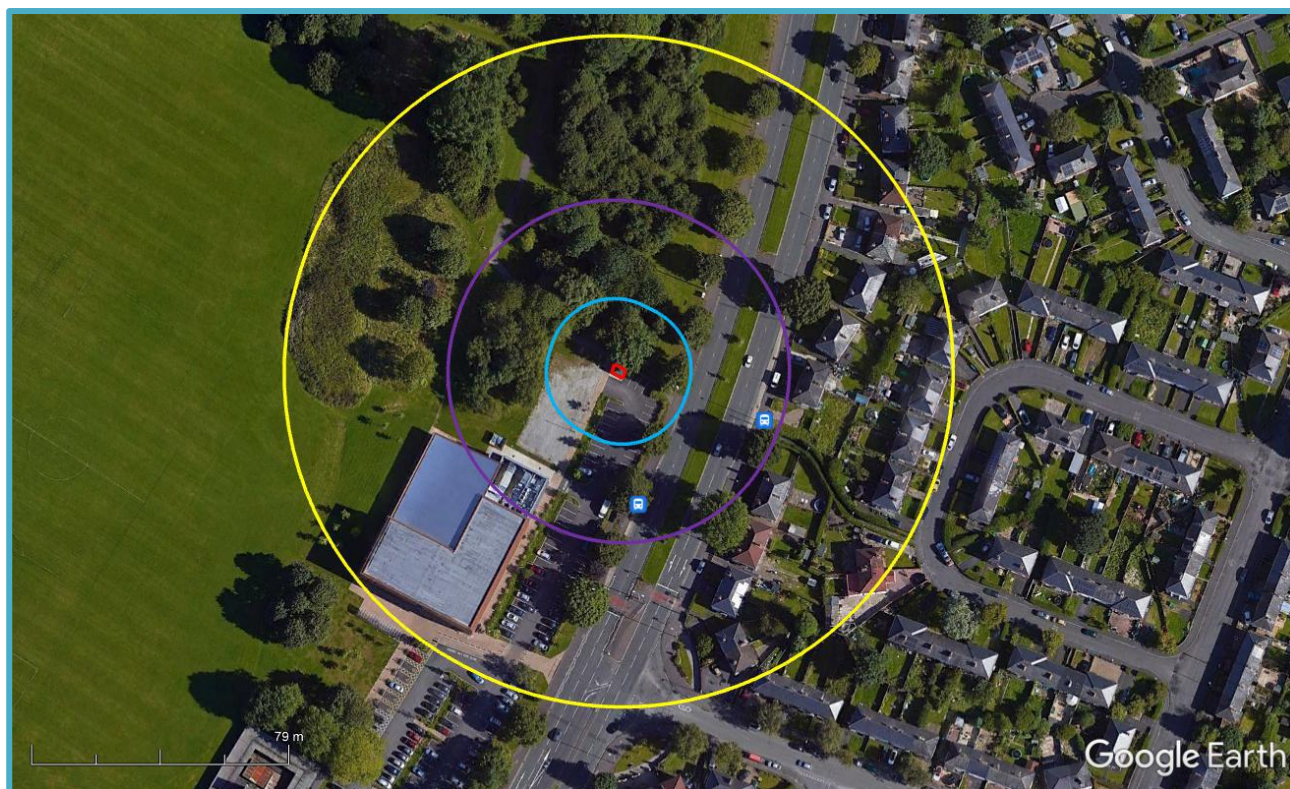


Legend

Demolition Boundary	20m Buffer	50m Buffer	100 m Buffer
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The other building to be demolished is the substation at the northern edge of the site. The current extent of the main leisure centre building is within 50 m of the demolition boundary. There are also approximately 27 residential properties on Princess Road within 100 m of the demolition boundary.

Figure 4. Demolition boundary of substation with 20 m, 50 m, and 100 m buffers



Legend

Demolition Boundary	20m Buffer	50m Buffer	100 m Buffer
---------------------	------------	------------	--------------

In total, there are approximately 47 highly sensitive receptors within 100 m of both demolition boundaries, as well as the leisure centre itself. The sensitivity of the local area to dust soiling effects due to demolition is **low** due to the number of sensitive receptors and their distance from the proposed works.

2) Earthworks

Earthworks will take place across the footprint of the existing leisure centre and car park. There will also be some earthworks taking place to the western side of the leisure centre, where two new 3G pitches will be developed. The earthworks boundary shown in **Figure 5** has been taken from the latest Site Masterplan (ref. HEV-EWA-02-XX-DR-L-79001, dated 17/03/21).

Approximately 18 residential dwellings on Princess Road are located within 50m of proposed earthworks area.

The sensitivity of the local area to dust soiling effects to due to earthworks is **medium**, due to the number of high sensitivity receptors, within 50m of the potential earthworks area.

Figure 5. Earthworks boundary with 20m and 50m buffers



Legend

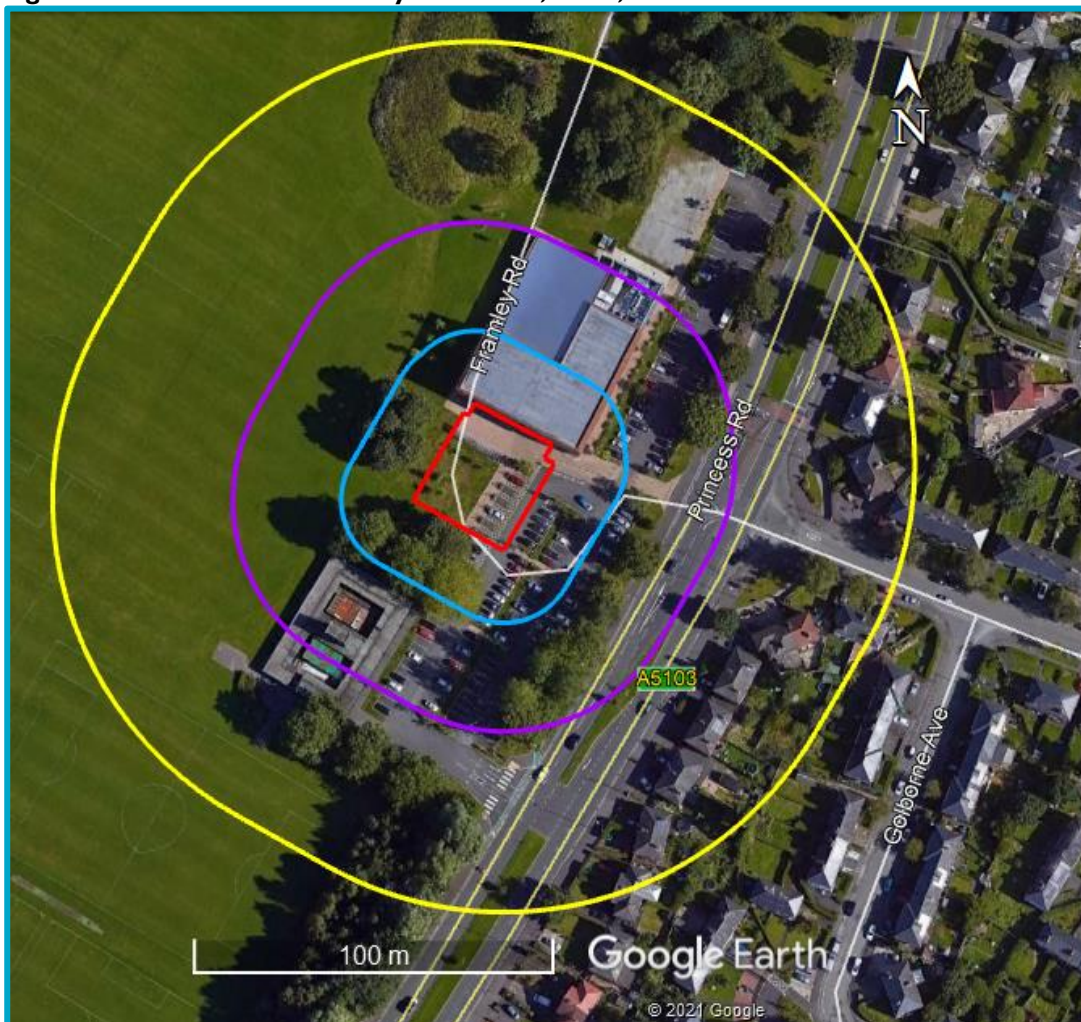
Earthworks Boundary	20m Buffer	50m Buffer
---------------------	------------	------------

3) Construction

The area marked for construction is relatively small; it is an extension of the current leisure centre building as shown in **Figure 5**. **Figure 5** shows the approximate construction area based on the Sketch Site Layout Plan (ref. HEV-EWA-Z2-00-SK-A-50410, dated 30/10/2020). The closest receptor is the Hough End Leisure Centre, which is located adjacent to the construction area, and therefore within 20 m of the construction boundary. There are residential dwellings, approximately 21, located on Princess Road and Whitchurch Road, within 100 m of the construction boundary.

The sensitivity of the local area to dust soiling effects to due to construction is **medium** due to the proximity of the parts of Hough End Leisure Centre that will be in use during the construction phase.

Figure 6. Construction boundary with 20 m, 50 m, and 100 m buffers



Legend

Construction Boundary	20m Buffer	50m Buffer	100 m Buffer
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4) Trackout

Access to the site is likely to be primarily from Princess Road; **Figure 6** shows the most likely trackout route from this access point for 500 m of road in northern and southern directions. This distance is chosen as the site is classed as large (greater than 2,500 m²) following IAQM guidance. There is the possibility that heavy duty vehicles (HDVs) may enter the site via Framley Road to the north, however, given the size of the road that may not be preferable, unless works are occurring in that area. Access is paved for works that are occurring near the main leisure centre building. Works on the field to install pitches will not have paved access to much of the area, so it is likely that construction vehicles will travel over unpaved paths of over 100 m.

There are a minimum of 29 residential dwellings within 20 m of the southern route on Princess Road, as well as St Bernadette's Catholic Church and a parade of 4 commercial businesses. The northern route on Princess Road has over 100 residential dwellings within 20 m including those in Windsor House.

The sensitivity of the local area to dust soiling effects due to trackout is **high** due to the large number of residential dwellings within 20 m of the trackout route in northern and southern directions. Although not shown in **Figure 6**, as it is far less likely to be used, the sensitivity of the local area to dust soiling using the Framley Road access is also high due to the number and proximity of residential dwellings.

Figure 7. Trackout route with 20 m and 50 m buffers



Legend



5.2.2 Health Effects of PM₁₀

The receptors identified in the previous section for the effect of dust soiling are relevant here, as there are health implications for sensitive receptors due to the dispersion and deposition of PM₁₀.

In **Table 1** the DEFRA background data on PM₁₀ show that the background concentration at the site was 11.7 µg/m³ in 2020 which is below the annual mean objective of 40 µg/m³, as well as the 24µg/m³ regime defined in the IAQM guidance. The measured data in **Table 3** show concentrations of 13.0 µg/m³ in an urban background location, and 15 µg/m³ in roadside locations. These values are also below the annual mean objective of 40 µg/m³, and the 24µg/m³ regime. Measured data will be taken forward in this assessment to represent more realistic conditions at the site, and the roadside measurement (15.0 µg/m³) will be used to represent a worst case.

1) Demolition

Approximately 47 dwellings, as well as the leisure centre itself, are located within 100 m of the demolition boundary. With receptors likely be exposed to 15.0 µg/m³ of PM₁₀, the health effects due to demolition are judged to be **low** due to the distance of receptors and relatively low background PM₁₀ concentrations.

2) Earthworks

There are approximately 18 residential dwellings within 50 m of the earthworks boundary. With receptors likely be exposed to 15.0 µg/m³ of PM₁₀, the health effects due to earthworks are judged to be **low** due to the distance, and number of receptors, and relatively low background PM₁₀ concentrations.

3) Construction

The Hough End leisure centre is located within 20 m of the construction boundary, and the closest residential receptors are located within 100 m. With receptors likely be exposed to 15.0 µg/m³ of PM₁₀, the health effects due to construction are judged to be **low** due to the distance of receptors and relatively low background PM₁₀ concentrations.

4) Trackout

Over 100 residential dwellings are located within 20 m of the northern trackout route and a minimum of 29 located on the southern trackout route. Following the worst-case scenario (i.e., the greatest number of receptors potentially affected), with receptors likely be exposed to 17.0 µg/m³ of PM₁₀, the health effects due to trackout are judged to be **medium**.

5.2.3 Ecological Effects

There are no sites with ecological designations within 50 m of the site boundary, nor within 50 m of the trackout routes. The closest are the Chorlton Water Park Local Nature Reserve (LNR), which is approximately 1.5 km southwest of the site, and the Chorlton Ees & Ivy Green LNR, approximately 2.2 km west of the site. LNRs typically have a low sensitivity to dust effects. These sites are located upwind of the site in the most common conditions, and therefore have less potential to be impacted by construction phase works at the proposed development. Overall, the sensitivity of ecological receptors to dust is judged to be **low**.

5.2.4 Summary of Sensitivity to Dust Effects

Table 5 summarises the sensitivities assessed for the area. The highest sensitivities assessed are recorded within the table and will be taken forward in the assessment.

Table 5. Sensitivity of Area

Potential Impact	Sensitivity of Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low	Medium	Medium	High
Human Health	Low	Low	Low	Medium
Ecological	Low	Low	Low	Low

5.3 Overall Dust Impact Risk

The predicted dust emission magnitude (**Table 4**) has been combined with the sensitivity of the area (**Table 5**) to determine the risk of impacts during the construction phase, prior to mitigation. **Table 6** summarises the risk of dust impacts for the proposed development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 6. Summary of Dust Risk Impacts

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

5.4 Dust Mitigation Measures

The following mitigation measures are recommended by IAQM to reduce the identified level of risk associated with dust soiling and human health effects during the construction phase.

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.
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 logbook.
Monitoring
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.
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 is 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 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.
Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing).

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 spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste management
Avoid bonfires and burning of waste materials.

Measures Specific to Earthworks

Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.

Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.

Only remove the cover in small areas during work and not all at once.

Measures Specific to Construction

Avoid scabbling (roughening of concrete surfaces) if possible.

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

Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

For smaller supplies of fine powder materials, ensure bags are sealed after use and are stored appropriately to prevent dust.

Measures Specific to Trackout

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 logbook.

Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

6.0 Construction and Operational Phase Impacts

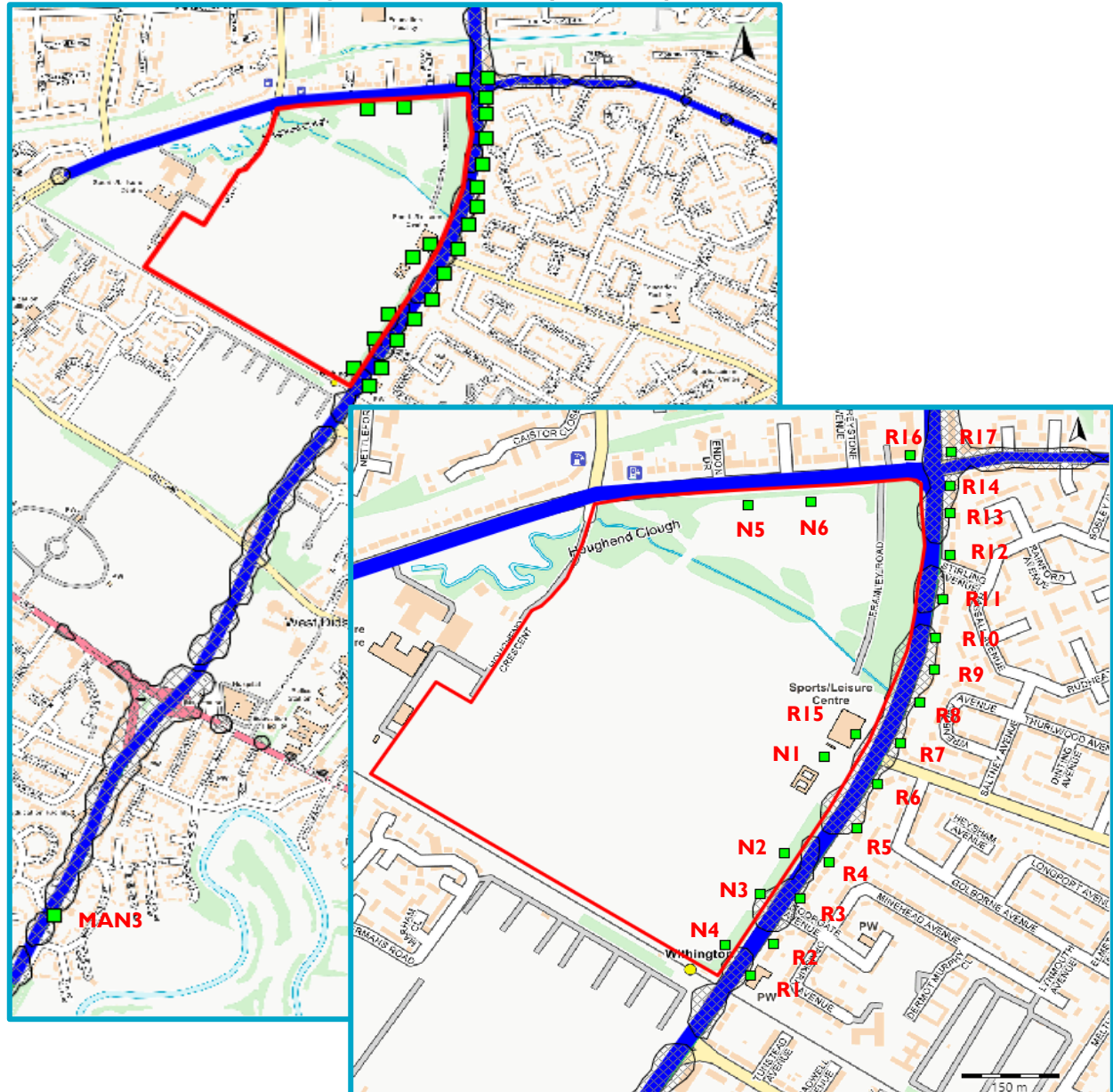
6.1 Construction Vehicles and Plant

The predicted number of HDVs visiting the site per day during the construction phase is 6. If each vehicle makes 1 trip daily, a total of 12 movements would be made per day; if 2 trips were made daily, 24 movements would be expected per day. The construction period is scheduled for approximately 45 weeks. While the site itself is not within an AQMA, large parts of Princess Road, (the main access route) are. Therefore, the IAQM/EPUK threshold for HDV movements within an AQMA will be applied here. Examination of the information provided indicates that the IAQM/EPUK threshold for HDV movements, 25 within an AQMA per day, will not be exceeded.

6.2 Operational Road Traffic

The car parking provision at the proposed development is set to increase to a total of 362 places. The Transport Assessment (ref. 076910-CUR-00-XX-RP-TP-002, dated: 05/03/2021) performed by Curtains Consulting Ltd. for the development describes the trip generation for the leisure centre extension and the new sports pitches. The A5103/Princess Road is likely to be the main access for users of the facility, and this route forms part of the MCC/GCMA AQMA. It is expected that the IAQM/EPUK threshold for LDV movements, 100 within an AQMA, will be exceeded once the site is operational, as confirmed by the transport assessment, and the consultants. As the IAQM/EPUK threshold is likely to be exceeded, a detailed air quality assessment has been completed to quantitatively assess the impact of emissions associated with the development on air quality at existing sensitive receptors locations, within and outside of the AQMA, using the atmospheric dispersion model ADMS Roads (version 5.0.0.1). Concentrations of NO₂, PM₁₀, and PM_{2.5} have been predicted at several existing receptors close to roads where the proposed development is predicted to bring about a change in traffic, as well as at receptors within the site, in line with EPUK / IAQM guidance and thresholds. These locations are shown in **Figure 7** and described in **Appendix D**.

Figure 7. Site boundary and receptor locations



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Legend

Site Boundary



Modelled Roads



Receptors



AQMA

Three assessment scenarios have been considered:

- 2019 - Model verification and baseline
- 2022 - Future baseline
- 2022 - Future baseline with development in place.

Further details of the methodology used in the assessment are set out in **Appendix D**. Traffic data and emissions used in the assessment are set out in **Appendix E**. Full results of the assessment are detailed in **Appendix F** and are summarised below.

7.0 NO₂, PM₁₀ and PM_{2.5} Concentrations

7.1 Annual and Hourly Mean NO₂ Concentrations

7.1.1 2019 Baseline

The largest annual mean NO₂ concentration of 35.6 µg/m³ was modelled at **R17** (250 Mauldeth Road). This location is on the junction with Princess Road and close to a bus stop. The next highest concentrations were modelled at **R13** (489 Princess Rd) and **R14** (479 Princess Rd) at 33.4 µg/m³ and 33.6 µg/m³, respectively. These receptors are also located near bus stops, and the junction with Mauldeth Rd W, and are therefore exposed to idling, slow moving, accelerating, and decelerating traffic. The location with the highest modelled concentration on the grounds of the proposed development was 24.5 µg/m³ at **R15**, which is the current Hough End Leisure Centre building. Of the potential new receptors, **N3** (Leisure Centre, new development location) had the highest modelled concentration at 28.4 µg/m³. **N3** is located closest to a bus stop (Princess Rd/Opposite Moorgate Ave), which may contribute to the higher concentrations modelled here.

7.1.2 2022 Future Baseline

The largest annual mean NO₂ concentration of 31.0 µg/m³ was also modelled at **R17**, which is an overall decrease from the 2019 scenario. The next highest modelled concentrations were again at **R13** and **R14**, at 29.7 µg/m³ and 29.4 µg/m³, respectively.

Concentrations at **R15** decreased from the 2019 scenario, to 21.2 µg/m³. Location **N3** saw the highest predicted NO₂ concentration at 24.9 µg/m³, which is also a decrease from the 2019 baseline. This location is scheduled to be part of a sports pitch in the proposed development.

Modelled concentrations decreased by between 4.6 µg/m³ (**R17**) and 2.4 µg/m³ (**N5**, new development area) in comparison to the 2019 baseline. The overall decrease in modelled NO₂ concentrations is likely attributed to the predicted decrease in the background NO₂ concentrations modelled by DEFRA; no traffic growth (or decrease) was applied to this scenario in agreement with the transport report. All d

7.1.3 2022 Future with Development

R17 remains the location with the greatest modelled concentration of NO₂ at 31.1 µg/m³. **R13** and **R14** are still the next highest at 29.8 µg/m³ and 29.3 µg/m³. **R17** and **R13** show a very slight increase (approximately 0.1 µg/m³) from the 2022 baseline, whereas **R14** shows a very slight decrease (approximately 0.1 µg/m³).

Similar levels of change are observed in modelled concentrations for **R15**, which has increased by approximately 0.1 µg/m³ to 21.3 µg/m³, and for **N3**, which has also increased by approximately 0.1 µg/m³ to 25.0 µg/m³. These locations showed the greatest change of all locations in comparison to the 2022 baseline.

7.1.4 Summary

All modelled concentrations in all scenarios were below the 40 µg/m³ air quality objective limit (AQOL) for annual concentrations of NO₂. It is, therefore, unlikely that the 200 µg/m³ AQO for hourly concentrations

will be exceeded as the modelled annual concentrations are far below the 60 $\mu\text{g}/\text{m}^3$ indicative threshold. The highest concentrations were modelled at **R17**, which was 78 % of the AQO in the '2022 with Development' scenario. The highest concentration within the site of the proposed development was at **R13** was 74 % of the AQO in the '2022 with Development' scenario.

Very slight increases and decreases in concentrations were observed over all receptors from the '2022 Baseline' to the '2022 with Development' scenario; all changes in annual mean concentration between scenarios are below 1 % of the AQO at all modelled receptors. It can therefore be concluded that the significance of the impact on local NO_2 concentrations brought by the proposed development will be **negligible**.

7.2 Annual and Daily Mean PM_{10} Concentrations

7.2.1 2019 Baseline

The highest annual mean PM_{10} was modelled at **R17** (250 Mauldeth Road) and **R14** (479 Princess Rd), both of which had concentrations of 13.7 $\mu\text{g}/\text{m}^3$. Both receptors are located close to the Princess Rd/Mauldeth Rd W junction, and bus stops, which means that they are exposed to idling, slow moving, accelerating, and decelerating traffic.

R15 (the current Hough End Leisure Centre) has modelled concentrations of 12.8 $\mu\text{g}/\text{m}^3$. The highest concentration modelled for the new receptors was at **N3** and **N4**, both at 13.1 $\mu\text{g}/\text{m}^3$. This is likely due to their proximity to the road and potentially related to the proximity of the bus stop (**N3**), and potential to be exposed to traffic slowing/queuing at the crossing for the Withington Metrolink Tram Stop (**N4**).

7.2.2 2022 Future Baseline

R17 and **R14** have the highest modelled concentrations of PM_{10} at 13.6 $\mu\text{g}/\text{m}^3$. This is likely due to their proximity to the Princess Rd/Mauldeth Rd W junction. Within the proposed development boundary, **N3** and **N4** have the highest modelled concentrations at 12.9 $\mu\text{g}/\text{m}^3$.

The current Hough End Leisure Centre building (**R15**) had modelled concentrations of 12.6 $\mu\text{g}/\text{m}^3$. Very slight decreases were modelled from the 2019 baseline for all receptors; the maximum decrease was observed at **R14**, **R16**, and **R17** of approximately 0.2 $\mu\text{g}/\text{m}^3$. This is likely because of the predicted decrease in DEFRA background concentrations, as no significant change in traffic has been predicted from 2019 to 2022.

7.2.3 2022 Future with Development

All increases from the 2022 baseline were 0.1 $\mu\text{g}/\text{m}^3$ or less. **R17** and **R14** have the highest modelled concentrations of PM_{10} at 13.6 $\mu\text{g}/\text{m}^3$; no significant changes from the 2022 baseline have been observed at these receptors. No significant changes from the 2022 baseline have also been observed at the **N3** and **N4** receptors, which still have modelled concentrations of 12.9 $\mu\text{g}/\text{m}^3$. A slight increase in concentrations was modelled at **R15**, which returned a concentration of 12.7 $\mu\text{g}/\text{m}^3$.

7.2.4 Summary

PM₁₀ concentrations are predicted to exceed 50 µg/m³ once per year at all locations excluding **R3**, **R13**, **R14**, **R16**, and **R17**. This is below the air quality objective (AQO) limit of 35 exceedances of 50 µg/m³ in a year.

The overall increase in annual mean PM₁₀ concentrations is very low when compared to the AQO of 40 µg/m³: less than 1% in all locations. All concentrations modelled were approximately 33 % of the AQO or less. The number of days predicted to exceed 50 µg/m³ is also very low in comparison to the AQO. It can therefore be concluded that the significance of the impact on local PM₁₀ concentrations brought by the proposed development will be **negligible**.

7.3 Annual Mean PM_{2.5} Concentrations

7.3.1 2019 Baseline

The highest annual mean PM_{2.5} concentration was modelled at **R17** (250 Mauldeth Road) and **R14** (479 Princess Rd), both of which had concentrations of 9.4 µg/m³. Both receptors are located close to the Princess Rd/Mauldeth Rd VV junction, and bus stops, which means that they are exposed to idling, slow moving, accelerating, and decelerating traffic.

Within the proposed development boundary, the current leisure centre building, **R15**, returned modelled concentrations of 8.8 µg/m³. The largest concentration was 9.0 µg/m³ modelled at **N3**, which is an area that is part of the new development. The **N3** receptor is close to a bus stop; slowing and idling buses may contribute to PM_{2.5} concentrations in this location.

7.3.2 2022 Future Baseline

R17 and **R14** have the highest modelled concentrations of PM_{2.5} at 9.0 µg/m³, which may be attributed to the proximity of these receptors to the junction of Princess Rd and Mauldeth Rd VV. **N2** and **N3** have the highest modelled PM_{2.5} concentrations within the site boundary, at 8.5 µg/m³ and 8.6 µg/m³, respectively. **R15**, the current leisure centre building returned a modelled concentration of 8.4 µg/m³. Proximity to Princess Rd and the bus stop (Princess Rd/Opposite Moorgate Ave) are the likely to be the reason why concentrations are slightly higher in this location. Concentrations modelled in this baseline are overall lower than those modelled for the 2019 baseline. This can be attributed to the fact that no traffic growth has been predicted between 2019 and 2022, and the DEFRA background concentrations predict a decrease ambient PM_{2.5} levels.

7.3.3 2022 Future with Development

No changes have been modelled at any receptor from the 2022 baseline to the 'With Development' scenario at most receptors, other than **R7**, **R10**, **R15**, and **N4**, which had predicted increases of 0.1 µg/m³.

The highest PM_{2.5} concentration was modelled at **R17** (9.0 µg/m³) outside of the proposed development boundary and **N3** (8.6 µg/m³) within the development boundary.

7.3.4 Summary

The overall increase in modelled annual mean PM_{2.5} concentrations compared to the AQO is very low; less than 1 % at all receptors. All receptors returned concentrations which were 36 % or less of the AQO. It can therefore be concluded that the significance of the impact on local PM_{2.5} concentrations brought by the proposed development will be **negligible**.

8.0 Mitigation

8.1 Construction Phase Mitigation

The assessment of potential construction phase impacts has found that the proposed development is **medium risk** for dust soiling, **low risk** for human health effects and **low risk** for ecological effects.

Section 5.4 presents mitigation measures that should be used to reduce the risk of air quality impacts during the construction phase of the proposed development.

Although the IAQM/EPUK thresholds for construction traffic have not been exceeded, the measures in **Section 8.3** must be adhered to where practicable.

8.2 Operational Phase Mitigation

The results of the quantitative air quality modelling demonstrate that development-generated traffic will likely have a negligible impact on both new and existing receptors.

Based on the results of the assessment, the proposed development complies with local and national policy and no air quality mitigation is required. The good practice measures in **Section 8.3** should be followed where applicable, however.

8.3 Good Practice Measures

In Section 5.10 of the IAQM/EPUK guidance, the following examples of good practice principles are listed:

“Design Phase:

- *The provision of at least 1 Electric Vehicle (EV) “fast charge” point per 10 residential dwellings and/or 1000m² of commercial floorspace. Where on-site parking is provided for residential dwellings, EV charging points for each parking space should be made*
- *New developments should not contravene the Council’s AQAP, or render any of the measures unworkable*
- *Wherever possible, new developments should not create a new “street canyon”, or a building configuration that inhibits effective pollution dispersion*
- *Delivering sustainable development should be the key theme of any application*
- *New development should be designed to minimise exposure to pollution sources, e.g., by locating habitable rooms away from busy roads or directing combustion generated pollutants through well sited vents or chimney stacks.*

Operational Phase:

- Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measure its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure, and layouts to improve accessibility and safety
- All gas-fired boilers to meet a minimum standard of $<40\text{mgNO}_x/\text{kWh}$
- All gas-fired CHP plant to meet a minimum emission standard of:
 - Spark ignition engine: $250\text{mgNO}_x/\text{Nm}^3$
 - Compression ignition engine: $400\text{mgNO}_x/\text{Nm}^3$
 - Gas turbine: $50\text{mgNO}_x/\text{Nm}^3$
- A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:
 - Solid biomass boiler: $275\text{mgNO}_x/\text{Nm}^3$ and $25\text{mgPM}/\text{Nm}^3$

9.0 Conclusions

9.1 Construction Phase

A qualitative assessment of the potential impacts of construction activities associated with the proposed development on local air quality has been done. The assessment of potential construction phase impacts has found that the proposed development is **medium** risk for dust soiling, **low** risk for human health effects and **low** risk for ecological effects. The IAQM/EPUK threshold for construction phase HDVs is not expected to be exceeded; therefore, this does not need to be assessed further in a detailed air quality assessment.

Through good site practice and suitable mitigation measures, these effects will be reduced; the residual effects will therefore likely be **negligible**.

9.1.1 NO₂

This assessment has shown that the NO₂ concentration at the site is likely to be below the annual mean objective limit of 40µg/m³. Local authority monitoring data (**Table 2**) shows that NO₂ concentrations are close to 90 % of the limit in roadside locations and approximately 75 % of the limit at locations towards the centre of the site. Future occupants of the development will therefore likely be exposed to acceptable levels of NO₂.

9.1.2 PM₁₀

This assessment has shown that the PM₁₀ concentration at the site is likely to be below the annual mean objective limit of 40 µg/m³. DEFRA background data (**Table 1**) show that the PM₁₀ concentration at the site is approximately 12.0 µg/m³ and local authority monitoring data (**Table 2**) show that the PM₁₀ concentration at the site is likely approximately 17.0 µg/m³. Future occupants of the development will therefore likely be exposed to acceptable levels of PM₁₀.

9.1.3 PM_{2.5}

This assessment has shown that the PM_{2.5} concentration at the site is likely to be below the annual mean objective limit of 25µg/m³. DEFRA background data (**Table 1**) show that the PM_{2.5} concentration at the site is 7.8 µg/m³. Future occupants of the development will therefore likely be exposed to acceptable levels of PM_{2.5}.

9.2 Operational Phase

A quantitative assessment of the potential impacts on local air quality from the development-generated traffic emissions associated with the proposed development has been performed. The results of air quality modelling show that the proposed development will have a negligible impact on local pollutant concentrations at new and existing receptors.

Based on the results of the assessment, the proposed development complies with relevant national and local planning policies and there are no air quality constraints. The good practice measures in **Section 8.3** should be followed where applicable, however.

9.2.1 NO₂

This assessment has shown that the NO₂ concentration at the site and existing receptors is to be below the annual mean objective limit (AQO) of 40 µg/m³ for all modelling scenarios: the '2019 baseline', '2022 baseline', and '2022 with development'. Modelled concentrations were a maximum of 31.1 µg/m³ (78 % of the AQO) in the '2022 With Development' scenario.

9.2.2 PM₁₀

This assessment has shown that the PM₁₀ concentration at the site and existing receptors is to be below the annual mean objective limit (AQO) of 40 µg/m³ for all modelling scenarios: : the '2019 baseline', '2022 baseline', and '2022 With Development'. Modelled concentrations were a maximum of 13.6 µg/m³ (33 % of the AQO) in the '2022 with development' scenario.

9.2.3 PM_{2.5}

This assessment has shown that the PM_{2.5} concentration at the site and existing receptors is to be below the annual mean objective limit (AQO) of 25 µg/m³ for all modelling scenarios: the '2019 baseline', '2022 baseline', and '2022 with development'. Modelled concentrations were a maximum of 9.0 µg/m³ (36 % of the AQO) in the '2022 With Development' scenario.

Appendix A - Glossary

Table AI. Definitions

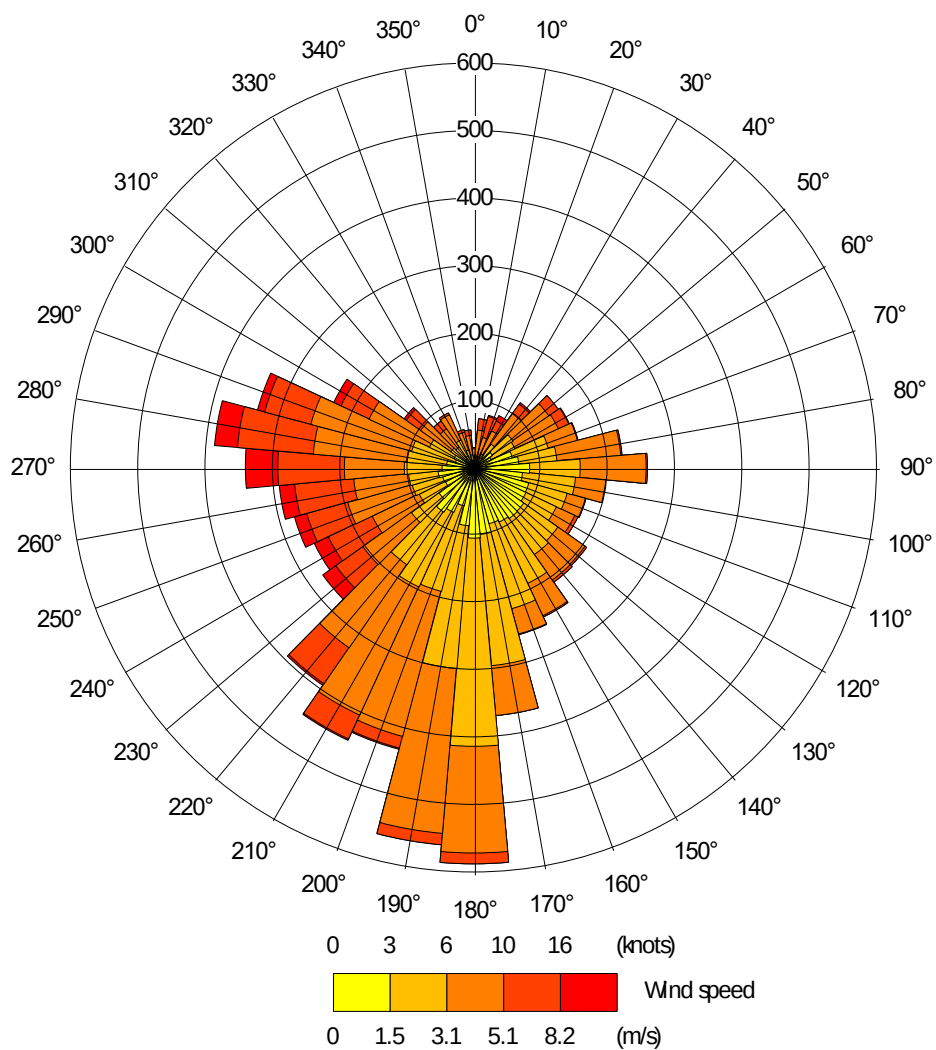
Term	Definition
AADT	Annual average daily traffic
Annual mean	The average of the hourly mean concentrations measured for one year
AQMA	Air Quality Management Area
DEFRA	Department for Environment, Food and Rural Affairs
EPUK	Environmental Protection UK
Exceedance	Where the concentration of a pollutant is greater than the appropriate air quality objective
HDV/HGV	Heavy duty vehicle / Heavy goods vehicle
IAQM	Institute of Air Quality Management
LA	Local Authority
LAQM	Local Air Quality Management
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10 micrometres
PM _{2.5}	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres

Appendix B - Air Quality Objectives

Table B1. Pollutant objectives

Pollutant	Objective	Averaging Period
Nitrogen dioxide (NO ₂)	40µg/m ³	Annual mean
	200µg/m ³ not to be exceeded more than 18 times per year	Hourly mean
Particulate Matter (PM ₁₀)	40µg/m ³	Annual mean
	50µg/m ³ not to be exceeded more than 35 times per year	Daily mean
Particulate Matter (PM _{2.5})	25µg/m ³	Annual mean

Appendix C - Windrose from Manchester Airport, 2019



Appendix D - Assessment Methodology and Results

D1. Assessment Methodology

Pollutant concentrations have been predicted at existing receptor locations using the dispersion model ADMS Roads (version 5.0.0.1) which is widely used for this type of modelling. The model allows concentrations to be predicted at user defined locations (receptors), taking account of local conditions (road geometry, width and height, and local meteorological conditions).

Meteorological data from the Manchester Airport for 2019 has been used in the model. 2019 is the most recent year in which a whole year of meteorological data is available.

Traffic data have been obtained from Curtins, the project transport consultants, as well as from the Department for Transport (DfT). Traffic speeds have been estimated from local speed limits taking account of the proximity to junctions and services (e.g., petrol filling stations, bus stops). The following scenarios were modelled:

- 2019 - Model verification and existing baseline
- 2022 - Future baseline
- 2022 - Future baseline with development in place.

2019 is the most recent year for which a full year of monitoring data are available. 2022 is the year in which the proposed development will be in use and occupied.

D2. Vehicle Emission Factors

Vehicle emission factors for NO_x, PM₁₀ and PM_{2.5} used in the assessment were taken from the latest version of DEFRA's Emissions Factor Toolkit (EFT) (v10.1) which predicts emissions from 2018 to 2030.

D3. Background Concentrations

The latest version of DEFRA's background maps was used to obtain background concentrations for the assessment. These provide estimated background concentrations across the UK at 1km x 1km grid resolution for years between 2018 and 2030.

D4. Model verification

Whilst ADMS Roads is widely validated for use in this type of assessment, model verification for the area around the site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results at a representative monitoring location is to be done in line with methodology specific in LAQM.TG(16). This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run to predict the 2019 annual mean road-NO_x contribution at the MAN37 monitoring location. This monitor was the closest to the proposed development and experienced the most similar traffic conditions to the proposed development due to its location. The modelled road-NO_x output has been compared to the 2019 'measured' road-NO_x, which was determined from the NO₂ concentration measured at the monitoring location, utilising the most recent version of the NO_x from NO₂ calculator provided by DEFRA, and DEFRA NO₂ background concentrations (v8.1). **Table D1** presents the data used in the verification.

Table 1. Verification data

Monitoring Site	Receptor ID	Measured Annual Mean NO ₂ Concentration (µg/m ³)	Background NO ₂ (µg/m ³)	Measured Road-NO _x (µg/m ³) (from NO _x :NO ₂ Calculator)	Modelled Road-NO _x	Ratio (Measured / Modelled)
Manchester 37	MAN37	38.70	17.20	43.96	42.64	0.97

Processed results were compared against the relevant objectives set out in **Table B1** in **Appendix B**. LAQM.TG(16) advises that, where road traffic is the predominant source, an exceedance of the 1-hour mean NO₂ objective is unlikely to occur where the annual mean concentration is below 60µg/m³. This concentration has been used to screen whether the hourly mean NO₂ objective is likely to be achieved.

No verification factor will be applied to the model output for NO_x, as the verification factor is very close to 1. This follows LAQM.TG(16) guidance, which states that a verification factor is not required where it has been calculated as being between 1.1 and 0.9.

D5. Sensitive Receptors

Relevant sensitive receptor locations for the assessment are places where the public may be expected to be regularly present for the averaging period of the objective. Based on guidance in LAQM.TG(16), existing residential dwellings, shops and commercial units are sensitive receptors to the annual mean and short-term objectives.

Several existing receptors were chosen at locations adjacent to the local road network affected by traffic associated with the proposed development and in close proximity to the proposed development works; the receptors are summarised in **Table D1** and are shown in **Figure 7**.

Table D1. Receptor locations

Receptor ID	Receptor Name	Receptor Description	Height (m)	X	Y
R1	St Bernadette's RC Church	Church	1.5	383615.4	392906.8
R2	Bon Appetit Restaurant	Commercial	1.5	383648.9	392958.1
R3	623 Princess Rd	Residential	1.5	383688.3	393028.1
R4	607 Princess Rd	Residential	1.5	383731.2	393085.3
R5	591 Princess Rd	Residential	1.5	383772.6	393139.5
R6	573/575 Princess Rd	Residential	1.5	383802.6	393209.5
R7	576 Princess Rd	Residential	1.5	383836.9	393273.8
R8	555 Princess Rd	Residential/ Commercial	1.5	383864.0	393338.0
R9	541/543 Princess Rd	Residential	1.5	383885.4	393389.4
R10	531/533 Princess Rd	Residential	1.5	383888.3	393439.4
R11	515 Princess Rd	Residential	1.5	383898.3	393499.4
R12	505/507 Princess Rd	Residential	1.5	383908.3	393569.4

Receptor ID	Receptor Name	Receptor Description	Height (m)	X	Y
R13	489 Princess Rd	Residential	1.5	383909.7	393635.1
R14	479 Princess Rd	Residential	1.5	383908.3	393677.9
R15	Hough End Leisure Centre	Recreational	1.5	383769.8	393286.6
R16	252 Mauldeth Rd W Windsor House	Residential	1.5	383850.8	393727.0
R17	250 Mauldeth Rd W (Kane Funeral Services)	Commercial	1.5	383910.7	393732.1
N1	Leisure Centre (new)	Proposed Development	1.5	383724.1	393252.3
N2	Leisure Centre (new)	Proposed Development	1.5	383665.5	393098.1
N3	Leisure Centre (new)	Proposed Development	1.5	383628.4	393035.3
N4	Leisure Centre (new)	Proposed Development	1.5	383576.9	392958.1
N5	Leisure Centre (new)	Proposed Development	1.5	383611.2	393647.9
N6	Leisure Centre (new)	Proposed Development	1.5	383704.1	393653.6

D6. Significance Criteria

The principles set out in the IAQM / EPUK guidance have been used within this assessment, along with professional judgement, to describe the impact of the proposed development on local air quality once operational. The guidance states that the judgement of significance should take into account relevant factors, including:

- The extent to which an objective or limit value is exceeded; and
- The influence and validity of any assumptions adopted when undertaking prediction of concentrations, including the extent to which any assumptions are worst-case.

Table D2 sets out the significance criteria used in this assessment.

Table D2. Impact descriptors for individual receptors

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: The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as Negligible. The table is only designed to be used with annual mean concentrations. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration for an increase. Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.				

D7. Limitations and Assumptions

There are uncertainties associated with both measured and predicted concentrations. The model relies on input data (including projected traffic flows), which also have uncertainties associated with them. 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 Roads model will not consider.

To make the model more representative of the road traffic around Hough End Leisure Centre, the following were added to the model:

- a time varying profile: derived from the data provided by the DfT Road Traffic Statistics
- Bus Stops (where applicable on the A5013/Princess Road and Mauldeth Rd W) modelled as volume sources
- Traffic Queues (at the following times only: 6:00-9:00, and 16:00-18:00)
- Junctions (where A5013/Princess Road crosses Mauldeth Rd W)

The Annual Average Daily traffic (AADT) data used in the model is based on parameters from the Weekday PM and Sunday peak hours; the project traffic consultants, Curtins Consulting Ltd, consider this to be a worst-case, robust assumption.

The traffic data used comes from the Transport Assessment for the consented Hough End application in 2014 and was subsequently compared with TfGM/DfT traffic data from 2019 and 2020. Curtins demonstrated that there has been no traffic growth on the local highway network and therefore no growth has been applied to the base years or future assessment years (excluding growth assigned to the proposed development). As such, data obtained from the DfT for roads not included in the data provided by Curtins, (i.e., Mauldeth Rd W, A5013/Princess Rd south of A5154/ Barlow Moor Rd, and A5013/Princess Rd north of Mauldeth Rd W) have been treated in the same manner.

Appendix E - Traffic Data and Emissions

Table E1. 2019 baseline

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013 (North of Site Access)	2120	1.1	48	0.1848	0.0200	0.0116
A5013 (South of Site Access)	2106	1.1	48	0.1833	0.0199	0.0115
Mauldeth Rd W (east)	399	1.1	48	0.0340	0.0037	0.0021
Mauldeth Rd W (west)	349	0.5	48	0.0304	0.0033	0.0019
A5013 (South of A5145)	3183	1.4	48	0.2837	0.0307	0.0178
A5103 (North of Mauldeth Rd W)	1640	2.0	48	0.1507	0.0162	0.0094
Mauldeth Rd W/ A5013 western Jct.	349	0.5	25	0.0391	0.0034	0.0020
Mauldeth Rd W/ A5013 eastern Jct.	399	1.1	25	0.0431	0.0038	0.0023
A5013/ Mauldeth Rd W southern Jct.	2120	1.1	25	0.2376	0.0207	0.0123
A5013/ Mauldeth Rd W northern Jct.	1640	2.0	25	0.1971	0.0168	0.0100
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013/Nell Ln (Southbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Nell Ln (Northbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/The Blvd. (Southbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/The Blvd. (Northbound)	1250	1.1	5	0.2356	0.0130	0.0080

A5013/Metrolink (Southbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Metrolink (Northbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Leisure Centre (Southbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Leisure Centre (Northbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Mauldeth Rd W (Northbound)	1250	1.1	5	0.2356	0.0130	0.0080
A5013/Mauldeth Rd W (Southbound)	1250	1.1	5	0.2778	0.0135	0.0083
Mauldeth Rd W/A5013 (Westbound)	1250	1.1	5	0.2356	0.0130	0.0080
Mauldeth Rd W/A5013 (Eastbound)	1250	0.5	5	0.2145	0.0127	0.0078
Volume Source		Volume (m³)	Emission Height (m)	NO _x Emissions (g/m²/s)	PM ₁₀ Emissions (g/m²/s)	PM _{2.5} Emissions (g/m²/s)
Princess Rd/Mersey Avenue (Southbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
Withington Metrolink (Stop A)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
West Didsbury/Princess Road (Stop B)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
Princess Rd/Opposite Moorgate Ave		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
Princess Rd/Whitchurch Rd (Northbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Westbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Eastbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696×10 ⁻⁰⁷

Princess Rd/Whitchurch Rd (Southbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}
Withington Metrolink (Stop C)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}
Mauldeth Rd W (Eastbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}
Mauldeth Rd W (Westbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}

No traffic growth factors have been applied to 2019 baseline to generate the 2022 baseline. It has been agreed in principle that growth is minimal between the years. Further explanation is in section **D7**.

Table E2. 2022 baseline

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013 (North of Site Access)	2120	1.1	48	0.1393	0.0194	0.0109
A5013 (South of Site Access)	2106	1.1	48	0.1383	0.0192	0.0108
Mauldeth Rd W (East)	399	1.1	48	0.0258	0.0036	0.0020
Mauldeth Rd W (West)	349	0.5	48	0.0229	0.0032	0.0018
A5013 (South of A5145)	3183	1.3	48	0.2132	0.0297	0.0167
A5103 (North of Mauldeth Rd W)	1640	2.0	48	0.1123	0.0157	0.0088
Mauldeth Rd W/ A5013 western Jct.	349	0.5	25	0.0293	0.0033	0.0019
Mauldeth Rd W/ A5013 eastern Jct.	399	1.1	25	0.0326	0.0037	0.0021
A5013/ Mauldeth Rd W southern Jct.	2120	1.1	25	0.1780	0.0198	0.0114
A5013/ Mauldeth Rd W northern Jct.	1640	2.0	25	0.1457	0.0161	0.0092
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013/Nell Ln (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Nell Ln (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/The Blvd. (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/The Blvd. (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073

A5013/Metrolink (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Metrolink (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Leisure Centre (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Leisure Centre (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Mauldeth Rd W (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Mauldeth Rd W (Southbound)	1250	1.1	5	0.2152	0.0127	0.0076
Mauldeth Rd W/A5013 (Westbound)	1250	1.1	5	0.1814	0.0123	0.0073
Mauldeth Rd W/A5013 (Eastbound)	1250	0.5	5	0.1645	0.0121	0.0072
Volume Source		Volume (m³)	Emission Height (m)	NO _x Emissions (g/m²/s)	PM ₁₀ Emissions (g/m²/s)	PM _{2.5} Emissions (g/m²/s)
Princess Rd/Mersey Avenue (Southbound)		147	0.5	5.068x10 ⁻⁰⁵	6.512x10 ⁻⁰⁷	4.570x10 ⁻⁰⁷
Withington Metrolink (Stop A)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
West Didsbury/Princess Road (Stop B)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Opposite Moorgate Ave		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Whitchurch Rd (Northbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Westbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Eastbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Whitchurch Rd (Southbound)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Withington Metrolink (Stop C)		147	0.5	5.989 ×10 ⁻⁰⁵	5.40 ×10 ⁻⁰⁷	7.696x10 ⁻⁰⁷

Mauldeth Rd W (Eastbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}
Mauldeth Rd W (Westbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}

Table E3. 2022 with development

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013 (North of Site Access)		1.1	48	0.1419	0.0197	0.0111
A5013 (South of Site Access)		1.1	48	0.1405	0.0196	0.0110
Mauldeth Rd W (east)		1.1	48	0.0263	0.0037	0.0021
Mauldeth Rd W (west)		0.5	48	0.0234	0.0033	0.0018
A5013 (South of A5145)		1.3	48	0.2166	0.0302	0.0170
A5103 (North of Mauldeth Rd W)		2.0	48	0.1143	0.0160	0.0090
Mauldeth Rd W/ A5013 western Jct.		0.5	25	0.0299	0.0033	0.0019
Mauldeth Rd W/ A5013 eastern Jct.		1.1	25	0.0333	0.0037	0.0021
A5013/ Mauldeth Rd W southern Jct.		1.1	48	0.1812	0.0202	0.0116
A5013/ Mauldeth Rd W northern Jct.		1.1	48	0.1482	0.0164	0.0094
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A5013/Nell Ln (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Nell Ln (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/The Blvd. (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073

A5013/The Blvd. (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Metrolink (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Metrolink (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Leisure Centre (Southbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Leisure Centre (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Mauldeth Rd W (Northbound)	1250	1.1	5	0.1814	0.0123	0.0073
A5013/Mauldeth Rd W (Southbound)	1250	1.1	5	0.2152	0.0127	0.0076
Mauldeth Rd W/A5013 (Westbound)	1250	1.1	5	0.1814	0.0123	0.0073
Mauldeth Rd W/A5013 (Eastbound)	1250	0.5	5	0.1645	0.0121	0.0072
Volume Source		Volume (m³)	Emission Height (m)	NO _x Emissions (g/m²/s)	PM ₁₀ Emissions (g/m²/s)	PM _{2.5} Emissions (g/m²/s)
Princess Rd/Mersey Avenue (Southbound)		147	0.5	5.068x10 ⁻⁰⁵	6.512x10 ⁻⁰⁷	4.570x10 ⁻⁰⁷
Withington Metrolink (Stop A)		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
West Didsbury/Princess Road (Stop B)		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Opposite Moorgate Ave		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Whitchurch Rd (Northbound)		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Westbound)		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷
Princess Rd/Mauldeth Rd W (Eastbound)		147	0.5	5.989 x10 ⁻⁰⁵	5.400x10 ⁻⁰⁷	7.696x10 ⁻⁰⁷

Princess Rd/Whitchurch Rd (Southbound)	147	0.5	5.989×10^{-05}	5.400×10^{-07}	7.696×10^{-07}
Withington Metrolink (Stop C)	147	0.5	5.989×10^{-05}	5.400×10^{-07}	7.696×10^{-07}
Mauldeth Rd W (Eastbound)	147	0.5	5.989×10^{-05}	5.400×10^{-07}	7.69×10^{-07}
Mauldeth Rd W (Westbound)	147	0.5	5.989×10^{-05}	5.40×10^{-07}	7.696×10^{-07}

Appendix A - Results

Table F1. Annual mean NO_x concentrations (µg/m³)

Receptor ID	2019 Baseline	2022 Future Baseline	2022 With Development	Change
MAN37	42.7	36.1	37.5	1.4
R1	15.9	12.4	13.0	0.5
R2	22.6	19.2	19.9	0.7
R3	19.9	15.9	16.6	0.7
R4	12.6	9.6	10.0	0.4
R5	9.9	7.4	7.8	0.3
R6	13.5	10.1	10.5	0.5
R7	15.4	11.9	12.4	0.5
R8	21.4	18.0	18.7	0.7
R9	12.8	10.0	10.5	0.4
R10	15.6	11.8	12.3	0.6
R11	14.9	11.1	11.7	0.5
R12	15.6	11.9	12.5	0.6
R13	33.0	28.3	29.4	1.1
R14	33.5	27.4	28.5	1.1
R15	14.8	11.8	12.3	0.5
R16	23.5	18.4	19.1	0.3
R17	37.8	31.1	32.3	0.5
N1	8.0	6.2	6.5	0.7
N2	16.0	12.9	13.4	0.6
N3	22.5	18.9	19.6	0.1
N4	17.0	13.6	14.2	0.2
N5	3.4	2.7	2.8	0.8
N6	4.8	3.8	4.0	1.2

Table F2. Annual mean NO₂ concentrations (µg/m³)

Receptor ID	2019 Baseline	2022 Future Baseline	2022 With Development	Change	% Change relative to AQAL	% of AQAL	Significance
MAN37	38.1	33.5	33.6	0.1	0.3	84	Negligible
R1	25.9	22.1	22.2	0.1	0.2	56	Negligible
R2	29.2	25.7	25.7	0.1	0.2	64	Negligible
R3	27.1	23.4	23.5	0.1	0.2	59	Negligible
R4	23.4	20.1	20.1	0.1	0.2	50	Negligible
R5	22.0	18.9	18.9	0.1	0.2	47	Negligible
R6	23.9	20.3	20.4	0.1	0.2	51	Negligible
R7	24.8	21.3	21.4	0.1	0.2	53	Negligible
R8	27.8	24.5	24.6	0.1	0.2	61	Negligible
R9	23.5	20.3	20.4	0.1	0.2	51	Negligible
R10	24.9	21.2	21.3	0.1	0.3	53	Negligible
R11	24.6	20.9	21.0	0.1	0.3	52	Negligible
R12	24.9	21.3	21.4	0.1	0.3	54	Negligible
R13	33.4	29.7	29.8	0.1	0.2	74	Negligible
R14	33.6	29.2	29.3	0.1	0.3	73	Negligible
R15	24.5	21.2	21.3	0.1	0.2	53	Negligible
R16	28.8	24.7	24.8	0.1	0.2	62	Negligible
R17	35.6	31.0	31.1	0.1	0.3	78	Negligible
N1	21.1	18.2	18.3	0.0	0.1	46	Negligible
N2	25.1	21.8	21.9	0.1	0.2	55	Negligible
N3	28.4	24.9	25.0	0.1	0.2	63	Negligible
N4	26.4	22.8	22.8	0.1	0.2	57	Negligible
N5	18.6	16.3	16.3	0.0	0.1	41	Negligible
N6	19.4	16.9	16.9	0.0	0.1	42	Negligible

Table F3. Annual mean PM₁₀ concentrations (µg/m³)

Receptor ID	2019 Baseline	2022 Future Baseline	2022 With Development	Change	% Change relative to AQAL	% of AQAL	Significance
MAN37	14.0	14.0	14.0	0.0	0.1	35	Negligible
R1	13.1	12.9	13.0	0.0	0.1	32	Negligible
R2	13.1	12.9	12.9	0.0	0.0	32	Negligible
R3	13.2	13.1	13.1	0.0	0.1	33	Negligible
R4	12.8	12.7	12.7	0.0	0.0	32	Negligible
R5	12.6	12.5	12.5	0.0	0.0	31	Negligible
R6	13.0	12.8	12.9	0.0	0.1	32	Negligible
R7	13.0	12.8	12.8	0.0	0.1	32	Negligible
R8	13.0	12.8	12.8	0.0	0.1	32	Negligible
R9	12.7	12.6	12.6	0.0	0.0	31	Negligible
R10	13.1	13.0	13.0	0.0	0.1	33	Negligible
R11	13.1	13.0	13.0	0.0	0.1	32	Negligible
R12	13.1	12.9	13.0	0.0	0.1	32	Negligible
R13	13.4	13.3	13.3	0.0	0.1	33	Negligible
R14	13.7	13.6	13.6	0.0	0.1	34	Negligible
R15	12.78	12.6	12.7	0.0	0.0	32	Negligible
R16	13.27	13.1	13.1	0.02	0.1	33	Negligible
R17	13.73	13.6	13.6	0.03	0.1	34	Negligible
N1	12.35	12.2	12.2	0.01	0.0	31	Negligible
N2	12.87	12.7	12.7	0.02	0.0	32	Negligible
N3	13.05	12.9	12.9	0.02	0.0	32	Negligible
N4	13.05	12.9	12.9	0.02	0.0	32	Negligible
N5	11.93	11.8	11.8	0.00	0.0	29	Negligible
N6	12.02	11.9	11.9	0.01	0.0	30	Negligible

Table F4. Number of days with PM₁₀ concentrations exceeding 50µg/m³

Receptor ID	2019 Baseline	2022 Future Baseline	2022 With Development	Change
MAN37	0	0	0	0
R1	0	1	1	0
R2	1	1	1	0
R3	0	1	1	0
R4	1	1	1	0
R5	1	1	1	0
R6	1	1	1	0
R7	0	1	1	0
R8	1	1	1	0
R9	0	1	1	0
R10	0	1	1	0
R11	0	1	1	0
R12	0	1	1	0
R13	0	0	0	0
R14	0	0	0	0
R15	0	1	1	0
R16	0	0	0	0
R17	0	0	0	0
N1	1	1	1	0
N2	0	1	1	0
N3	0	1	1	0
N4	0	1	1	0
N5	1	1	1	0
N6	1	1	1	0

Table F5. Annual mean PM_{2.5} concentrations (µg/m³)

Receptor ID	2019 Baseline	2022 Future Baseline	2022 With Development	Change	% Change relative to AQAL	% of AQAL	Significance
MAN37	9.5	9.1	9.0	0.0	0.1	36	Negligible
R1	8.8	8.5	8.5	0.0	0.0	34	Negligible
R2	8.8	8.5	8.5	0.0	0.0	34	Negligible
R3	9.0	8.7	8.7	0.0	0.1	35	Negligible
R4	8.8	8.5	8.5	0.0	0.0	34	Negligible
R5	8.7	8.3	8.4	0.0	0.0	33	Negligible
R6	8.9	8.6	8.6	0.0	0.0	34	Negligible
R7	8.9	8.6	8.6	0.0	0.0	34	Negligible
R8	8.9	8.6	8.6	0.0	0.0	34	Negligible
R9	8.7	8.4	8.4	0.0	0.0	34	Negligible
R10	9.0	8.7	8.7	0.0	0.1	35	Negligible
R11	9.0	8.6	8.6	0.0	0.1	35	Negligible
R12	9.0	8.6	8.6	0.0	0.1	34	Negligible
R13	9.2	8.8	8.8	0.0	0.1	35	Negligible
R14	9.4	9.0	9.0	0.0	0.1	36	Negligible
R15	8.8	8.5	8.5	0.0	0.0	34	Negligible
N1	8.5	8.2	8.2	0.0	0.0	33	Negligible
N2	8.8	8.5	8.5	0.0	0.0	34	Negligible
N3	9.0	8.6	8.6	0.0	0.0	34	Negligible
N4	8.8	8.5	8.5	0.0	0.0	34	Negligible
N5	8.3	8.0	8.0	0.0	0.0	32	Negligible
N6	8.3	8.0	8.0	0.0	0.0	32	Negligible
R16	9.1	8.7	8.8	0.0	0.1	35	Negligible
R17	9.4	9.0	9.0	0.0	0.1	36	Negligible

Sudbury Consultancy

Holbrook House
 Little Waldingfield
 Sudbury
 Suffolk
 CO10 0TF
 Tel: +44 (0)1787 247595

Manchester Consultancy

Suite 1.9, Canada House
 Chepstow Street
 Manchester
 M1 5FW
 Tel: +44 (0)161 929 5585

London Consultancy

07-106
 8 Devonshire Square
 London
 EC2M 4PL
 Tel: +44 (0)207 251 3585

Birmingham Consultancy

Cornwall Buildings
 45 Newhall Street
 Birmingham
 B3 3QR
 Tel: +44 (0)121 270 6680

South Africa Consultancy

102 Heritage House
 20 Dreyer Street
 Claremont
 Cape Town
 7708
 South Africa
 Tel: +27 (0)21 205 9201

Laboratory

Holbrook House
 The Street
 Sudbury
 Suffolk
 CO10 0TF
 Tel: +44 (0)1787 247595

Website: www.srltsl.com
 e-mail: srl@srltsl.com

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SRL Technical Services Limited
 Holbrook House
 Little Waldingfield
 Sudbury
 Suffolk
 CO10 0TF

Registered Number: 907694 England

