Airport City North Plots E1, E2 and E3

Air Quality Assessment

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1. Introduction

This Air Quality Assessment has been prepared by AECOM on behalf of Airport City Limited Partnership to support a planning application for the proposed development of two office units and a multi-storey car park (MSCP), to be located on Plot E of the Airport City Manchester development. Plot E1 will comprise a 1497-space MSCP, whilst plots E2 and E3 will comprise approximately 8,570m^2 of office space and include the potential for ground floor amenity space.

A map of the air quality study area can be found in Appendix A, Figure 1.

The air quality baseline was established through a review of the published ambient air quality data and a recent NO_2 diffusion tube survey. Against the projected baseline conditions the magnitude of predicted impacts due to the Proposed Development was assessed.

During the construction phase of the Proposed Development, there is the potential for construction site activities to generate fugitive emissions of particulate matter (dust and PM_{10}). The methodology of dust assessment is described in Appendix B.

For the operational phase, the potential for changes to long term and short term mean concentrations of particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2) to occur at air quality sensitive receptors as a result of predicted changes in road traffic movements on the local road network have been modelled. The methodology of operational phase assessment is described in Appendix C and Appendix D.

2. Legislative and Policy Context

2.1 European Air Quality Directives

The Clean Air for Europe (CAFE) programme revisited the management of air quality within the European Union (EU) and replaced the EU Framework Directive 96/62/EC (The Council of the European Union, 1996), its associated Daughter Directives 1999/30/EC (The Council of the European Union, 1999), 2000/69/EC (The European Parliament and the Council of the European Union, 2000), 2002/3/EC (The European Parliament and the Council of the European Union, 2002), and the Council Decision 97/101/EC (The Council of the European Union, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008).

Directive 2008/50/EC (The European Parliament and the Council of the European Union, 2008) is transcribed into UK legislation by the Air Quality Standards Regulations 2010 (HM Government, 2010) which came into force on the 11th June 2010. These limit values are legally binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects of air quality on human health and on the environment as a whole.

Commission Directive 2015/1480 (The European Commission, 2015) amended Directives 2008/50/EC and 2004/107/EC (The European Commission, 2015). The amendment was transposed into national legislation by The Air Quality Standards (Amendment) Regulations 2016 (HM Government, 2016), which came into force on 31st December 2016.

2.2 National Air Quality Strategy

The UK National Air Quality Strategy (Department of the Environment, 1997) was initially adopted in 1997, under the requirements of the Environment Act 1995 (HM Government, 1995). The most recent revision of the Strategy (DEFRA, 2007) sets objective values for key pollutants as a tool to help local authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive (The Council of the European Union, 1996). Some of these objective values have been laid out within the Air Quality (England) Regulations 2000 (HM Government, 2000) and later amendment (HM Government, 2002).

The air quality objective values have been set down in regulation solely for the purposes of local air quality management. Under the local air quality management regime, local authorities have a duty to carry out regular assessments of air quality against the objective values and if it is unlikely that the objective values will be met in

the given timescale, they must designate an AQMA and prepare an Air Quality Action Plan (AQAP) with the aim of achieving the objective values. The boundary of an AQMA is set by the governing local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. Consequently it is not unusual for the boundary of an AQMA to include within it, relevant locations where air quality is not at risk of exceeding an air quality objective.

The UK's national air quality objective values and EU limit values for the pollutants of relevance to this assessment are displayed in Table 1.

Table 1, Air Quality Strategy Objectives and EU Limit Values

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances	Criteria
Nitrogen Dioxide (NO_2)	Annual Mean	40 µg/m^3	None	Objective & limit value
	Hourly Mean	200 µg/m^3	18 times per year	Objective & limit value
Particulate Matter (PM_{10})	Annual Mean	40 µg/m^3	None	Objective & limit value
	24-hour	50 µg/m^3	35 times per year	Objective & limit value
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25 µg/m^3	None	Limit value

Source: DEFRA's Air Quality Strategy

2.3 National Planning Policy

2.3.1 National Planning Policy Framework (2018)

The revised National Planning Policy Framework (NPPF) was published in July 2018 (Ministry of Housing, Communities & Local Government, 2018a) and concisely sets out national policies and principles on land use planning. Paragraph 103 of the NPPF states that:

> *"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health."*

Air quality is considered as an important element of the natural environment. On conserving and enhancing the natural environment, Paragraph 170 states that:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by: …*
>
> *e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality …"*

Air quality in the UK has been managed through the Local Air Quality Management regime using national objectives. The effect of a proposed development on the achievement of such policies and plans are matters that may be a material consideration by planning authorities, when making decisions for individual planning applications. Paragraph 181 of the NPPF states that:

> *"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. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. 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."*

The different roles of a planning authority and a pollution control authority are addressed by the NPPF in paragraph 183:

> *"The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities."*

2.3.2 National Planning Practice Guidance (2016, updated 24 July 2018)

The Planning Practice Guidance (PPG) was updated on 24 July 2018 (Ministry of Housing, Communities & Local Government, 2018b), with specific reference to air quality, which was published on 6 March 2014. The PPG states that the planning system should consider the potential effect of new developments on air quality where relevant limits have been exceeded or are near the limit. Concerns also arise where the development is likely to adversely affect the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife). In addition dust can also be a planning concern, for example, because of the effect on local amenity.

When deciding whether air quality is relevant to a planning application the PPG states that a number of factors should be taken into consideration including if the development will:

> *Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; adds to turnover in a large car park; or result in construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more.*
>
> *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area;*
>
> *Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality.*
>
> *Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations.*
>
> *Affect biodiversity. In particular, is it likely to result in deposition or concentration of pollutants that significantly affect a European-designated wildlife site, and is not directly connected with or necessary to the management of the site, or does it otherwise affect biodiversity, particularly designated wildlife sites.*

On how detailed an air quality assessment needs to be, the PPG states:

> *"Assessments should be proportionate to the nature and scale of the development proposed and the level of concern about air quality... Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented."*

2.4 Regional Planning Policy – Greater Manchester Air Quality Action Plan 2016 – 2021

All of the Greater Manchester local authorities have declared Air Quality Management Areas (AQMAs). They have worked together to produce an action plan (TfGM, 2016) that covers the whole of Greater Manchester. Regarding development control and planning regulation, Greater Manchester councils are to adopt the IAQM Guidance on the Assessment of Dust from Demolition and Construction sites (IAQM, 2014) to ensure appropriate mitigation controls are conditioned and to adopt the most recent IAQM air quality planning guidance (EPUK &

IAQM, 2017) to help ensure that planning applications consider impacts consistently and opportunities to improve air quality are realised.

2.5 Local Planning Policy – Local Development Framework

Manchester City Council (MCC) adopted Manchester's Local Development Framework Core (MCC, 2012) on 11th July 2012.

Policy EN 16 of the core strategy is about air quality, which states:

> *The Council will seek to improve the air quality within Manchester, and particularly within Air Quality Management Areas, located along Manchester's principal traffic routes and at Manchester Airport. Developers will be expected to take measures to minimise and mitigate the local impact of emissions from traffic generated by the development, as well as emissions created by the use of the development itself, including from Combined Heat and Power and biomass plant.*
>
> *When assessing the appropriateness of locations for new development the Council will consider the impacts on air quality, alongside other plan objectives. This includes cumulative impacts, particularly in Air Quality Management Areas.*

3. Assessment Methodology and Significance Criteria

3.1 Scope of Assessment

The assessment has been undertaken with reference to guidance that is current in the assessment of air quality impacts (Institute of Air Quality Management (IAQM), 2014; Environmental Protection UK (EPUK) & IAQM, 2017; EPUK, 2010).

The potential for air quality impacts have been considered for two distinct phases:

- The 'construction' phase: during which the greatest impact is expected to be from dust.
- The 'operational' phase: when the impacts will be primarily associated with vehicle emissions.

3.2 Construction Phase

During the construction phase of the proposed development, there is the potential for construction activities to generate fugitive emissions of particulate matter (dust and PM_{10}). There is the risk of such emissions giving rise to significant adverse effects on amenity or health at receptors located within 350m of the source of emissions (IAQM, 2014) unless appropriate mitigation measures are adopted. There are receptors located within 100 m of the site boundary and therefore an assessment of the significance of effects from fugitive emissions of dust and PM_{10} from the site has been undertaken. The assessment includes the consideration of the risk of adverse effects associated with the potential track-out of material at receptors located within 50 m of roads extending up to 500 m from the site's access points.

The effects associated with the construction phase of the Development have been qualitatively assessed with reference to the IAQM published 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014).

According to the IAQM, the main air quality effects that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentration of airborne particles and NO_2 due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the site.

According to the EPUK guidance criteria, a quantitative air quality assessment of potential emissions from construction vehicles should only be undertaken for, 'large, long term construction sites that would generate large Heavy Goods Vehicles (HGV, > 3.5 tonnes) flows (>200 movements per day) over a period of a year or more.' The Development is not expected to fit this criterion, therefore a quantitative assessment is not required and the effects due to vehicle emissions during the construction phase should be considered insignificant.

Activities on construction sites are classified into four types to reflect their different potential effects:

- Demolition;
- Earthworks;
- Construction; and
- Track out (the transportation of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network).

The following steps, as defined by the IAQM (IAQM, 2014), were followed:

- STEP 1 Screen the requirement for a detailed assessment. Human and ecological receptors were identified and distance to the Site and construction routes were determined;
- STEP 2 Assess the risk of dust impacts. The potential risk of dust effects occurring for each activity was determined, based on the magnitude of the potential dust emissions and the sensitivity of the area;
- STEP 3 Identify the need for site-specific mitigation. Based on the risk of effects occurring, site specific mitigation measures were determined; and
- STEP 4 Define impacts and their significance. The significance of the potential residual dust effects (taking mitigation into account) for each activity was determined.

Further details are provided in Appendix B.

3.3 Operational Phase

The local air quality assessment has been undertaken in accordance with the EPUK/IAQM (2017) 'Land-use planning & development control: planning for air quality' guidance and DEFRA (2016) Local Air Quality Management Technical Guidance (LAQM.TG(16)). Traffic data used for this assessment are shown in Appendix C. Trip generation due to the operation of the proposed development dictates that a detailed assessment of local air quality impacts as a result of the increase in road traffic emissions is required.

3.3.1 Emission Scenarios and Dispersion Modelling

Atmospheric Dispersion Modelling System (ADMS) Roads detailed modelling software has been used to predict concentrations of road transport derived pollutants NO_2, PM_{10} and $PM_{2.5}$, at selected sensitive receptors. The following scenarios were modelled:

- 2017 Existing Scenario (using 2017 traffic data, 2017 meteorological data, 2017 traffic emissions factors and 2017 backgrounds) for model verification;
- 2021 Baseline Scenario (without development, using 2021 traffic data, 2017 meteorological data, 2021 traffic emissions factors and 2021 backgrounds) as the future baseline; and
- 2021 With Development Scenario (with development, using 2021 traffic data, 2017 meteorological data, 2021 traffic emissions factors and 2021 backgrounds) as the future with development scenario.

The future scenarios listed above have been used to represent the impact of the operational Development when 100% complete. To consider the risk that the improvement of vehicle emission factors may not be realised as projected by DEFRA, two more scenarios have been modelled:

- 2021 Baseline Sensitivity Scenario (without development, using 2021 traffic data, 2017 meteorological data, 2019 traffic emissions factors and 2017 backgrounds) as the future baseline; and
- 2021 With Development Sensitivity Scenario (with development, using 2021 traffic data, 2017 meteorological data, 2019 traffic emissions factors and 2017 backgrounds) as the future with development scenario.

The emission factors applied to the model were derived from the UK Emission Factor Toolkit v8.0.

This assessment has used the latest version of dispersion model software ADMS-Roads (v4.1.0) to quantify baseline and with-development pollution levels at selected receptors. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies.

3.3.2 Conversion of NO_X to NO_2

The proportion of NO_2 in NO_X varies greatly with location and time according to a number of factors including the amount of oxidant available and the distance from the emission source. NO_X concentrations are expected to decline in future years due to falling emissions, therefore NO_2 concentration will not be limited as much by ozone and consequently it is likely that the NO_2/NO_X ratio will in the future increase. In addition, a trend has been noted in recent years whereby roadside NO_2 concentrations have been increasing at certain roadside monitoring sites, despite emissions of NO_X falling. The direct NO_2 phenomenon is having an increasingly marked effect at many urban locations throughout the UK and must be considered when undertaking modelling studies.

In this study modelled NO_X values were converted to NO_2 using the 'NO_X to NO_2' calculator, released in June 2016, and available at the Air Quality Archive (DEFRA, 2018). The year and region for which the modelling has been undertaken are specified and local factors, such as an appropriate factor of NO_X emitted as NO_2, are used in the calculation.

3.3.3 Receptors

Receptor locations were selected that were considered to be representative of relevant sensitive exposure, such as residential properties and schools. Four AECOM diffusion tube monitoring locations are also included as receptors for model verification purposes.

The receptors that have been selected to represent locations where people are likely to be present are based on Air Quality Objectives that are relevant to public exposure for long and short-term objectives (see Table 2). The Air Quality Objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, the elderly or people who may be predisposed respiratory conditions. The locations of the selected receptors can be found in Appendix A, Figure 1.

There are no ecological receptors located within 200 m of the Development or roads that are included in the assessment.

Table 2, Modelled Receptors

Receptor ID	Description	OS Grid Coordinate	
T1	AECOM Monitoring Site	381197	386065
T2	AECOM Monitoring Site	381551	386037
T3	AECOM Monitoring Site	382206	385830
T4	AECOM Monitoring Site	382938	385303
R1	Residential, 2 Haletop Cottages	381196	386084
R2	School, Little Flyers Day Nursery	381518	386064
R3	Residential, 25 Gorston Walk	382225	385932
R4	Residential, 1st floor, Airport Pub	382917	385260
R5	Residential, 46 Carsdale Road	383121	385425
R6	Residential, 103 Hilary Road	382009	386069
R7	Residential, 79 Selstead Road	381997	386145
R8	Residential, 66 Selstead Road	381978	386160

3.3.4 Background Pollutant Concentration Data

For any modelling exercise the ideal situation is to estimate emissions from all known sources (road, rail, industry etc). In practice, information will only be available for those sources under the spotlight. In this case it's the road traffic component. Under these circumstances all other sources are collectively considered to be a background element. The concentrations calculated by the model due to vehicle emissions are therefore added to these background concentrations to give the total concentration.

Therefore, the annual mean background pollutant concentration used in this assessment were modelled estimations provided by DEFRA (DEFRA, 2018), who provide values for the centre point of each 1 km by 1 km grid square in the UK, for each year between 2015 and 2030. Estimated average background concentrations for the Ordnance Survey grid square containing the model receptors are provided in Table 3. These data were downloaded in July 2018.

Table 3, Modelled Annual Mean Background Pollutant Concentrations

Receptors	At Cell Centre	2017 NO_2 ($\mu g/m^3$)	2017 PM_{10} ($\mu g/m^3$)	2017 $PM_{2.5}$ ($\mu g/m^3$)	2021 NO_2 ($\mu g/m^3$)	2021 PM_{10} ($\mu g/m^3$)	2021 $PM_{2.5}$ ($\mu g/m^3$)
T1, T2, R1, R2, R7, R8	381500, 386500	22.2	13.4	8.6	18.3	13.0	8.2
R6	382500, 386500	19.8	11.9	7.9	16.4	11.5	7.5
T3, T4, R3, R4	382500, 385500	25.6	11.9	8.1	21.6	11.3	7.4
R5	383500, 385500	18.2	11.1	7.4	14.8	10.7	7.0

3.3.5 Meteorological Data

The meteorological dataset used in the assessment was recorded in 2017 at the meteorological station at Manchester airport, located approximately 1 km to the west of the site. The meteorological site is considered to be representative of regional meteorological conditions and sufficient to satisfy the requirements of this assessment.

3.3.6 Model Verification

Modelling results are subject to systematic and random error; systematic error arises due model formulations and random errors to variable factors, such as uncertainty in the traffic data and the composition of the vehicle fleet, and uncertainty in the meteorological dataset. This can be addressed and, if necessary, adjusted for by comparison with monitoring data. The accuracy of the future year modelling results are relative to the accuracy of the base year results, therefore greater confidence can be placed in the future year concentrations if good agreement is found for the current (2017) existing scenario.

A model adjustment factor of 0.87 was achieved through comparison with local air quality monitoring data. Even without an adjustment, the accuracy of the model is with a resultant RMSE of ±3.7 µg/m3, already within 10% of the air quality objective. According to LAQM.TG16 (DEFRA, 2016), an adjustment is not required under this situation. This is a conservative choice because the adjustment using a factor smaller than 1 would lower the pollutant concentrations. Similarly, no adjustment is applied to either PM_{10} or $PM_{2.5}$. The verification calculations are provided in Appendix D.

3.4 Significance Criteria

3.4.1 Construction Phase

Step 4 of the construction phase assessment methodology defines the significance of the potential residual effect, i.e. after mitigation dust impacts.

According to the IAQM Guidance (IAQM, 2014) the residual effects assessment assumes that all mitigation measures (recommended in Step 3) to avoid or reduce effects will be adhered to, and therefore the residual effects should be considered to be 'not significant'.

3.4.2 Operational Phase

With regard to road traffic emissions, the change in pollutant concentrations, with respect to the baseline concentrations, has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the modelled scenarios is also described, and this is used to identify the risk of the Air Quality Objective values being exceeded in each scenario.

For consideration of a change in annual mean concentrations of a given magnitude, the EPUK & IAQM (2017) have jointly published recommendations for describing the effects of such impacts at individual receptors, as set out in Table 4.

The EPUK & IAQM guidance includes seven explanatory notes to accompany the terminology for the effect descriptors. In particular it is noted that the descriptors are for individual receptors only and that overall significance is determined using professional judgement. Additionally, it is noted that it is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the objective value. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the objective value, rather than being exactly equal to it.

For NO_2, the AQAL is 40 µg/m^3; for PM_{10}, the AQAL is 32 µg/m^3 to take into account the number of days exceeding a daily mean concentration of 50 µg/m^3 being no more than 35 times per year; for $PM_{2.5}$, the AQAL is 25 µg/m^3.

A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% (0.2 µg/m^3) is considered to be so small as to be negligible. A change (impact) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

Table 4, Effects Descriptors at Individual Receptors - Annual Mean NO_2, PM_{10} and $PM_{2.5}$

Annual Mean Pollutant Concentration at Receptor in Assessment Year	Change in Annual Mean Concentration of NO_2/PM_{10}/$PM_{2.5}$				
	< 1% of AQAL	1% of AQAL	2-5% of AQAL	6-10% of AQAL	> 10% of AQAL
≤ 75% of AQAL	Negligible	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Negligible	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Negligible	Moderate	Moderate	Substantial	Substantial
≥ 110% of AQAL	Negligible	Moderate	Substantial	Substantial	Substantial

The EPUK & IAQM guidance indicates that it is the intention of the effect descriptors for smaller changes in pollutant concentrations to capture the potential risk associated with cumulative development. Changes of 1% of a relevant Air Quality Objective could, under the EPUK & IAQM guidance, result in slight to moderate air quality effects at individual receptors. In practice this assessment inherently considers cumulative impacts through the use of traffic data, DEFRA background concentrations and predictions at committed developments. Additionally, the EPUK & IAQM guidance also includes the potential for sight to substantial air quality effects as a result of changes in pollutant concentrations between 2 and 5% of relevant Air Quality Objectives. For annual average NO_2 concentrations, this relates to changes in concentrations ranging from 0.6 – 2.1 µg/m^3. In practice, changes in concentration of this magnitude, and in particular changes at the lower end of this band are likely to be very difficult to distinguish through any post operational monitoring regime due to the number of sources of NO_2 in an urban environment and the inter annual effects of varying meteorological conditions. Changes in concentration of more than 5% (the two highest bands) are considered to be of a magnitude which is far more likely to be discernible and as such carry additional weight within the overall evaluation of significance for air quality.

3.4.3 Overall Determination of Significance

The significance of all the reported impacts is then considered for the development in overall terms. The potential for the development to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality are considered if relevant, but the principal focus is any change in the likelihood of future achievement of the Air Quality Objective values for the following pollutants:

- Annual mean nitrogen dioxide (NO_2) concentration of 40 µg/m^3;
- 1-hour mean NO_2 concentration of 200 µg/m^3 not to be exceeded on more than 18 times per year;
- Annual mean particulate matter (PM_{10}) concentration of 40 µg/m^3;
- 24-hour mean PM_{10} concentration of 50 µg/m3 not to be exceeded on more than 35 days per year; and
- Annual mean fine particulate matter ($PM_{2.5}$) concentrations of 25 µg/m^3.

Local Authorities are focused on achieving these AQOs.

In terms of empirical studies undertaken by EPUK & IAQM the statistical significance of the consequences of any adverse impacts, an effect is reported as being either 'not significant' or as being 'significant'. If the overall effect of the development on local air quality or on amenity is found to be 'moderate' or 'substantial' this is deemed to be 'significant'. Effects found to be 'minor' are considered to be 'not significant', although they may be a matter of local concern. 'Negligible' effects are considered to be 'not significant'.

3.5 Limitations and Assumptions

The assessment has adopted a methodology that is considered as a standard practice and has been widely accepted nationally. There are uncertainties associated with the dispersion model and measurements, which are considered acceptable for the purpose of this assessment.

4. Baseline Conditions

4.1 Local Air Quality Management

The local air quality management review and assessment responsibilities for the area around the Site are undertaken by Manchester City Council (MCC), jointly with other local authorities as the Greater Manchester Combined Authority.

Manchester currently meets six of the air quality objectives relevant to Local Air Quality Management (LAQM) for lead, sulphur dioxide, benzene, 1,3-butadiene, carbon monoxide and PM_{10} particulates. The principal pollutant of concern in Manchester is nitrogen dioxide (NO_2). Exceedances of the annual objective are predicted in the city and are a particular issue for the city centre and close to busy roads.

The current Greater Manchester AQMA was declared on 19 April 2016, based on modelled NO_2 concentration exceeding 35 µg/m^3. The M56, World Way, Outwood Lane, Ringway Road West and Thorley Lane close to the development Site are all partially covered by the AQMA.

4.2 Pollutants of Concern

4.2.1 Nitrogen Dioxide (NO_2)

The Government and the Devolved Administrations adopted two Air Quality Objectives for nitrogen dioxide (NO_2) which were to be achieved by the end of 2005. In 2010, mandatory EU air quality limit values on pollutant concentrations were to apply, although it continues to be breached in locations throughout the UK. The EU limit values for NO_2 in relation to human health are the same as the national objectives (DEFRA, 2007):

- An annual mean concentration of 40 µg/m^3; and
- An hourly mean concentration of 200 µg/m^3, not to be exceeded more than 18 times per year (equivalent to 99.79th percentile).

In practice, meeting the annual mean objective has been and is expected to be considerably more demanding than achieving the 1-hour objective. The annual mean objective of 40 µg/m^3 is currently widely exceeded at

roadside sites throughout the UK, with exceedances also reported at urban background locations in major conurbations. Exceedances are associated almost exclusively with road source emissions.

There is considerable year-to-year variation in the number of exceedances of the hourly objective, driven by meteorological conditions which give rise to winter episodes of poor dispersion and summer oxidant episodes. Analysis of the relationship between 1-hour and annual mean NO_2 concentrations at roadside and kerbside monitoring sites indicate that exceedances of the 1-hour objective are unlikely where the annual mean is below 60 µg/m^3 (DEFRA, 2016).

NO_2 and nitric oxide (NO) are both oxides of nitrogen and are collectively referred to as NO_X. All combustion processes produce NO_X emissions, largely in the form of NO, which is then converted to NO_2, mainly as a result of its reaction with ozone in the atmosphere. Therefore, the ratio of NO_2 to NO is primarily dependent on the concentration of ozone and the distance from the emission source.

4.2.2 Particulate Matter (PM_{10} and $PM_{2.5}$)

Particulate matter is composed of a wide range of materials arising from a variety of sources. Particulate matter is typically assessed as total suspended particulates or as a mass size fraction.

This assessment considers the annual mean and daily mean air quality objectives, as specified in the AQS for England, Scotland, Wales and Northern Ireland (DEFRA, 2007). Two objectives have been adopted in England and Wales for PM_{10} (particulate matter), which were to be achieved by the end of 2004:

- An annual mean concentration of 40 µg/m^3 (gravimetric); and
- A 24-hour mean concentration of 50 µg/m^3 (gravimetric) not to be exceeded more than 35 times per year (equivalent to 90.4th percentile).

One objective has been adopted for $PM_{2.5}$ in England and Wales which is an annual mean concentration of 25 µg/m^3 (gravimetric).

Both short-term and long-term exposure to ambient levels of particulate matter are consistently associated with respiratory and cardiovascular illness and mortality as well as other ill-health effects. Particles of less than 10 micrograms (µm) in diameter have the greatest likelihood of reaching the thoracic region of the respiratory tract. Here particles may remain resident and therefore have increased likelihood of doing harm.

It is not currently possible to discern a threshold concentration below which there are no effects on the whole population's health. Reviews by World Health Organisation and the Committee on the Medical Effects of Air Pollutants (COMEAP, 2010) have suggested exposure to a finer fraction of particles ($PM_{2.5}$, which typically make up around two thirds of PM_{10} emissions and concentrations) give a stronger association with the observed ill health effects, but also warn that there is evidence that the coarse fraction (between PM_{10} – $PM_{2.5}$) also has some effects on health.

4.2.3 Construction Dust

Dust is defined as all particulate matter up to 75 µm in diameter (BSI, 1994) and comprising both suspended and deposited dust, whereas PM_{10} is a mass fraction of airborne particles of diameter of 10 µm or less. The health effects associated with dust include eye, nose and throat irritation in addition to the nuisance caused by deposition on cars, windows and property. Dust and PM_{10} emissions arise from a number of sources, so construction activities and emissions from vehicles associated with a development should be considered.

4.3 Pollutant Monitoring

Manchester City Council undertakes monitoring using both continuous and passive monitoring techniques.

The closest continuous monitoring location is approximately 1.5 km north-east of the Proposed Development Site. NO_2 concentrations at the Proposed Development Site are considered to be similar to those monitored. Annual mean NO_2 concentrations from this location are shown in Table 5. Monitoring at this location only began in 2016, however no exceedances of the annual mean objective for NO_2 of 40 µg/m^3 or the hourly mean objective of 200 µg/m^3 were recorded in this year.

Table 5, Manchester City Council Air Quality Automatic Monitoring, Annual Mean NO_2

ID	Location	Site Type	Coordinates	Annual Mean NO_2 (µg/m^3)

					(Number of exceedances of the 1 hour mean (200 µg/m^3) are indicated in brackets)		
			X	Y	2014	2015	2016
MAN8	Manchester South	Suburban Background	383904	385818	22 (0)	20 (0)	-
MAHG	Manchester Sharston	Suburban Background	384202	386121	-	-	23 (0)

Source: Manchester City Council, 2017

Annual mean PM_{10} concentrations from the Manchester Sharston continuous monitoring location are shown in Table 6. Neither the annual mean objective for PM_{10} of 40 µg/m^3 nor the hourly mean objective of 50 µg/m^3 were exceeded at this location in 2016.

Table 6, Manchester City Council Air Quality Automatic Monitoring, Annual Mean PM_{10}

ID	Location	Site Type	Coordinates		Annual Mean PM_{10} (µg/m^3) (Number of exceedances of the 1 hour mean (50 µg/m^3) are indicated in brackets)		
			X	Y	2014	2015	2016
MAN8	Manchester South	Suburban Background	383904	385818	16 (8)	15 (4)	-
MAHG	Manchester Sharston	Suburban Background	384202	386121	-	-	13.6 (0)

Source: Manchester City Council, 2017

Annual mean $PM_{2.5}$ concentrations from the Manchester Sharston continuous monitoring location are shown in Table 7. The annual mean objective for $PM_{2.5}$ of 25 µg/m^3 was not exceeded at this location in 2016.

Table 7, Manchester City Council Air Quality Automatic Monitoring, Annual Mean $PM_{2.5}$

ID	Location	Site Type	Coordinates		Annual Mean $PM_{2.5}$ (µg/m^3)		
			X	Y	2014	2015	2016
MAN8	Manchester South	Suburban Background	383904	385818	10	8	-
MAHG	Manchester Sharston	Suburban Background	384202	386121	-	-	8.2

Source: Manchester City Council, 2017

Three NO_2 diffusion tubes are co-located at Manchester Sharston automatic monitoring site. The monitored concentrations are provided in Table 8, and as expected are equivalent to Table 5.

Table 8, Manchester City Council Air Quality Passive Monitoring, Annual Mean NO_2

ID	Location	Site Type	Coordinates		Annual Mean NO_2 (µg/m^3)			
			X	Y	2014	2015	2016	2017
MAN62, MAN63, MAN64	Manchester South	Suburban Background	383904	385818	24.3	20.6	-	-
MAN90, MAN91, MAN92	Manchester Sharston	Suburban Background	384202	386121	-	-	22.5	22.3

Source: Manchester City Council, 2018

Manchester City Council's monitoring provides air quality information for a broader area. However, it is too far away from the development Site, and hence is not suitable for model verification. In order to make the modelling

assessment robust, AECOM's monitoring performed recently for another development have used in the model verification, see Appendix D.

4.4 Baseline Dust

A background level of dust exists in all urban and rural locations in the UK. Dust can be generated on a local scale from vehicle movements and from the action of wind on exposed soils and surfaces. Dust levels can also be affected by long range transport of dust from distant sources into the local vicinity.

Residents currently experience dust deposition at a rate that is determined by the contributions of local and distant sources. This baseline rate of soiling is considered normal and varies dependent on prevailing climatic conditions. The tolerance of individuals to deposited dust is therefore shaped by their experience of baseline conditions.

Existing local sources of particulate matter includes windblown dust from agricultural land, exhaust emissions from energy plant and road vehicles, break and tyre wear from road vehicles and the long range transport of material from outside the study area.

5. Identification and Evaluation of Significant Effects

5.1 Construction Dust

Within 50m of the development Site, there are no sensitive receptors. Within 100m of the Site, Etrop Grange Hotel on Thorley Land and Kingsley Hall on Bailey Land are sensitive receptors.

5.1.1 Demolition

There are no buildings within the Site boundaries.

5.1.2 Earthworks

Site clearance works, the digging of trenches for foundations and utilities represent the principal activities that may generate emissions of particulate material. The potential for exposed materials to generate dust depends on the nature of the material. Earth is soft and friable compared to hardcore. However, hardcore generally has lower moisture content than soil, and consequently they can both be a potential source of dust.

The total site area is greater than 10,000 m^2, the criterion for a large site. The potential dust emission magnitude for earthworks is therefore assessed as **'Large'**.

There are two receptors of medium sensitivity to dust within 100 m of the Development, therefore sensitivity of the surrounding area to dust soiling is considered to be low. The annual mean PM_{10} concentration is below 24 $\mu g/m^3$ so the sensitivity of the surrounding area to human health impacts is low. The low sensitivity of area and the large magnitude of dust potential together give a low risk of dust soiling as the indicator to define site-specific mitigation. The low sensitivity of area to human health impacts and the large magnitude of dust potential together give a low risk of dust impacts on human health.

A number of mitigation measures can be implemented on the Development Site to either avoid or reduce potential effects to neighbouring receptors. The adoption of these mitigation measures would reduce the low risk of potential impacts on the receptors (property and amenity) to a negligible risk, resulting in a likely effect of being negligible (not significant).

5.1.3 Construction

Dust emissions during construction can give rise to elevated dust deposition and PM_{10} concentrations. These are generally short-lived changes over a few hours or days, which occur over a limited time period of several weeks or months. The total building volume is not fixed yet, but is expected to be more than 100,000 m^3. The buildings will be built in phased programme, therefore it is conservative to assume that the potential dust emission magnitude for construction is **'Large'**.

There are two receptors of medium sensitivity to dust within 100 m of the Development, therefore sensitivity of the surrounding area to dust soiling is considered to be low. The annual mean PM_{10} concentration is below 24 $\mu g/m^3$ so the sensitivity of the surrounding area to human health impacts is low. The low sensitivity of area and

the large magnitude of dust potential together give a low risk of dust soiling as the indicator to define site-specific mitigation. The low sensitivity of area to human health impacts and the large magnitude of dust potential together give a low risk of dust impacts on human health.

It has assumed that standard mitigation measures will be implemented on the Development Site to either avoid or reduce potential effects to neighbouring receptors, resulting in a likely effect of being negligible (not significant).

5.1.4 Track-out of Material

The maximum daily number of outward HGV is expected to be less than 50 outward HGV movements; hence the potential dust emission magnitude for material track-out is assessed as **'Medium'**.

There will be less than 10 high sensitivity receptors within 500 m of the construction traffic route so the sensitivity of the surrounding area to dust soiling is considered to be medium. The annual mean PM_{10} concentration is below 24 µg/m^3, so the sensitivity of the surrounding area to human health impacts is low. The medium sensitivity of area and the medium magnitude of dust potential together give a low risk of dust impacts as the indicator to define site-specific mitigation. The low sensitivity of area to human health impacts and the medium magnitude of dust potential together give a low risk of dust impacts.

It has assumed that standard mitigation measures will be implemented on the Site to either avoid or reduce potential effects to neighbouring receptors, resulting in a likely negligible effect (not significant).

5.1.5 Summary

The conclusions of the construction dust assessment are summarised in Table 9. Overall the effects of the construction phase activities are considered to be slightly adverse, which is not considered to represent a significant effect.

Table 9. Risk of Unmitigated Dust Impacts

Source	Dust Soiling	Human Health
Demolition	n/a	n/a
Earthworks	Low	Low
Construction	Low	Low
Track-out	Low	Low

5.2 Operational Phase

Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5}$ and the number of exceedances of the 24-hour PM_{10} objective, at the selected existing air quality sensitive receptors in the 2021 With Development scenario are listed in Table 10. The table also provides the predicted change in concentration, in comparison with the future (2021) baseline scenario.

Table 10, Predicted Operational Pollutant Statistics in 2021

Receptor ID	Total Concentration				Change in Concentration			
	Annual Mean Conc. (µg/m^3)			Days PM_{10} >50 µg/m^3	Annual Mean Conc. (µg/m^3)			Days PM_{10} >50 µg/m^3
	NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$	
R1	28.6	15.1	9.4	1	1.2 (3%)	0.2 (1%)	0.1 (1%)	0
R2	30.7	15.8	9.7	1	1.7 (4%)	0.4 (1%)	0.2 (1%)	0
R3	29.6	12.8	8.4	0	1.9 (5%)	0.4 (1%)	0.2 (1%)	0

R4	25.0	11.9	7.8	0	-0.2 (0%)	0.0 (0%)	0.0 (0%)	0
R5	27.4	13.4	8.5	0	-2.0 (-5%)	-0.3 (-1%)	-0.2 (-1%)	0
R6	24.2	13.1	8.4	0	1.9 (5%)	0.4 (1%)	0.2 (1%)	0
R7	25.8	14.5	9.1	0	1.4 (3%)	0.3 (1%)	0.2 (1%)	0
R8	27.7	14.9	9.3	1	1.4 (4%)	0.3 (1%)	0.2 (1%)	1
Air Quality Objective	40	40	25	35				

Table 10 demonstrates that annual mean concentrations of all the pollutants considered are below the relevant national air quality objectives in the operational scenario, as are the number of exceedances of the 24 hour mean air quality objective for PM_{10}.

At R2, NO_2 concentration is above 75% of its annual mean objective value. A change of 4% of AQAL results in a slight adverse effect according to Table 4. Except that, all other changes are no more than 5% of relevant air quality objective value for NO_2, PM_{10} and $PM_{2.5}$ respectively. According to EPUK and IAQM guidance (EPUK & IAQM, 2017), a change of this magnitude, in an area where annual mean concentrations are less than 75% of relevant air quality objective value, constitutes a negligible effect, which is not considered to be significant.

Due to the current uncertainty in the rate of improvement to future background pollutant concentrations, and in the rate of improvement to future vehicle emission factors, a sensitivity test has been undertaken assuming that the background concentration remains at 2017 values, and the vehicle emission factors are only improved to the projected values for 2019. Table 11 shows the statistics from this sensitivity test.

Table 11, Predicted Operational Pollutant Statistics in 2021, Using Emission Factors for 2019

Receptor ID	Total Concentration				Change in Concentration			
	Annual Mean Conc. ($\mu g/m^3$)			Days PM_{10} >50 $\mu g/m^3$	Annual Mean Conc. ($\mu g/m^3$)			Days PM_{10} >50 $\mu g/m^3$
	NO_2	PM_{10}	$PM_{2.5}$		NO_2	PM_{10}	$PM_{2.5}$	
R1	34.4	15.6	9.9	1	1.4 (3%)	0.2 (1%)	0.1 (1%)	0
R2	36.7	16.3	10.2	1	1.9 (5%)	0.4 (1%)	0.2 (1%)	0
R3	34.5	13.5	9.0	0	2.2 (5%)	0.4 (1%)	0.2 (1%)	0
R4	29.0	12.5	8.4	0	-0.2 (0%)	0.0 (0%)	0.0 (0%)	0
R5	32.6	13.8	9.0	0	-2.4 (-6%)	-0.3 (-1%)	-0.2 (-1%)	0
R6	29.0	13.5	8.8	0	2.2 (5%)	0.4 (1%)	0.2 (1%)	0
R7	31.0	15.0	9.5	1	1.6 (4%)	0.3 (1%)	0.2 (1%)	0
R8	33.3	15.4	9.7	1	1.6 (4%)	0.3 (1%)	0.2 (1%)	1
Air Quality Objective	40	40	25	35				

Similar to Table 10, Table 11 demonstrates that annual mean concentrations of all the pollutants considered are below the relevant national air quality objectives in the operational scenario, as are the number of exceedances of the 24 hour mean air quality objective for PM_{10}.

As the background for 2017 and vehicle emission factors for 2019 have been used in this sensitivity test, NO_2 concentrations would not decrease to below 75% of its annual mean objective value. Higher NO_2 concentrations would make the local area more sensitive to the emission changes. Consequently, the small changes at receptors R1, R2, R3, R7 and R8 would have slight adverse effects. At receptor R5, the magnitude of change would become medium, and hence have a moderate beneficial effect.

However, the changes in PM_{10} and $PM_{2.5}$ concentrations would still be no more than 1% of relevant air quality objective value for PM_{10} and $PM_{2.5}$ respectively. According to EPUK and IAQM guidance (EPUK & IAQM, 2017), a change of this magnitude, in an area where annual mean concentrations are less than 75% of relevant air quality objective value, constitutes a negligible effect, which is not considered to be significant.

Overall, the modelling results show that in the year of operation all receptors will be subject to air pollutant concentrations which are below the air quality objective values for NO_2, PM_{10} and $PM_{2.5}$. No receptor is predicted in the main test to experience deterioration in air quality that cannot be described as negligible. Therefore, it can be concluded that the proposed development would not impact on local air quality with a significant effect.

6. Mitigation Measures

6.1 Construction Phase

6.1.1 Dust Control Mitigation

Determining site-specific mitigation measures corresponds to Step 3 of the construction dust impact assessment methodology.

A number of mitigation measures can be adopted to reduce the production and/or dispersal of dust to lessen the nuisance and limit the human health impacts. Ideally dust should be controlled at the source as once airborne it is difficult to suppress.

Appropriate mitigation measures are provided in the IAQM 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).

According to the IAQM Guidance (IAQM, 2014), the dust risk for each of the activities determined in Step 2C should be used to define the appropriate site specific mitigation measures to be adopted. Where a negligible risk of dust effects was determined, no mitigation measures, beyond those required by legislation are required. However, mitigation measures may be applied as part as good practice.

Appropriate mitigation measures, taking into consideration the risk of dust impacts determined in Step 2C, are provided in Table 12. Mitigation should be implemented through the existing Construction Environmental Management Plan (CEMP) for the car park construction works and the measures should be enforced and adhered to. Contractors should also carry the 'Considerate Contractors' registration.

Table 12, Measures to Mitigate Potential Dust Impacts

Activity	Possible Dust Control Methods
Communication	• Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary; • Display the head or regional office contact information; and • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority.
Site Management	• Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken; • Make the complaints log available to the local authority when asked; and • Record any exceptional incidents that cause dust and/or air emissions, either on or off Site and the action taken to resolve the situation in the log book.
Monitoring	• Undertake daily on-site and off-site inspections, where receptors

	(including roads) are nearby, to monitor dust, record inspection results and make the 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; and • Carry out regular 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.
Preparing and maintaining the site	• Plan site layout so that machinery and dust causing activities are located away from receptors as far as possible; • Erect solid screens or barriers around dusty activities 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; • Remove materials that have a potential to produce dust from Site as soon as possible unless being re-used on Site; • Cover, seed or fence stockpiles to prevent wind whipping; • Avoid Site run-off of water or mud; and • Keep Site fencing, barriers and scaffolding clean using wet methods.
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; and • Impose and signpost a maximum speed limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work area.
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays; • Ensure an adequate water supply on the Site for effective dust/particulate matter suppression/mitigation; • Use enclosed chutes and conveyors and covered skips; • Minimise drop heights; and • Ensure equipment is readily available on site to clean 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.
Construction	• Avoid scabbling, if possible; and • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out.
Track out	• Use water assisted dust sweeper(s) on the access and local roads, to remove, as necessary any material tracked out of the Site; • Avoid dry sweeping of large areas; • Ensure vehicles entering and leaving the Site are covered to prevent escape of materials during transport; • Record all inspection of haul routes and any subsequent action in a site log book; and • Implement a wheel washing system.

6.2 Operational Phase

No mitigation measures are considered necessary, because no receptor is predicted to experience a significant deterioration in air quality, and all existing receptors (such as nearby residential properties) will not be exposed to pollutant concentrations above national objectives and European limits.

7. Cumulative Effects

7.1 Construction Phase

According to the IAQM Guidance (IAQM, 2014), a receptor is considered to be sensitive to the adverse effects of airborne dust and dust soiling from a construction site if it is located within 350 m of the boundary of the Proposed Development Site or within 50 m of the route(s) used by construction vehicles on the public highway.

Nearby approved developments include a pedestrian and cyclist bridge (LPA Ref: 115826/FO/2017), the extension of Terminal 2 building (LPA Ref: 110720/FO/2015/S2), a hotel development (LPA Ref: 118409/FO/2017) and an office with carparks (LPA Ref: 110827/MO/2015/S).

If a dust incident does take place, the impact will be the worst near the source, diminishing eventually with the distance. So the distance between developments is an important factor when considering the cumulative effects of construction dust. It is assumed that construction works associated with committed developments within 350 m of the Site and 50m of the construction routes will also be undertaken in accordance with best practice guidance and adopt best practice mitigation measures as outlined, as is standard practice on all well managed construction sites across the UK. This will ensure the cumulative dust effects at these receptors remain at acceptable levels. Overall the cumulative effects of the construction phase activities are considered to be slightly adverse, which is not considered to represent a significant effect.

7.2 Operational Phase

From the existing traffic flows to the future baseline traffic flows, the traffic growth has included those from nearby developments, hence the cumulative effects are considered within the baseline traffic data.

The assessment has used traffic data provided on 17 August 2018. Ever since, the Transport Statement has considered changes at other parts of the Airport City North, particularly it has included the traffic generation due to a potential future office development on the spare land within the boundary of the E Plots development, but not a part of the current E Plots application. Limited by the time available, the dispersion modelling has not been rerun to include this small additional traffic, which would have contributed to the cumulative effects. However, the additional traffic is really small comparing with the overall traffic generation, so the judgement is that the findings of this air quality assessment would be unchanged even if the dispersion model has been rerun with the small additional traffic.

As no exceedance of national air quality objectives and European limits is predicted, no further actions are required.

8. Residual Effects

8.1 Construction Phase

Determining the residual effects corresponds to Step 4 of the construction dust assessment methodology.

The effects associated with the construction phase of the Development have been qualitatively assessed with reference to the IAQM published draft 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).

The IAQM guidance states that:

> *'in the case of demolition / construction it is assumed that mitigation (secured by planning conditions, legal requirements or required by regulations) will ensure that a potential significant adverse effect will not occur, so the residual effect will normally be 'not significant''.*

Therefore, overall it is considered that the residual effects during the construction phase are of **Negligible** significance.

8.2 Operational Phase

Development in operation was assessed for a future year (2021). A sensitivity test was also undertaken considering a more pessimistic improvement in vehicle emissions by 2021. The Proposed Development would

cause a small increase in the number of vehicles travelling along the local roads. The levels of traffic increase would not have significant impacts on local air quality.

The modelling results show that in the year of operation all receptors will be subject to air pollutant concentrations which are below the air quality objective values for NO_2, PM_{10} and $PM_{2.5}$. No receptor is predicted in the main test to experience deterioration in air quality that cannot be described as **negligible**. Therefore, it can be concluded that the proposed development would not impact on local air quality with a significant effect.

9. Summary and Conclusions

The potential impacts of the Proposed Development on local air quality have been assessed during the construction phase and once built. During construction the concern is associated with dust generation and deposition on nearby property. Once operational the primary concern is to ensure that any additional traffic does not cause a significant deterioration in air quality with resultant health concerns.

The construction phase assessment was performed qualitatively in accordance with appropriate guidance. Taking into consideration the risk of potential impacts, appropriate mitigation measures were recommended, such as those mitigation measures listed in Table 12, to reduce any potential impacts to non-significant levels.

The impact of traffic emissions once built was assessed quantitatively in accordance with appropriate guidance. Dispersion modelling was undertaken to determine the impacts at nearby sensitive receptors, such as residential properties and a school.

Although Greater Manchester Air Quality Management Area covers major roads close to the Proposed Development, monitoring data and the assessment modelling have found that the key air quality pollutants are below their respective air quality objective values at nearby sensitive receptors.

Activities during the construction phase have the potential to generate dust as a result of demolition, earthworks, construction and track-out of material onto local roads. Dust generation from these activities would be controlled using on site management (through the use of a Construction Environmental Management Plan) to the extent that significant impacts would not occur.

Once built the Proposed Development would cause an increase in the number of vehicles travelling along most local roads, but also a decrease on some road sections. The modelling results show that in the first year of operation all existing receptors (such as nearby residential properties) will not be exposed to pollutant concentrations above national and European objectives. No receptor is predicted to experience a significant deterioration in air quality, and hence no specific measures are considered necessary to reduce the potential impacts further.

10. References

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Appendix A Air Quality Study Area

Figure 1, Air Quality Study Area

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

LEGEND

- AQMA Boundary
- E Plots Boundaries
- Monitoring Locations
- Receptor Locations

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Purpose of Issue: FINAL

Client: AIRPORT CITY LP

Project Title: AIRPORT CITY NORTH PLOTS E1, E2 AND E3

Drawing Title: AIR QUALITY SURVEY AREA

Drawn	Checked	Approved	Date
CR	TS	TS	30/08/2018

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Appendix B Construction Dust Assessment Methodology

The effects associated with the construction phase of the proposed development have been qualitatively assessed with reference to the IAQM published 'Guidance on the Assessment of Dust from Demolition and Construction' (IAQM, 2014).

According to the IAQM, the main air quality effects that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes, which are evidence of dust emissions;
- Elevated PM_{10} concentrations, as a result of dust generating activities on site; and
- An increase in concentration of airborne particles and NO2 due to exhaust emissions from diesel powered vehicles and equipment on site and vehicles accessing the site.

According to the EPUK Guidance (2017) a quantitative air quality assessment should be undertaken for, 'large, long term construction sites that would generate large Heavy Goods Vehicle (HGV) flows (> 200 movements per day) over a period of a year or more'. If this criterion is not exceeded then the potential effects should be considered insignificant. Taking into consideration the scale of the proposed site, it is very unlikely that the number of construction phase HGV movements will exceed the criterion. Therefore, a quantitative assessment is not required and the potential effects from vehicle emissions are considered to be insignificant.

Activities on construction sites are classified into four types to reflect their different potential effects:

- Demolition;
- Earthworks;
- Construction; and
- Track out (the transportation of dust and dirt from the construction site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network).

The following steps, as defined by the IAQM, were followed:

- STEP 1 Screen the requirement for a detailed assessment. Human and ecological receptors were identified and distance to the site and construction routes were determined;
- STEP 2 Assess the risk of dust impacts. The potential risk of dust impacts occurring for each activity was determined, based on the magnitude of the potential dust emissions and the sensitivity of the area;
- STEP 3 Identify the need for site-specific mitigation. Based on the risk of impacts occurring, site specific mitigation measures were determined; and
- STEP 4 Define impacts and their significance. The significance of the potential residual dust impacts (taking mitigation into account) for each activity was determined.

B.1 STEP 1: Screen the Requirement for a Detailed Assessment

Sensitive receptors were identified and the distance to the site and construction routes were determined according to the examples of sensitivity shown in Table 13. According to the IAQM, an assessment will normally be required where there are sensitive receptors within 350 metres (m) of the boundary of a site and/or within 50 m of route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance. A human receptor, as considered within the IAQM guidance, is any location where a person or property may experience:

- The annoyance effects of airborne dust or dust soiling e.g. dwellings, industrial or commercial premises such as a vehicle showroom, food manufacturers, electronics manufacturers, amenity areas and horticultural operations; or
- Exposure to PM_{10} over a period relevant to the air quality objectives.

Ecological receptors within 50 m of the boundary of the site or routes used by construction vehicles on the public highway, up to 500 m from the site entrance, also need to be identified.

Table 13, Examples of Dust Sensitive Receptors

Receptor Sensitivity	Dust Soiling	Human Health	Ecological
High	- Dwellings, - Museum and other culturally important collections, - Medium and long term car parks - Car showrooms.	- Residential properties. - Hospitals, - Schools - Residential care homes	- Locations with an international or national designation (e.g. SAC) and the designated features may be affected by dust soiling
Medium	- Parks - Places of work.	- Office and shop workers, but will generally not include workers occupationally exposed to PM_{10}, as protection is covered by Health and Safety at Work legislation.	- Locations with a national designation (e.g. SSSI) where the features may be affected by dust deposition
Low	- Playing fields - Farmland (unless commercially-sensitive horticultural), - Footpaths, - Short term car parks - Roads	- Public footpaths, - Playing fields, - Parks - Shopping streets.	- Locations with a local designation where the features may be affected by dust deposition local Nature Reserve with dust sensitive features.

SAC: Special Area of Conservation; SSSI: Site of Special Scientific Interest

B.2 STEP 2: Assess the Risk of Dust Impacts

The risk of dust arising in sufficient quantities to cause annoyance and/or health effects was determined for each activity (demolition, earthworks, construction works and track out), taking account of:

- The scale and nature of the works, which determines the potential dust emission magnitude (small, medium or large) (Step 2A); and
- The sensitivity of the area (low, medium or high) (Step 2B).

These factors were then combined to give the risk of dust effects with no mitigation applied, as Negligible, Low, Medium or High.

It should be noted that where detailed information was not available to inform the risk category, professional judgement and experience was used and a cautious approach adopted, in accordance with the guidance.

i) Step 2A – Define the Potential Dust Emission Magnitude

(1) Demolition

The classifications in Table 14 are based on examples of suitable criteria, although factors such as seasonality, building type, duration and scale were also taken into consideration, where possible.

Table 14, Potential Demolition Dust Emission Classification

Receptor Sensitivity	Dust Soiling
Large	- Total Building Area: > 50,000 m^3 - Potentially dusty construction material (e.g. concrete) - On-site crushing and screening - Demolition activities: > 20 m above ground level
Medium	- Total Building Area: 20,000 - 50,000 m^3 - Potentially dusty construction material - Demolition activities: 10 - 20 m above ground level

Small	- Total Building Area: < 20,000 m^3 - construction material with low potential for dust release - Demolition activities: < 10 m above ground level, - Demolition occurring in wetter months

(2) Earthworks

Earthworks will primarily involve excavating material, haulage, tipping and stockpiling. The classifications in Table 15 are based on examples of suitable criteria. Factors such as existing land use, topography, seasonality, duration and scale were also taken into consideration, where possible.

Table 15, Potential Earthworks Dust Emission Classification

Receptor Sensitivity	Dust Soiling
Large	- Total site area: >10,000 m^2 - Potentially dusty soil type (e.g. clay) - >10 heavy earth moving vehicle active at any one time - Formation of bunds >8 m in height - Total material moved >100,000 tonnes
Medium	- Total site area: 2,500 - 10,000 m^2 - Moderately dusty soil type (e.g. silt) - 5 -10 heavy earth moving vehicle active at any one time - Formation of bunds 4 - 8 m in height - Total material moved 20,000 – 100,000 tonnes
Small	- Total site area: <2,500 m^2 - Soil type with large grain size (e.g. sand) - < 5 heavy earth moving vehicle active at any one time - Formation of bunds < 4 m in height - Total material moved <20,000 tonnes - Earthworks during wetter months

(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 classifications in Table 16 are based on examples of suitable criteria. Factors such as seasonality, building type, duration and scale were also taken into consideration, where possible.

Table 16, Potential Construction Dust Emission Classification

Receptor Sensitivity	Dust Soiling
Large	- Total building volume >100,000m^3 - Piling, on site concrete batching, sandblasting
Medium	- Total building volume 25,000 – 100,000m^3 - Potentially dusty construction material (e.g. concrete) - On-site concrete batching
Small	- Total building volume <25,000m^3 - Construction material with low potential for dust release (e.g. metal cladding or timber)

(4) Track-out

Track-out is the transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the local road network. The classifications in Table 17 are based on examples of suitable criteria. Factors such as vehicle size, speed, numbers, geology and duration were also taken into consideration, where possible.

Table 17, Potential Track-out Dust Emission Classification

Receptor Sensitivity	Dust Soiling
Large	- 50 HGV (>3.5t) outward movements in any one day - Potentially dusty surface material - Unpaved road length > 100 m
Medium	- 10 – 50 HGV (>3.5t) outward movements in any one day - Moderately dusty surface material - Unpaved road length 50 – 100 m
Small	- < 10 HGV (>3.5t) outward movements in any one day - Surface material with low potential for dust release - Unpaved road length < 50m

ii) Step 2B – Define the Sensitivity of the Area

The sensitivity of the area takes account of the following factors:

- The specific sensitivities of receptors in the area;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentrations; and
- Site specific factors, such as whether there are natural shelters, such as trees to reduce the risk of wind-blown dust.

The sensitivity of the area is determined separately for dust soiling impacts on people and properties (Table 18), human health impacts (Table 19).

Table 18, Sensitivity of the Area to Dust Soiling Impacts on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		< 20	< 50	< 100	< 350
High	>100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 -10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 19, Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from the Source (m)				
			< 20	< 50	< 100	< 200	< 350
High	>32 µg/m^3	>100	High	High	High	Medium	Low
		10 – 100	High	High	Medium	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	28 - 32 µg/m^3	>100	High	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low	Low
		1 - 10	High	Medium	Low	Low	Low
	24 - 28 µg/m^3	>100	High	Medium	Low	Low	Low

		10 – 100	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low	Low
		10 – 100	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28 - 32 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24 - 28 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	≥1	Low	Low	Low	Low	Low

iii) Step 2C - Define the Risk of Impacts

The dust emission magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of effects with no mitigation applied (Table 20 to Table 23). This Step is undertaken for each activity undertaken on site.

Table 20, Risk of Dust Impacts - Demolition

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table 21, Risk of Dust Impacts - Earthworks

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 22, Risk of Dust Impacts - Construction

Sensitivity of Area	Dust Emission Classification		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 23, Risk of Dust Impacts - Track-out

Sensitivity of Area	Dust Emission Classification

	Large	Medium	Small
High	High	Medium	Medium
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

B.3 STEP 3: Identify the need for Site-Specific Mitigation

Based on the risk of effects determined in Step 2C for each activity, appropriate site-specific mitigation measures were recommended. Appropriate mitigation measures are set out in the IAQM Guidance (2014) and summarised in Table 12.

B.4 STEP 4: Define impacts and their significance

Finally, the significance of the potential residual dust impacts, i.e. after mitigation, was determined. According to the IAQM Guidance (2014) the residual impacts assumes that all mitigation measures (recommended in Step 3) to avoid or reduce impacts are adhered to, and therefore the residual impacts should be considered to be ‘not significant’.

Appendix C Traffic Data and Determination of Assessment Stage

C.1 Traffic Data

Traffic data were derived by AECOM (project transportation consultant) in the form of 24-hour annual average daily traffic (AADT) flows for affected road links near the proposed development.

The traffic data provided for the assessment on 17 August 2018 are shown in Table 24.

Table 24, Traffic Data

Road Link	AADT	% HDV	Speed (kph)
2017 Existing Scenario			
1: M56Spur – EB*	60229	0.0%	62
2: M56Spur – WB*	50169	0.0%	65
3: Enterprise Way - NB	6275	5.4%	37
4: Enterpris Way - SB	4816	4.7%	31
5: Thorley Ln - EB	6134	3.6%	30
6: Thorley Ln - WB	5400	3.2%	37
7: Bailey NB	n/a	n/a	n/a
8: Bailey SB	n/a	n/a	n/a
9: Enterprise - EB	3645	3.5%	33
10: Enterprise - WB	2091	1.5%	35
11: Aviator - EB	1998	0.2%	16
12: Aviator - WB	968	0.0%	41
13: Enterprise Way - NB	2970	1.3%	38
14: Enterprise Way - SB	3630	3.2%	24
15: Ringway Rd W - EB	9667	2.6%	39
16: Ringway Rd W - WB	8310	1.9%	28
17: Ringway W EB	11550	1.9%	25
18: Ringway W WB	10621	2.0%	27
19: Outwood NB	10305	0.5%	39
20: Outwood SB	10730	1.1%	36
21: World NB	8222	1.8%	31
22: World SB	7001	0.4%	46
23: JP2_E - NB	0	n/a	n/a
24: JP2_E - SB	0	n/a	n/a
25: HUT - In	0	n/a	n/a
26: HUT - Out	0	n/a	n/a
27: Plot X - In	0	n/a	n/a

28: Plot X - Out	0	n/a	n/a
2021 Without Development			
1: M56Spur - EB	33542	3.7%	96
2: M56Spur - WB	31131	2.1%	85
3: Enterprise Way - NB	5183	4.2%	37
4: Enterpris Way - SB	5744	3.9%	31
5: Thorley Ln - EB	5944	6.4%	30
6: Thorley Ln - WB	2551	6.4%	37
7: Bailey NB	2776	10.1%	29
8: Bailey SB	2397	2.8%	35
9: Enterprise - EB	7452	2.0%	33
10: Enterprise - WB	5026	2.6%	35
11: Aviator - EB	1989	0.0%	16
12: Aviator - WB	967	0.0%	41
13: Enterprise Way - NB	5581	2.4%	38
14: Enterprise Way - SB	7095	2.0%	24
15: Ringway Rd W - EB	21632	5.4%	39
16: Ringway Rd W - WB	24179	2.8%	28
17: Ringway W EB	17654	6.1%	25
18: Ringway W WB	21590	2.7%	27
19: Outwood NB	11525	0.5%	39
20: Outwood SB	15256	1.1%	36
21: World NB	7071	1.8%	31
22: World SB	10125	0.4%	46
23: JP2_E - NB	161	15.4%	17
24: JP2_E - SB	176	8.0%	44
25: HUT - In	0	n/a	n/a
26: HUT - Out	0	n/a	n/a
27: Plot X - In	0	n/a	n/a
28: Plot X - Out	0	n/a	n/a
2021 With Development			
1: M56Spur - EB	41893	3.2%	96
2: M56Spur - WB	34581	1.9%	83
3: Enterprise Way - NB	9870	2.2%	35
4: Enterpris Way - SB	7442	2.4%	28
5: Thorley Ln - EB	6659	6.0%	27
6: Thorley Ln - WB	2984	5.8%	38
7: Bailey NB	2895	9.2%	29

8: Bailey SB	2700	2.4%	34
9: Enterprise - EB	10804	1.4%	30
10: Enterprise - WB	9222	1.4%	30
11: Aviator - EB	1935	0.0%	16
12: Aviator - WB	967	0.0%	37
13: Enterprise Way - NB	9328	1.6%	37
14: Enterprise Way - SB	8468	1.8%	21
15: Ringway Rd W - EB	22254	5.2%	39
16: Ringway Rd W - WB	19442	2.8%	42
17: Ringway W EB	20144	5.5%	22
18: Ringway W WB	22165	2.6%	27
19: Outwood NB	11528	0.5%	38
20: Outwood SB	15157	1.1%	36
21: World NB	7097	2.4%	31
22: World SB	10089	0.9%	45
23: JP2_E - NB	2528	1.8%	13
24: JP2_E - SB	4388	1.4%	40
25: HUT - In	3676	0.0%	37
26: HUT - Out	1591	0.0%	13
27: Plot X - In	2656	0.0%	21
28: Plot X - Out	1156	0.0%	14

C.2 EPUK & IAQM Development Guidance

According to the EPUK & IAQM Guidance document (EPUK & IAQM, 2017), ‘an operational phase air quality assessment is required where there is a risk of a significant air quality effect, either from a new development causing an air quality impact or creating exposure to high concentrations of pollutants for new residents’.

The EPUK & IAQM (2017) Guidance sets out a two-stage approach to determine the need for an operational phase air quality assessment. Stage 1 requires any of the criteria under ‘A’ coupled with any of the criteria under ‘B’ to apply (Table 25) before proceeding to Stage 2. If none of the criteria are met then there is no requirement to carry out an air quality assessment and the impacts can be considered to be insignificant.

Table 25, Stage 1 Criteria

Criteria to proceed to Stage 2
A) If any of the following apply:
- 10 or more residential units or a site area of more than 0.5 ha; and - More than 1,000 m^2 of floor space for all other uses or a site area greater than 1 ha.
B) Coupled with any of the following:
- The development has more than 10 parking spaces; and - The development will have a centralised energy facility or other centralised combustion process.

The proposed development exceeds both Criteria A and B, and so has been progressed to Stage 2.

Following the identification of whether an air quality assessment is required or not (Stage 1), Stage 2 is referred to, as set out in Table 26, to determine the detail of the assessment required.

Table 26, Stage 2 Criteria

The Development will:	Indicative Criteria to proceed to an Air Quality Assessment
Cause a significant change in Light Duty Vehicle traffic flows on local roads with relevant receptors.	A change of Light Duty Vehicles flows of: - More than 100 AADT[1] within or adjacent to an AQMA; or - More than 500 AADT elsewhere
Cause a significant change in heavy Duty Vehicles traffic flows on local roads with relevant receptors.	A change of Heavy Duty Vehicles flows of: - More than 25 AADT within or adjacent to an AQMA; or - More than 100 AADT elsewhere

[1] *AADT = Annual Average Daily Traffic flow*

Thorley Lane, Bailey Lane, Enterprise Way, Ringway Road West and Ringway Road near the development Site are partially covered by the AQMA. The Development will lead to an increase of over 100 AADT of Light Duty Vehicles (LDV) on several public roads in its vicinity, when in full operation. As such, a detailed assessment of local air quality impacts as a result of the increase in road traffic emissions has been undertaken. Further details regarding the traffic impact of the Development are provided in Paragraphs 5.94 – 5.101.

Appendix D Model Verification

To account for model bias, DEFRA guidance suggests model verification should be undertaken, whereby modelled predictions are made at set locations where there is measurement data available. The variation between modelled predictions and monitored concentrations at these locations is then analysed and the resultant factor(s) applied to modelled output at other locations, to account for model bias.

The measurement data used to inform the model verification exercise has been sourced from a project specific NO_2 diffusion tube survey, organised and maintained by AECOM. The survey was undertaken for another development. However, duo to the proximity of the monitoring sites, three tubes are suitable for the model verification in this assessment. The three-month AECOM survey data was undertaken between 01/12/17 – 05/03/18. The period mean data was then annualised to represent an annual mean for 2017 following the method described in DEFRA guidance, by comparing monitoring data from the nearest Council continuous monitoring sites (Glazebury, Manchester Piccadilly and Salford Eccles) for the same period with the annual mean for 2017. The AECOM survey data is summarised in Table 27. The location of the diffusion tubes is provided in Appendix A, Figure 1.

Table 27, AECOM NO_2 Diffusion Tube Survey Results

Monitoring Site	OS Grid Reference		Period Mean NO_2 Conc. ($\mu g/m^3$)[1]	2017 Annualised Mean NO_2 Conc. ($\mu g/m^3$)[2]
T1	381197	386065	44.2	35.8
T2	381551	386037	41.3	33.4
T3	382206	385830	47.3	38.2
T4	382938	385303	40.1	32.4

[1] *Average concentration measured between 01/12/17 – 05/03/18 (i.e. the Period)*

[2] *Period mean multiplied by the factor (0.81) obtained from the comparison of period mean and annual mean concentrations for 2017 at the nearest Council continuous monitoring stations*

The model over-estimated concentrations when compared to the monitoring data (Table 28) and so the modelled results for NO_X and PM_{10} were adjusted in accordance with the procedure detailed in technical guidance LAQM.TG(16).

Table 28, Comparison of Modelled and Monitored NO_2 Concentrations, 2017

Monitoring Site	Monitor Type	Background NO_2 ($\mu g/m^3$)	Monitored Total NO_2 ($\mu g/m^3$)	Modelled Total NO_2 ($\mu g/m^3$)	NO_2 % Difference [(modelled-monitored)/monitored]
T1	Diffusion Tube	22.2	35.8	36.2	1.2%
T2	Diffusion Tube	22.2	33.4	39.5	18.2%
T3	Diffusion Tube	25.6	38.2	34.0	-11.0%
T4	Diffusion Tube	25.6	32.4	32.0	-1.4%

An adjustment factor was calculated as follows:

$NO_{X\ [monitored,\ traffic\ contribution]} = NO_{X\ [monitored]} - NO_{X\ [background]}$

$NO_{2\ [modelled,\ traffic\ contribution]} = NO_{2\ [modelled]} - NO_{2\ [background]}$

Adjustment Factor = $NO_{X\ [monitored,\ traffic\ contribution]} / NO_{X\ [modelled,\ traffic\ contribution]}$

As more than one monitored locations were modelled, an adjustment factor of 0.87 was derived for the monitored locations using regression.

The statistical data show that, even without an adjustment, the accuracy of the model is with a resultant RMSE of ±3.7 µg/m^3, already within 10% of the air quality objective. As a result, no adjustment has been applied to modelled road-NO_x. This is a conservative choice because the adjustment using a factor smaller than 1 would lower the pollutant concentrations.

In the absence of suitable PM_{10} and $PM_{2.5}$ data for verification, the modelled road-PM_{10} and $PM_{2.5}$ have been treated the same as for the road-NO_X. This is in accordance with LAQM.TG(16).

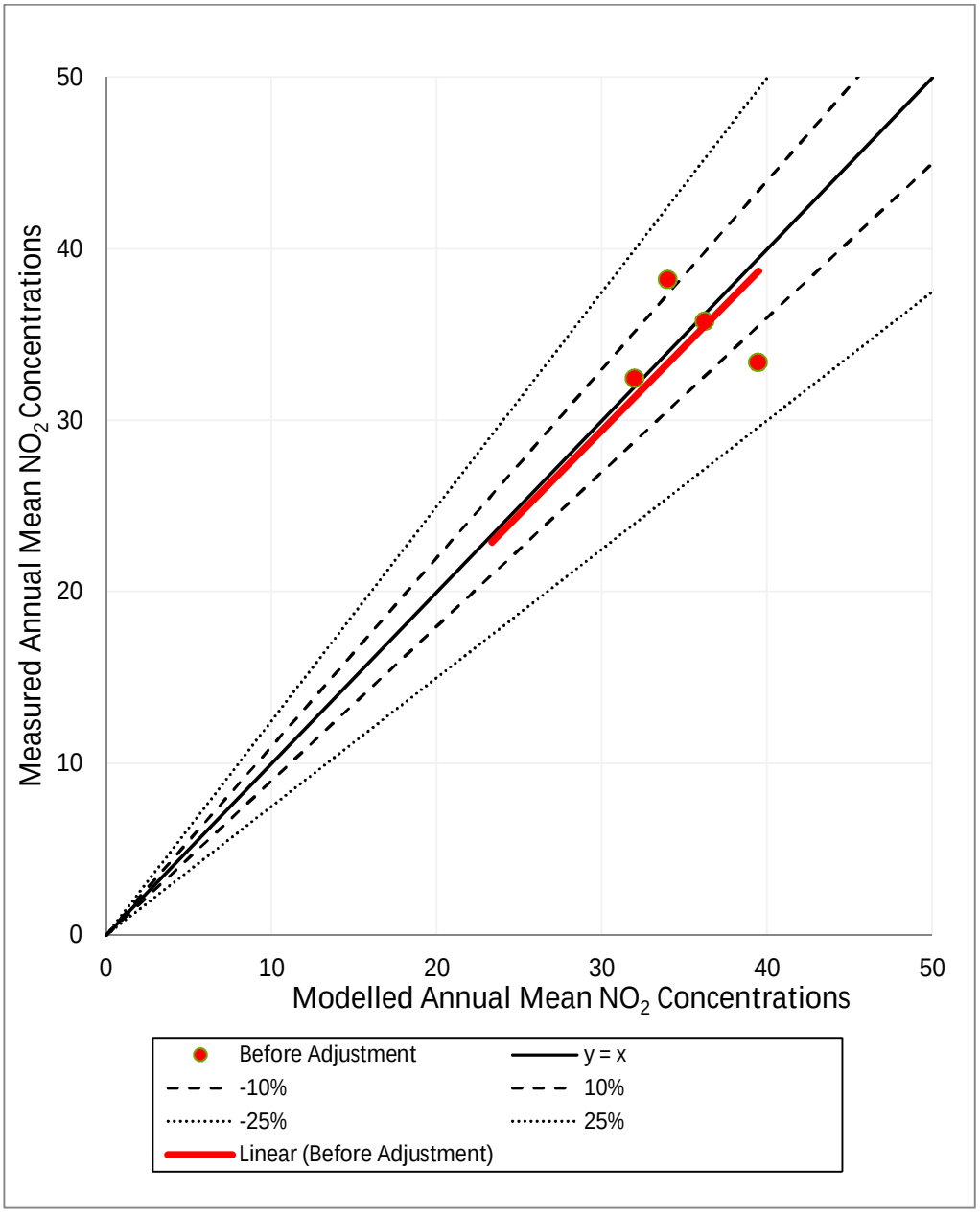


Figure 2, Modelled vs. Monitored NO_2 Concentrations