

Appendix 2.4

AIR QUALITY ASSESSMENT



NOTE

Jackson's Row Developments Ltd (hereinafter referred to as 'the Applicant') is seeking to construct a major development proposal known as St Michael's, Jackson's Row, Manchester, UK

The planning application for the development was originally registered in January 2017. Following feedback, the decision was taken to revise the scheme. Revised plans and documents were submitted in November 2017 and the development was granted planning permission in June 2018.

Through the detailed design process, a number of relatively minor improvements to the original scheme have been identified; these will also provide technical and functional improvements through the next stage design process. The Applicant wishes to progress these proposed changes, which are considered to require amendments to the original scheme, through a Section 73 application.

An Environmental Statement, produced in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011, was submitted in support of the Approved Development in 2017. The 2017 Environmental Statement comprised three volumes, as follows:

Volume 1: Main Text and Figures;
Volume 2: Technical Appendices;
Volume 3: Non-Technical Summary

With reference to Volumes 1 and 2 of the 2017 Environmental Statement, it has been decided that rather than updating and re-submitting the entire Volumes in support the Section 73 application, an 'Addendum' to the 2017 Environmental Statement should be submitted. This is because the Proposed Amendments to the scheme are minor in nature and the potential to affect the environmental assessment is limited.

This Environmental Statement Volume 2 (2017) appendix formed part of the application package for the June 2018 approved scheme and remains valid.



Jackson's Row Developments Ltd

**ST MICHAEL'S, JACKSON'S ROW,
MANCHESTER**

Air Quality Assessment



Jackson's Row Developments Ltd

ST MICHAEL'S, JACKSON'S ROW, MANCHESTER

Air Quality Assessment

TYPE OF DOCUMENT (VERSION) PUBLIC

PROJECT NO. 70010278-411

OUR REF. NO. 70010278-411

DATE: NOVEMBER 2017

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft	PM review	First Issue	Second Issue
Date	06/10/2017	23/10/2017	08/11/2017	30/11/2017
Prepared by	John Harrington	Sally Newbold	John Harrington	John Harrington
Signature				
Checked by	Gabor Antony		Gabor Antony	Gabor Antony
Signature				
Authorised by	Gabor Antony		Gabor Antony	Gabor Antony
Signature				
Project number	70010278-411	70010278-411	70010278-411	70010278-411
Report number	001	002	003	004
File reference	\\uk.wspgroup.com\central data\Projects\70010xxx\70010278 - Jackson's Row\06 Technical\Air Quality\05 Report			

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EXECUTIVE SUMMARY

WSP has been commissioned by Jackson's Row Development Ltd to carry out an assessment of the potential air quality impacts arising from the Proposed Scheme at Jackson's Row, Manchester. It is proposed to develop the Application Site to construct two buildings, including one tower. The proposals include provision for two hotels, leisure use, office space, residential use and a synagogue along with public realm space and associated infrastructure.

This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational phases of the Proposed Scheme. For both phases, the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed.

The assessment of construction phase impacts associated with fugitive dust and fine particulate matter (PM₁₀ and PM_{2.5}) emissions has been undertaken in line with the relevant Institute of Air Quality Management (IAQM) guidance. This identified that there is a Medium Risk of dust soiling impacts and a Low Risk of increases in particulate matter concentrations due to construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and particulate matter releases would be significantly reduced. The residual effects of the construction phase on air quality are considered to be negligible.

The assessment of the potential air quality impacts associated with traffic generated by the operational phase of the Proposed Scheme has been completed in line with published methodologies and technical guidance. The pollutants considered in this part of the assessment were nitrogen dioxide (NO₂), PM₁₀ and PM_{2.5}.

An assessment of the potential for future residents of the Proposed Scheme to be exposed to poor air quality, given the site's location in an Air Quality Management Area, has also been undertaken.

The results show that the Proposed Scheme would cause a negligible increase in concentrations of NO₂, PM₁₀ and PM_{2.5}. According to the assessment significance criteria, the residual effects of the Proposed Scheme are therefore negligible. Concentrations of all pollutants were below the relevant UK Air Quality Strategy (AQS) objectives at the Application Site, and therefore future residents will not be exposed to poor air quality.

Based on the assessment results, it is considered that the Proposed Scheme complies with national, regional and local policy for air quality, and air quality is considered to be a low priority within the planning process.

1 INTRODUCTION

- 1.1.1. WSP has been commissioned by Jackson's Row Developments Ltd to carry out an assessment of the potential air quality impacts arising from the Proposed Scheme at Jackson's Row, Manchester, hereafter referred to as the 'Proposed Scheme or 'Application Site'.
- 1.1.2. The Application Site lies within the administrative boundary of Manchester City Council (MCC) and is situated to the north of the A34 and the east of the A56. It is bordered to the north by Jackson's Row, to the east by Southmill Street and to the south by Bootle Street and covers the region of 0.56 Hectares (ha) of land. It is proposed to develop the Application Site to construct two buildings, including one tower. The proposals include provision for two hotels, leisure use, office space, residential use and a synagogue along with public realm space and associated infrastructure.
- 1.1.3. An energy centre is included in the proposals; however a final design for the plant was not available to assess the impact of any boilers or CHP units. There is also the potential for the Proposed Scheme to join an existing Manchester heat network. Like other combustion technologies, these elements would impact on air quality, though this would vary depending on the technology and fuel used, the size and design of the plant and other factors. This will be assessed at a later post planning design stage.
- 1.1.4. The report presents the findings of an assessment of the potential air quality impacts of the Proposed Scheme during both the construction and operational phases. For both phases, the type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these described.
- 1.1.5. This report also considers the potential exposure of future residents of the Proposed Scheme to local pollution concentrations given the Application Site is located in an urban setting surrounding by heavily, slow moving trafficked roads and in Air Quality Management Area.
- 1.1.6. A glossary of terms used in this report is provided in **Appendix A**.

2 LEGISLATION, POLICY AND GUIDANCE

2.1 AIR QUALITY LEGISLATION & POLICY

2.1.1. A summary of the relevant air quality legislation and policy is provided below.

UK AIR QUALITY STRATEGY

- 2.1.2. The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS)¹. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation.
- 2.1.3. The AQS also sets standards and objectives for nine key air pollutants to protect health, vegetation and ecosystems. These are benzene (C₆H₆), 1,3 butadiene (C₄H₆), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), particulate matter (PM₁₀ and PM_{2.5}), sulphur dioxide (SO₂), ozone (O₃), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Appendix B**.
- 2.1.4. The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.
- 2.1.5. The air quality objectives are medium-term policy based targets set by the Government, which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.
- 2.1.6. For the pollutants considered in this assessment, there are both long-term (annual mean) and short-term standards. In the case of NO₂, the short-term standard is for a 1-hour averaging period, whereas for PM₁₀ it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.
- 2.1.7. The AQS contains a framework for considering the effects of a finer group of particles known as 'PM_{2.5}' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM₁₀. Local Authorities are required to work towards reducing emissions/concentrations of particulate matter within their administrative area. However, there is no statutory objective given in the AQS for PM_{2.5} at this time.

AIR QUALITY REGULATIONS

- 2.1.8. Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000² and the Air Quality (England) (Amendment) Regulations 2002³ for the purpose of Local Air Quality Management (LAQM).
- 2.1.9. These Regulations require that likely exceedances of the AQS objectives are assessed in relation to:
"...the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present..."
- 2.1.10. The Air Quality Standards (Amendment) Regulations 2016⁴ transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM₁₀, PM_{2.5} and NO₂. The limit values for NO₂ and PM₁₀ are the same concentration levels as the relevant AQS objectives and the limit value for PM_{2.5} is a concentration of 25µg/m³.

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 The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928

³ The Air Quality (England) (Amendment) Regulations 2002- Statutory Instrument 2002 No.3043

⁴ The Air Quality Standards (Amendment) Regulations 2016- Statutory Instrument 2016 No. 1184

ENVIRONMENTAL PROTECTION ACT 1990 – CONTROL OF DUST AND PARTICULATES ASSOCIATED WITH CONSTRUCTION

- 2.1.11. Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:
- “Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance”;* and
- “Any accumulation or deposit which is prejudicial to health or a nuisance”*
- 2.1.12. Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.
- 2.1.13. There are no statutory limit values for dust deposition above which ‘nuisance’ is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

ENVIRONMENT ACT 1995

- 2.1.14. Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

2.2 PLANNING POLICY

- 2.2.1. A summary of the national and local planning policy relevant to the Proposed Scheme and air quality is provided below.

NATIONAL PLANNING POLICY

National Planning Policy Framework

- 2.2.2. The Government’s overall planning policies for England are described in the National Planning Policy Framework⁵. The core underpinning principle of the Framework is the presumption in favour of sustainable development, defined as:

‘Development that meets the needs of the present without compromising the ability of future generations to meet their own needs’

One of the 12 core planning principles in the NPPF is that planning should ‘contribute to conserving and enhancing the natural environment and reducing pollution.’

- 2.2.3. In relation to air quality, the following paragraphs in the document are relevant:
- i Paragraph 109, which states *‘The planning system should contribute to and enhance the natural and local environment by:...preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water, or noise pollution...’;*
 - i Paragraph 110, which states *‘In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity values, where consistent with other policies in this Framework’;*
 - i Paragraph 122, which states *‘...local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities 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’;*

⁵ Department for Communities and Local Government (2012). National Planning Policy Framework.

- i Paragraph 124, which states 'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan'; and
- i Paragraph 203, which states 'Local Planning authorities should consider where otherwise unacceptable development could be made acceptable though the use of conditions or planning obligations. Planning Obligations should only be used where it is not possible to address unacceptable impacts through a planning condition.'

LOCAL PLANNING POLICY

Manchester City Council Core Strategy

2.2.4. In this document⁶, Policy EN 16 Air Quality states that:

'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 impacts on air quality, alongside other plan objectives. This includes cumulative impacts, particularly in Air Quality Management Areas'.

Greater Manchester Spatial Framework

2.2.5. The draft Greater Manchester Spatial Framework, published in 2016 and currently undergoing review and consultation, provides the spatial planning context that the associated Greater Manchester councils will use to address sites for homes and employment as well as the environmental capacity of the region. Within this document, there is one policy relevant to air quality:

Policy GM17: Major improvements will be secured in air quality across Greater Manchester, helping to minimise the detrimental impacts on human health. There will be a particular focus on tackling air pollution in the locations where most people live.

The emission of air pollutants will be minimised by:

1. *Locating and designing new development so as to minimise the need to travel and maximise the use of walking, cycling and public transport for any trips;*
2. *Influencing individual travel behaviour, including through personal travel planning, especially as part of major developments, improved travel information and implementing integrated and smart public transport fares and ticketing;*
3. *Identifying employment sites that enable the movement of a higher proportion of freight by rail and water;*
4. *Reducing the use of polluting vehicles, potential through the introduction of Clean Air Zones in the areas with lowest air quality and travel demand management measures;*
5. *Stimulating the uptake of low-emission vehicles, including through a significant increase in the provision of electric vehicle charging points in new developments, the expansion of the public charging network and bus franchising contracts;*
6. *Managing the highway network so as to minimise congestion and smooth traffic flow;*
7. *Supporting the development of urban distribution centres and urban consolidation centres served by ultra-low emission vehicles;*
8. *Delivering major investment in improvements to walking, cycling, public transport and sustainable freight infrastructure, including through the use of planning obligations and the community infrastructure levy; and*

⁶ Manchester City Council (2012). Manchester's Local Development Framework – Core Strategy Development Plan Document.

9. Carefully controlling developments that would generate significant point source pollution such as some types of industrial activity and energy generation;
10. The removal of pollutants from the air will be significantly increased by:
11. Enhancing the green infrastructure network across Greater Manchester, including through a major programme of tree planting and bog restoration; and
12. Encouraging the use of building materials that capture pollutants from the air.

Planning applications will be determined in accordance with the most recent development and planning control guidance published jointly by the Institute of Air Quality Management and Environmental Protection UK and the most recent IAQM Guidance on the Assessment of Dust from Demolition and Construction subsequent updates.'

- 2.2.6. Reference has been made to these policies by assessing impacts as a result of the proposals.

2.3 GUIDANCE

- 2.3.1. A summary of the publications referred to in the undertaking of this assessment is provided below.

LOCAL AIR QUALITY MANAGEMENT REVIEW AND ASSESSMENT TECHNICAL GUIDANCE

- 2.3.2. The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities in their review and assessment work⁷. This guidance, referred to in this document as LAQM.TG16, has been used where appropriate in the assessment presented herein.

LAND-USE PLANNING & DEVELOPMENT CONTROL: PLANNING FOR AIR QUALITY

- 2.3.3. Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance⁸ that offers comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures that may be implemented to minimise these impacts.

GUIDANCE ON THE ASSESSMENT OF DUST FROM DEMOLITION AND CONSTRUCTION

- 2.3.4. This document⁹ published by the IAQM was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM₁₀ impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

NATIONAL PLANNING PRACTICE GUIDANCE – AIR QUALITY

- 2.3.5. This guidance¹⁰ provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, and explains how much detail air quality assessments need to include for proposed developments, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by Local Authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

⁷ Defra (2016) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Technical Guidance LAQM.TG16

⁸ Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). Land Use Planning & Development Control: Planning for Air Quality

⁹ Institute of Air Quality Management (Version 1.1 Updated June 2016). Guidance on the Assessment of Dust from Demolition and Construction

¹⁰ Department of Communities and Local Government (DCLG) (March 2014). National Planning Practice Guidance

EMISSIONS OF NITROGEN OXIDES FROM MODERN DIESEL VEHICLES AND CALCULATOR USING REALISTIC EMISSIONS FOR DIESELS (CURED)

- 2.3.6. This document¹¹, prepared by Air Quality Consultants (AQC), considers recent evidence of on-road emissions performance and reviews it within the context of Defra's Emission Factor Toolkit¹² which assumes a reduction in vehicle emissions year on year due to future improvements in vehicle technology. In recent years, there has been evidence (ambient measurements) to suggest that vehicle emissions for oxides of nitrogen (NO_x) are not reducing at the rates assumed within the EfT attributable to the on-road performance of some modern diesel vehicles. Following the publication of their report, AQC launched a corresponding tool¹³ for use within air quality modelling. This tool, the Calculator Using Realistic Emissions for Diesels (CURED) provides more realistic NO_x emission factors for use within air quality modelling based on the reasonable worst-case sensitivity for future year modelling described within the AQC report.

DERIVING BACKGROUND CONCENTRATIONS OF NO_x AND NO₂

- 2.3.7. This document¹⁴ produced by AQC provides a methodology for calibrating Defra background concentrations of NO_x and NO₂ utilising factors to uplift concentrations. The document also provides a methodology for projecting future background concentrations of NO_x and NO₂ for use within air quality modelling, when using emission factors from CURED.

¹¹ Air Quality Consultants, 2016. Emissions of Nitrogen Oxides from Modern Diesel Vehicles.

¹² Defra, 2017. Emissions Factor Toolkit. [online] <Available at <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factor-toolkit.html>> [Accessed 25.09.2017]

¹³ Air Quality Consultants, 2016. Calculator Using Realistic Emissions for Diesels

¹⁴ Air Quality Consultants, 2016. Deriving Background Concentrations of NO_x and NO₂ – August 2016 Update.

3 SCOPE AND METHODOLOGY

3.1 SCOPE

- 3.1.1. The scope of the assessment has been determined in the following way:
- i Consultation with the Environmental Health Officer (EHO) at Manchester City Council (MCC) to agree the scope of the assessment and the methodology to be applied;
 - i Review of MCC's latest review and assessment reports and air quality data for the area surrounding the Application Site, including data from MCC, Defra, the Environment Agency (EA);
 - i Desk study to confirm the location of nearby existing receptors that may be sensitive to changes in local air quality and a review of the masterplan for the Proposed Scheme to establish the location of new sensitive receptors; and
 - i Review of the traffic data provided by WSP.
- 3.1.2. The scope of the assessment includes consideration of the potential impacts on local air quality resulting from::
- i Dust and particulate matter generated by on-site activities during the construction phase;
 - i Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant; and
 - i Increases in pollutant concentrations as a result of exhaust emissions arising from traffic generated by the Proposed Scheme once operational.
- 3.1.3. In addition, the potential exposure of future residents of the Proposed Scheme to poor air quality will also be considered.
- 3.1.4. It should be noted that within the proposals there is the provision for an energy centre. However a final design regarding any potential boilers or CHP unit have not been provided. There is also the potential for the Proposed Scheme to join an existing Manchester heat network. Like other combustion technologies, these elements would impact on air quality, though this would vary depending on the technology and fuel used, the size and design of the plant and other factors. This should be assessed at a later post planning design stage.
- 3.1.5. It should also be noted that the Proposed Scheme includes a 136-space underground car park. Through discussion with the scheme architect it has been determined that the extract will be more than 20m away from a relevant receptor. As such, emissions associated with the car park ventilation have not been considered further in this assessment in accordance with EPUK/IAQM guidance.

3.2 METHODOLOGY

- 3.2.1. The following methodology has been discussed and agreed with the Environmental Health Officer (EHO) at MCC on the 9th October 2017.

CONSTRUCTION PHASE

- 3.2.2. Dust comprises particles typically in the size range 1-75 micrometres (μm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The large dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity to the source of emissions. Dust therefore is unlikely to cause long-term or widespread change to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.
- 3.2.3. The smaller particles of dust (less than $10\mu\text{m}$ in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total dust released; this includes a finer fraction, known as $\text{PM}_{2.5}$ (with an aerodynamic diameter less than $2.5\mu\text{m}$). As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, and can therefore be transported by wind over a wider area. PM_{10} and $\text{PM}_{2.5}$ are small enough to be drawn into the lungs during breathing, which could have a potential impact on human health.
- 3.2.4. An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology

published by the IAQM; the available information for this phase of the Proposed Scheme provided by the Project Team; and, professional judgement.

- 3.2.5. The IAQM methodology assesses the risk of potential dust and PM₁₀ impacts from the following four sources: demolition; earthworks; general construction activities and track-out. It takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM₁₀ levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined. A summary of the IAQM assessment methodology is provided in **Appendix C**.
- 3.2.6. In addition to impacts on local air quality due to on-site construction activities, 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 Application Site and in the vicinity of the Application Site itself. As information on the number of vehicles and plant associated with the construction phase was not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:
- i The number of type of construction traffic and plant likely to be generated by this phase of the Proposed Scheme;
 - i The number and proximity of sensitive receptors to the Application Site and along the likely routes to be used by construction vehicles; and
 - i The likely duration of the construction phase and the nature of the construction activities undertaken.

OPERATIONAL PHASE

- 3.2.7. Of the pollutants included in the AQS, concentrations of NO₂ and particulate matter (PM₁₀ and PM_{2.5}) have been considered in this assessment as road traffic is a major source of these pollutants and their concentrations tend to be close to, or in exceedance of, the objectives in urban locations.
- 3.2.8. For the prediction of impacts due to emissions arising from road traffic during the operation of the Proposed Scheme, the dispersion model ADMS Roads (version 4.1.1.0) has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness, and local meteorological conditions to predict pollutant concentrations at specific receptor locations, as determined by the user.
- 3.2.9. Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. 2015 meteorological data used in the model was obtained from the observation station at Manchester Airport (Ringway) meteorological station. This station is considered to provide representative data for the assessment.
- 3.2.10. A summary of traffic data and pollutant emission factors used in the assessment can be found in **Appendix D**. It includes details of the Annual Average Daily Traffic (AADT) flows, vehicle speeds (km/h) and the percentage of (Heavy Duty Vehicles (HDVs) for the local road network in all assessment years considered. Traffic speeds were reduced at junctions in line with guidance provided in LAQM.TG16, and using professional judgement.
- 3.2.11. For the assessment, three scenarios were modelled, as follows:
- i 2015 – Model Verification and Baseline;
 - i 2022 – Opening Year without Development;
 - i 2022 – Opening Year with Development.
- 3.2.12. 2015 is the most recent year for which monitoring data and meteorological data are available to enable verification of the model results, and so this year has been used as the baseline year for this assessment. 2022 is the anticipated opening year of the Proposed Development.
- 3.2.13. The traffic flows for the 'without development' scenarios include flows for committed developments in the locality of the Application Site but do not include any contribution to road traffic from the Proposed Scheme itself. The traffic flows for the 'with development' scenarios contributions to road traffic from the Proposed Scheme and the nearby committed developments.

VEHICLE EMISSION FACTORS

- 3.2.14. Vehicle emission factors for use in the assessment have been obtained using Emission Factor Toolkit (EFT) version 7.0¹⁵ (published in July 2016) available on the Defra website. The EFT allows for the calculation of emission factors arising from road traffic for all years between 2013 and 2030. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time.
- 3.2.15. Currently there is some uncertainty over how representative the future EFT emission factor predictions are, particularly for nitrogen oxides (NO_x). To address this, Air Quality Consultants (AQC) Ltd's 'Calculator Using Realistic Emissions for Diesels' (CURED) V2A¹⁶ has been used. The CURED tool has been developed to address the uncertainties associated with future emission estimates for diesel vehicles and is considered to provide more realistic NO_x emission factors than the EFT.
- 3.2.16. The results presented in this report have been calculated using the CURED V2A NO_x emission factors and EFT version 7 PM₁₀ and PM_{2.5} emission factors.

SELECTION OF BACKGROUND CONCENTRATIONS

- 3.2.17. Background air pollutant concentrations used in the assessment have been taken from the national maps provided on the Defra website¹⁷, where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK. Estimated concentrations are available for all years between 2013 and 2030. The maps assume that background concentrations will improve (i.e. reduce) over time, in line with the predicted reduction in vehicle emissions and emissions from other sources.
- 3.2.18. AQC Ltd has also published a methodology for deriving more realistic future background concentrations of NO_x and NO₂ for used with the CURED emission factors. AQC produced this methodology as they had found that the Defra background maps tend to under predict concentrations of NO_x and NO₂, again as a result of disparity relating to the on-road emissions performance of modern diesel vehicles. The methodology calibrates the background concentrations against more recent monitoring data from Automatic Urban and Rural Network sites, to provide more realistic indications of background concentrations, as opposed to the overly optimistic Defra mapped backgrounds.
- 3.2.19. For the purposes of the assessment, the 2015 and 2022 background NO_x concentrations have been calibrated as per AQC's methodology¹⁸.
- 3.2.20. Background concentrations for 2015 and 2022 have been utilised within the assessment for particulate matter (PM₁₀ and PM_{2.5}) in the respective scenarios considered.

MODEL VERIFICATION AND RESULT PROCESSING

- 3.2.21. The ADMS Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose. Model validation undertaken by the software developer will not have included validation in the vicinity of the Proposed Scheme.
- 3.2.22. To determine the performance of the model at a local level, a comparison of modelled results with the results of monitoring carried out within the study area was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain

¹⁵ Emission Factor Toolkit. Available at <http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html> [Accessed on 25.09.17].

¹⁶ Calculator Using Realistic Emissions for Diesels (August 2016). Available at <http://www.aqconsultants.co.uk/News/August-2016/Updated-CURED-to-V2A.aspx> [Accessed on 25.09.17].

¹⁷ Defra, 2017. Background Concentrations. [Online] <Available at <https://uk-air.defra.gov.uk/data/laqm-background-home>> [Accessed on 25.09.17].

¹⁸ AQC, 2016. CURED Methodology. [Online] <Available at <http://www.aqconsultants.co.uk/News/August-2016/Updated-CURED-to-V2A.aspx>> [Accessed 25.09.17].

greater confidence in the final results, and was carried out following the methodology specified in Chapter 7, Section 4, of LAQM.TG16.

- 3.2.23. Details of the verification factor calculations are presented in **Appendix E**. A factor of **2.34** was obtained during the verification process, which indicated that the model was under-predicting. This factor was applied to the model road-NO_x (oxides of nitrogen) outputs prior to conversion to annual mean NO₂ concentrations utilising the NO_x to NO₂ calculator (version 5.1, released June 2016) provided by Defra¹⁹. The NO₂ diffusion tube monitoring results provided by MCC were subsequently used to derive an indicative baseline annual mean NO₂ concentration for each site in the vicinity of the Proposed Scheme. Reference should be made to Figure 1 for a graphical representation of the diffusion tube monitoring locations within the assessment extents.
- 3.2.24. As local roadside monitoring data are not available for PM₁₀ or PM_{2.5}, the modelled road-PM₁₀ and road-PM_{2.5} components have been adjusted by the verification factor obtained for NO_x before adding to the appropriate background concentration. The number of days with PM₁₀ concentrations greater than 50µg/m³ was then estimated using the relationship with the annual mean concentration described in LAQM.TG16.
- 3.2.25. Once processed, the predicted concentrations were compared against the relevant AQS objective levels for NO₂, PM₁₀ and PM_{2.5} set out in **Appendix B**.

ASSESSMENT OF IMPACTS DUE TO EMISSIONS GENERATED BY THE PROPOSED ENERGY CENTRE

- 3.2.26. At the time of assessment, the proposals for the Energy Centre have not been finalised. Consequently, the impact of emissions from such plant on local air quality has not been assessed within this report. This should be assessed at a later post planning stage, once the design is finalised.

SELECTION OF SENSITIVE RECEPTORS

- 3.2.27. Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Proposed Scheme. These will include locations sensitive to an increase in dust deposition and PM₁₀ exposure as a result of on-site construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the exhausts of construction and operational traffic associated with the Proposed Scheme.

Construction Phase

- 3.2.28. The IAQM assessment is undertaken where there are: 'human receptors' within 350m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or 'ecological receptors' within 50m of the site boundary, or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). It is within these distances that the impacts of dust soiling and increased particulate matter in the ambient air will have the greatest impact on local air quality at sensitive receptors.

Operational Phase

- 3.2.29. In terms of locations that are sensitive to pollutants emitted from engine exhausts, these will include places where members of the public are likely to be regularly present over the period of time prescribed in the AQS. For instance, on a footpath where exposure will be transient (for the duration of passage along that path) comparison with a short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. At a school or adjacent to a private dwelling, where exposure may be for longer periods, comparison with a long-term standard (such as 24 hour mean or annual mean) may be more appropriate. Box 1.1 of LAQM.TG16 provides examples of the locations where the air quality objectives should/should not apply.
- 3.2.30. To complete the assessment of operational phase impacts, a number of 'receptors' representative of locations of relevant public exposure were identified at which pollution concentrations were predicted. Receptors have been located adjacent to the roads that are likely to experience the greatest change in traffic flows or composition, and therefore NO₂ and particulate matter concentrations, as a result of the Proposed Scheme.

¹⁹ Defra NO_x to NO₂ Calculator. Available at: <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxsector> [Accessed 25/09/2017].

3.2.31. The locations of the assessment receptors are shown on **Figure 2** and listed in **Table 1**.

Table 1 - Receptor Locations Used in this Assessment

Receptor	Description	Grid Reference (m, OS Grid Reference)		Height Above Ground Level (m)
		X	Y	
1	Slug and Lettuce	383773.1	398082.8	1.5
2	Dutton	383807.5	398082.8	1.5
3	Café Nero	383579.9	398080.1	1.5
4	Byron	383654.0	398237.6	1.5
5	Starbucks	383890.8	398154.2	1.5
6	Waterhouse	383960.9	398080.1	1.5
7	Arora	384054.9	397975.6	2.5
8	Midland	383845.9	397900.2	1.5
9	Brewdog	383742.7	397947.9	1.5
10	Watson Street	383633.4	397915.5	1.5
11	Watson Street	383633.4	397915.5	7.5
12	Revolution de Cuba	383570.7	398004.7	1.5
PWNW	Proposed West Building North West	383622.4	398051.0	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PWNE	Proposed West Building North East	383666.4	398043.0	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PWSE	Proposed West Building South East	383659.0	398004.0	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PWSW	Proposed West Building South West	383615.0	398012.7	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PENW	Proposed East Building North West	383678.5	398040.9	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PENE	Proposed East Building North East	383733.1	398022.4	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PESE	Proposed East Building South East	383726.5	397990.9	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PESW	Proposed East South West	383670.0	398002.3	1.5, 6.75, 9.75, 12.75, 15.75, 18.75
PWTN	Proposed West Building Tower North	383641.9	398040.4	21.75 – 123.75
PWTE	Proposed West Building Tower East	383651.4	398025.6	21.75 – 123.75
PWTS	Proposed West Building Tower South	383637.2	398014.8	21.75 – 123.75
PWTW	Proposed West Building Tower West	383628.1	398030.9	21.75 – 123.75

3.2.32. To complete the exposure assessment, pollution concentrations were also predicted at a number of locations within the Proposed Scheme. The receptors have been positioned at the midpoint of each floor of the Proposed Scheme.

3.3 SIGNIFICANCE CRITERIA

CONSTRUCTION PHASE

3.3.1. The IAQM assessment methodology recommends that significance criteria is only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

3.3.2. For the assessment of the impact of exhaust emissions from plant used on-site and construction vehicles accessing and leaving the Application Site on local concentrations of NO₂ and particulate matter, the significance of residual effects have been determined using professional judgement and the principles outlined in the EPUK/IAQM guidance, which are described below.

OPERATIONAL PHASE

- 3.3.3. The approach provided in the EPUK/IAQM guidance has been used within this assessment to assist in describing the air quality effects of additional emissions from traffic generated by the Proposed Scheme once operational.
- 3.3.4. This guidance recommends that the degree of an impact is described by expressing the magnitude of incremental change in pollution concentration as a proportion of the relevant assessment level and examining this change in the context of the new total concentration and its relationship with the assessment criterion, as summarised in **Table 2**.

Table 2 - Impact Descriptors for Individual Receptors

Long Term Average Concentration At Receptors 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
 AQAL = air quality assessment Level, which for this assessment related to the UK Air Quality Strategy objectives.
 Where the %change in concentrations is <0.5%, the change is described as 'Negligible' regardless of the concentration.
 When defining the concentration as a percentage of the AQAL, 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme;' concentration where there is an increase.
 Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.

- 3.3.5. The EPUK/IAQM guidance notes that the criteria in **Table 2** should be used to describe impacts at individual receptors and should be considered as a starting point to make a judgement on significance of effects, as other influences may need to be accounted for. The EPUK/IAQM guidance states that the assessment of overall significance should be based on professional judgement, taking into account several factors, including:
- ❑ The existing and future air quality in the absence of the development;
 - ❑ The extent of current and future population exposure to the impacts; and
 - ❑ The influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- 3.3.6. The EPUK/IAQM guidance states that for most road transport related emissions, long-term average concentrations are the most useful for evaluating the impacts. The guidance does not include criteria for determining the significance of the effect on hourly mean NO₂ concentrations or daily mean PM₁₀ concentrations. The significance of effects of hourly mean NO₂ and daily mean PM₁₀ concentrations arising from the operational phase have therefore been determined qualitatively using professional judgement and the principles described above.
- 3.3.7. The EPUK/IAQM guidance says that *'Where the air quality is such that an air quality objective at the building facade is not met, the effect on residents or occupants will be judged as significant, unless provision is made to reduce their exposure by some means. For people working at new developments in this situation, the same will not be true as occupational exposure standards are different, although any assessment may wish to draw attention to the undesirability of the exposure.'*

3.4 LIMITATIONS & ASSUMPTIONS

- 3.4.1. There are uncertainties associated with both measured and predicted concentrations. The model (ADMS Roads) used in this assessment relies on input data (including predicted 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 take into account.
- 3.4.2. In order to reduce the uncertainty associated with predicted concentrations, model verification has been carried out following guidance set out in LAQM.TG16. As the model has been verified against local monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations.

4 BASELINE CONDITIONS

4.1 MCC'S REVIEW & ASSESSMENT OF AIR QUALITY

- 4.1.1. The Greater Manchester Combined Authority (GMCA), of which MCC is a part, have designated one AQMA within their administrative area as a consequence of the Review and Assessment work carried out by the councils that comprise the GMCA. The site lies within the AQMA designated due to exceedances of the AQS objectives for NO₂.

4.2 LOCAL EMISSION SOURCES

- 4.2.1. The Application Site is located in area where air quality is mainly influenced by emissions from road transport using the A34 Peter Street and the A56 Deansgate.
- 4.2.2. There are no industrial pollution sources identified in the immediate vicinity of the site that would influence the local air quality.

4.3 BACKGROUND AIR QUALITY DATA

- 4.3.1. **Table 3** summarises the background pollutant concentrations of NO₂, PM₁₀ and PM_{2.5} for 2015 and 2022 that were utilised in the assessment. All of the annual mean background concentrations are well below the relevant objectives.

Table 3 - Background Concentrations (µg/m³)

Grid Square (Centre on O.S. Grid Reference)	NO ₂ (µg/m ³)		PM ₁₀ (µg/m ³)		PM _{2.5} (µg/m ³)	
	2015	2022*	2015	2022	2015	2022
383500, 397500	31.3	26.8	17.1	16.2	12.1	11.2
383500, 398500	33.8	29.5	17.1	16.0	12.3	11.2
384500, 397500	34.1	29.1	18.2	17.2	12.8	11.8

*Concentrations adjusted in accordance with CURED methodology.

4.4 LOCAL AUTHORITY AIR QUALITY MONITORING DATA

- 4.4.1. Concentrations of NO₂ measured by passive diffusion tube monitors in the vicinity of the Site by MCC are provided in **Table 4**.

Table 4 - Local Authority Air Quality Monitoring Data

Site Name	Site Type	Annual Mean NO ₂ Concentrations (µg/m ³)*				
		2012	2013	2014	2015	2016
MAN12 – Town Hall	Urban Background	36.30	32.26	33.82	31.22	-
MAN24 – Princess Street	Kerbside	50.78	47.05	50.32	55.24	45.30
MAN70 – Liverpool Road	Urban Centre	45.99	41.88	39.77	40.52	-

*Manchester City Council, 2016

- 4.4.2. Annual mean NO₂ concentrations have approached or exceeded the AQ objective of 40ug/m³ at two of the sites. Overall, there is no clear trend in measured concentrations.

4.5 SUMMARY

- 4.5.1. Air quality along nearby roads in the vicinity of the Site is relatively poor as measured by the diffusion tube monitors at Princess Street and Liverpool Road. This is perhaps due to slow moving city traffic around a busy area of the city. Measured background concentrations of NO₂ at the Town Hall site (closest to the Proposed Scheme) are close to those predicted in the Defra background maps and well below the annual objectives.
- 4.5.2. For model verification purposes, in order to represent a robust approach, the higher 2015 values have been used. This is due to the construction of a major infrastructure project within Manchester city centre close to the Princess Street diffusion tube which may have affected results.

5 ASSESSMENT OF IMPACTS

5.1 CONSTRUCTION PHASE

DUST AND PM₁₀ ARISING FROM ON-SITE ACTIVITIES

5.1.1. Construction activities that have the potential to generate and/or re-suspend dust and PM₁₀ include:

- i Securing of the Site and the implementation of temporary fencing;
- i Creation of internal access, haulage routes; parking and traffic measures;
- i Creation of construction compounds;
- i Site clearance, including vegetation and tree removal and removal of existing below ground services and structures;
- i Demolition of existing buildings;
- i Earthworks and surface re-profiling/sub-base works to obtain required finished floor levels;
- i Foundation construction (at this stage it is assumed that raft foundations would be required);
- i Materials handling, storage, stockpiling, spillage and disposal;
- i Movement of vehicles and construction traffic within the Site (including excavators and dumper trucks);
- i Use of crushing and screening equipment/plant;
- i Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- i Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- i Internal and external finishing and refurbishment; and
- i Site landscaping after completion.

5.1.2. The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

ASSESSMENT OF POTENTIAL DUST EMISSION MAGNITUDE

5.1.3. 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. The findings of the assessment are presented below.

Demolition

5.1.4. Total volume of buildings to be demolished on site is between 20,000m³ and 50,000m³, with potentially dusty construction material, and with demolition activities occurring between 10m and 20m above ground level. Therefore, the potential dust emission magnitude is considered to be **medium** for demolition activities.

Earthworks

5.1.5. The total area of the Application Site is between 2,500m² and 10,000m² which falls within the IAQM range for medium sites. It is expected that between 5 and 10 heavy earth moving vehicles may be present on site at any one time. Therefore, the potential dust emission magnitude is considered to be **medium** for construction activities.

Construction

5.1.6. The total volume of buildings to be constructed on the Application Site will be more than 100,000m³ with site concrete batching and sand blasting activities being undertaken. Therefore, the potential dust emission magnitude is considered to be **large** for construction activities.

Trackout

5.1.7. Some information on the number of Heavy Duty Vehicles (HDVs) associated with this phase of the Proposed Scheme has been provided. It is estimated that there will be between 10-50 outward HDV movements in any one day. This is relatively low in comparison with flows on surrounding roads. There is no unpaved road surface due to the existing concrete paving and road nearby. It is considered that the potential dust emission is **medium** for trackout.

5.1.8. **Table 5** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 5 - Potential Dust Emission Magnitudes

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

ASSESSMENT OF THE SENSITIVITY OF THE STUDY AREA

- 5.1.9. A wind rose generated from the meteorological data used for the dispersion modelling of operational phase impacts is provided in **Appendix F**. This shows that the prevailing wind direction is from the south and west. Therefore, receptors located to north and east of the Application Site are more likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase.
- 5.1.10. Under low wind speed conditions, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. The majority of the surrounding area is comprised of office units, bars and restaurants and a large public square to the north-east. There is one residential receptor within 20m of the Application Site boundary; however this is at a second floor location. This receptor is unlikely to be affected by trackout dust. There are no other residential receptors along potential trackout routes.
- 5.1.11. Taking the above into account and following IAQM assessment methodology, the sensitivity of the area to changes in dust and PM₁₀ has been derived for each of the construction activities considered. The results are shown in **Table 6**.

Table 6 - Sensitivity of the Study Area

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

RISK OF IMPACTS

- 5.1.12. The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 7** below provides a summary of the risk of dust impacts for the Proposed Scheme. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 7 - Summary Dust Risk Table to Define Site Specific Mitigation

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

CONSTRUCTION VEHICLES AND PLANT

- 5.1.13. The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the Site access. It is anticipated that construction traffic will access the site via Deansgate and Jackson's Row and egress via Southmill Street and John Dalton Street, back onto Deansgate thus eliminating reversing of vehicles on Site. Due to the size of the Site, it is considered likely that the construction traffic (approximately 25 HDV AADT) will be low in comparison to the existing traffic flows on these roads.

- 5.1.14. Final details of the exact plant and equipment likely to be used on Site will be determined by the appointed contractor but are considered likely to comprise a range of vehicles tracked excavators, diesel generators, and cranes. The number of plant and their location within the Site are likely to be variable over the construction period.
- 5.1.15. Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, and the likely numbers of construction vehicles and plant that will be used, the impacts are therefore considered to be of **negligible** significance according to the significance criteria published by EPUK/IAQM.

5.2 OPERATIONAL PHASE

- 5.2.1. Full results of the dispersion modelling are presented in **Appendix G** and a summary is provided below.

ANNUAL MEAN NO₂ CONCENTRATIONS

- 5.2.2. The results of the assessment show that in the 2015 baseline concentrations exceed the annual mean objective at most non-sensitive locations chosen in the assessment. The highest predicted concentration is 45.9µg/m³ at Receptor 6 (The Waterhouse). The highest predicted concentration at relevant sensitive receptors was 33.1µg/m³ Receptor 11 (Watson Street). These results agree with the conclusions of the Review and Assessment work undertaken by MCC, which concluded that exceedances of the objective for this pollutant may occur in their areas.
- 5.2.3. By 2022, the opening year of the Proposed Scheme, concentrations at the specific locations chosen are all well below the relevant objectives. Concentrations at the considered sensitive receptor location on Watson Street are also below the relevant objective. The highest concentration is predicted at Receptor 6 (The Waterhouse), a non-relevant location where the concentration is 38.0µg/m³ in the 'Without Development' scenario and 38.3µg/m³ in the 'With Development' scenario.
- 5.2.4. The highest concentration at relevant sensitive receptors (Receptor 11 - Watson Street) is 28.1µg/m³ in the 'Without Development' scenario and 28.2µg/m³ in the 'With Development' scenario, which are well below the annual mean objective.
- 5.2.5. The predicted changes in annual mean NO₂ at nine of the selected existing receptors were 1% of the relevant AQS objective. Concentrations at the remaining three selected existing receptors were <0.5% of the relevant objective. Therefore, in accordance with the EPUK/IAQM guidance, the impact of the increased emissions associated with the Proposed Scheme on annual mean NO₂ concentrations is considered to be **negligible**.

HOURLY MEAN NO₂ CONCENTRATIONS

- 5.2.6. The annual mean NO₂ concentrations predicted by the model were all below 60µg/m³, and therefore hourly mean NO₂ concentrations are unlikely to cause a breach of the hourly mean AQS objective. The impact of the Proposed Scheme on hourly mean NO₂ concentrations at existing sensitive receptors is considered to be **negligible**.

ANNUAL MEAN PM₁₀ CONCENTRATIONS

- 5.2.7. The AQS objective for annual mean PM₁₀ concentrations is a concentration of 40µg/m³. The results of the assessment show that in the 2015 baseline case concentrations at all of the receptors considered are predicted to meet the objective. The highest predicted concentration is 19.1µg/m³ at Receptor 7. These results agree with the conclusions of the Review and Assessment work undertaken by MCC, which concluded that no AQMAs needed to be designated for this pollutant.
- 5.2.8. Predicted concentrations of PM₁₀ are well below the annual mean objective at all receptors in each of the modelled 2022 scenarios. The highest concentration is predicted at Receptor 7, where a concentration of 18.0µg/m³ is predicted in the 'Without- and 'With Development' scenarios. The predicted changes in annual mean PM₁₀ concentrations are all <0.5% of the relevant AQS objective. Based on the EPUK/IAQM guidance, the impact of the increased emissions associated with the Proposed Scheme on annual mean PM₁₀ concentrations is considered to be **negligible**.

DAILY MEAN PM₁₀ CONCENTRATIONS

- 5.2.9. The AQS objective for daily mean PM₁₀ concentrations is 50µg/m³ to be exceeded no more than 35 times a year. The results of the dispersion modelling indicate that the highest number of predicted exceedances during 2015 was 2 at Receptors R3 to R7 and R9. This is significantly below the objective.
- 5.2.10. The largest increase in the number of days exceeding has been modelled at Receptor R7, with less than one day change during 2022.
- 5.2.11. As such, the impacts of increased emissions associated with the operational phase of the Proposed Scheme are **negligible**.

ANNUAL MEAN PM_{2.5} CONCENTRATIONS

- 5.2.12. Predicted annual mean concentrations of PM_{2.5} in 2022 are all well below the AQS objective of 25µg/m³ in all modelled scenarios. The highest modelled concentration is 12.3µg/m³, which is predicted at Receptor 7. The highest concentration at a residential receptor is 11.3µg/m³. All changes in PM_{2.5} as a result of increased traffic associated with the Proposed Scheme are <0.5% of the relevant AQS objective and therefore, based on the EPUK/IAQM guidance, the Proposed Scheme is considered to have a **negligible** impact on annual mean PM_{2.5} concentrations. In accordance with the EPUK/IAQM guidance, the impacts of increased emissions associated with the proposed development are **negligible**.

EXPOSURE OF FUTURE RESIDENTS

- 5.2.13. Predicted concentrations of NO₂, PM₁₀ and PM_{2.5} are all below the relevant objectives at all proposed receptor locations within the site boundary.
- 5.2.14. The highest predicted annual mean concentrations for NO₂ at relevant proposed residential sensitive receptors are 29.6µg/m³ at Floor 20. The highest annual mean PM₁₀ concentrations are 16.0µg/m³, with less than one day exceeding 50µg/m³ at Floor 20. The highest predicted PM_{2.5} concentration was 11.2µg/m³ at Floor 20.

6 MITIGATION AND RESIDUAL EFFECTS

6.1 CONSTRUCTION PHASE

MITIGATION

- 6.1.1. Based on the assessment results, mitigation will be required during the construction phase. Recommended mitigation measures are given below.

General Communication

- i A stakeholder communications plan that includes community engagement before work commences on site should be developed and implemented.
- i The name and contact details of person(s) accountable for air quality and dust issues should be displayed on the site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.
- i Display the head or regional office contact information.

General Dust Management

- i A Dust Management Plan (DMP), which may include measures to control other emissions, in addition to the dust and PM₁₀ mitigation measures given in this report, should be developed and implemented, and approved by the Local Authority. The DMP may include a requirement for monitoring of dust deposition, dust flux, real-time PM₁₀ continuous monitoring and/or visual inspections.

Site Management

- i All dust and air quality complaints should be recorded and causes identified. Appropriate remedial action should be taken in a timely manner with a record kept of actions taken including of any additional measures put in-place to avoid reoccurrence.
- i The complaints log should be made available to the local authority on request.
- i Any exceptional incidents that cause dust and/or air emissions, either on- or off- site should be recorded, and then the action taken to resolve the situation recorded in the log book.

Monitoring

- i Regular site inspections to monitor compliance with the DMP should be carried out, inspection results recorded, and an inspection log made available to the local authority when asked.
- i The frequency of site inspections should be increased 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

- i Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- i Where practicable, erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- i Where practicable, fully enclose site or specific operations where there is a high potential for dust production and the Site is active for an extensive period.
- i Avoid Site runoff of water or mud.
- i Keep Site fencing, barriers and scaffolding clean using wet methods.
- i 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 appropriately.
- i Where practicable, cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- i Ensure all vehicle operators switch off engines when stationary - no idling vehicles.
- i Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- i A Construction Logistics Plan should be produced to manage the sustainable delivery of goods and materials.

Operations

- i 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.
- i Ensure an adequate water supply on the Site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- i Use enclosed chutes and conveyors and covered skips.
- i Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- i 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

- i Avoid bonfires and burning of waste materials.

Measures Specific to Demolition

- i Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- i Avoid explosive blasting, using appropriate manual or mechanical alternatives.
- i Bag and remove any biological debris or damp down such material before demolition.

Measures Specific to Earthworks

- i Stockpile surface areas should be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up.
- i Where practicable, windbreak netting/screening should be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Site and the surroundings.
- i Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction.
- i During dry or windy weather, material stockpiles and exposed surfaces should be dampened down using a water spray to minimise the potential for wind pick-up.

Measures Specific to Construction

- i 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.
- i 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.
- i For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
- i All construction plant and equipment should be maintained in good working order and not left running when not in use.

RESIDUAL EFFECTS

- 6.1.2. The residual effects of dust and PM₁₀ generated by construction activities following the application of the mitigation measures described above and good site practice is considered to be **negligible**.
- 6.1.3. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **negligible**.

6.2 OPERATIONAL PHASE MITIGATION

- 6.2.1. The change in pollutant concentrations attributable to traffic emissions associated with the operation phase of the Proposed Scheme (i.e. impacts on local air quality) are negligible. The predicted concentrations for the future year are below the relevant objectives and as such, mitigation measures such as mechanical ventilation is not required.

- 6.2.2. Through consultation with the EHO at MCC, they have requested that should mitigation not be required, that best practice measures be used as outlined in paragraph 5.8 of the IAQM/EPUK guidance²⁰.
- 6.2.3. According to the IAQM/EPUK, it is recommended that 'rapid-charge' Electric Vehicle 'EV' charging points be installed or the infrastructure to accommodate EV charging points in the future.
- 6.2.4. It should be noted that there is a large provision for cycle parking of which aims to assist in lowering the impact the development has on the surrounding road network and encouraging methods of sustainable transport to and from the Proposed Scheme.

RESIDUAL EFFECTS

- 6.2.5. The Proposed Scheme is predicted to cause a negligible increase in NO₂ and PM₁₀ and PM_{2.5} concentrations.
- 6.2.6. At the majority of locations concentrations are predicted to meet the statutory objectives both with and without the Proposed Scheme.
- 6.2.7. The residual effects of the Proposed Scheme on air quality are **negligible** for all pollutants considered within the assessment according to the IAQM/EPUK assessment criteria.

²⁰ Environmental Protection UK and Institute of Air Quality Management (Version 1.2 Updated January 2017). Land Use Planning & Development Control: Planning for Air Quality.

7 CONCLUSIONS

- 7.1.1. A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Proposed Scheme using the IAQM methodology. This identified that there is a **Medium Risk** of dust soiling impacts and a **Low Risk** of increases in particulate matter concentrations due to construction activities. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM₁₀ releases would be significantly reduced. The residual effects of dust and PM₁₀ generated by construction activities on air quality are therefore considered to be **not significant**. The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **negligible**.
- 7.1.2. In addition, a quantitative assessment of the potential impacts during the operational phase was undertaken using ADMS Roads to predict the changes in NO_x, NO₂ and PM₁₀ concentrations that would occur due to traffic generated by the Proposed Scheme. The results show that the Proposed Scheme would cause a **negligible** increase in pollutant concentrations but would not cause any exceedances of the statutory objectives.
- 7.1.3. The results also show that future users of the Proposed Scheme would not be subject to the considered pollutants in concentrations that would exceed the statutory objectives.
- 7.1.4. Based on the assessment significance criteria, the residual effects of the Proposed Scheme are considered to be **negligible** for all pollutants assessed.
- 7.1.5. Furthermore, it is considered that the development proposals comply with national and local policy for air quality.

FIGURES AND APPENDICES

Figure 1 - NO₂ Diffusion Tube Monitoring Locations



Figure 2 - Receptor Locations



Appendix A

GLOSSARY



GLOSSARY

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modelled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
AQO	Air Quality Objective
AURN	Automatic Urban and Rural (air quality monitoring) Network, managed by contractors on behalf of Defra
Conservative	Tending to over-predict the impact rather than under-predict.
CURED	Calculator Using Realistic Emissions for Diesels
Data capture	The percentage of all the possible measurements for a given period that were validly measured.
Defra	Department for Environment, Food and Rural Affairs.
DfT	Department for Transport.
EFT	Emissions Factor Toolkit
Emission rate	The quantity of a pollutant released from a source over a given period of time.
EPUK	Environmental Protection (UK)
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
GMCA	Greater Manchester Combined Authority
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management.
MCC	Manchester City Council
Minor roads	Non “A” roads or Motorways.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO ₂	Nitrogen dioxide.
NO _x	Nitrogen oxides.

Term	Definition
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.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
Street Canyon	A section of road where tall buildings affect the dispersion of pollutants, causing a trapping effect within the street and elevating concentrations.
µg/m ³ microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m ³ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.
µg/m ³	Microgrammes per cubic metre.

Appendix B

RELEVANT UK AIR QUALITY

STRATEGY OBJECTIVES



National Air Quality Objectives and European Directive Limit Values for the Protection of Human Health

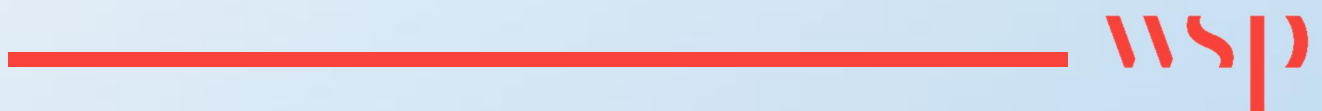
Nitrogen dioxide (NO ₂)	UK	200µg/m ³ not to be exceeded more than 18 times a year	1 hour mean	31.12.2005	200µg/m ³ not to be exceeded more than 18 times a year	01.01.2010
Particulate Matter (PM ₁₀) (gravimetric) ^A	UK	40µg/m ³	annual mean	31.12.2005	40µg/m ³	01.01.2010
	UK (except Scotland)	40µg/m ³	annual mean	31.12.2004	40µg/m ³	01.01.2005
Particulate Matter (PM _{2.5})	UK (except Scotland)	50µg/m ³ not to be exceeded more than 35 times a year	24 hour mean	31.12.2004	50µg/m ³ not to be exceeded more than 35 times a year	01.01.2005
	UK (except Scotland)	25µg/m ³	annual mean	2020	Target value 25µg/m ³	2010

^A Measured using the European gravimetric transfer sampler or equivalent

µg/m³ = microgram per cubic metre

Appendix C

IAQM CONSTRUCTION ASSESSMENT



METHODOLOGY

STEP 1 – SCREENING THE NEED FOR A DETAILED ASSESSMENT

An assessment will normally be required where there are:

- i 'human receptors' within 350m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s); and/or
- i 'ecological receptors' within 50m of the site boundary; or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

Where the need for a more detailed assessment is screened out, it can be concluded that the level of risk is 'negligible'.

STEP 2A – DEFINE THE POTENTIAL DUST EMISSION MAGNITUDE

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class). Other criteria may be used if justified in the assessment.

Table C1 - Examples of Human Receptor Sensitivity to Construction Phase Impacts

Dust Emission Magnitude	Activity
Large	Demolition >50,000m ³ building demolished, dusty material (e.g. concrete), on-site crushing/screening, demolition >20m above ground level
	Earthworks >10,000m ² site area, dusty soil type (e.g. clay), >10 earth moving vehicles active simultaneously, >8m high bunds formed, >100,000 tonnes material moved
	Construction >100,000m ³ building volume, on site concrete batching, sandblasting
	Trackout >50 HDVs out / day, dusty surface material (e.g. clay), >100m unpaved roads
Medium	Demolition 20,000 - 50,000m ³ building demolished, dusty material (e.g. concrete) 10-20m above ground level
	Earthworks 2,500 - 10,000m ² site area, moderately dusty soil (e.g. silt), 5-10 earth moving vehicles active simultaneously, 4m - 8m high bunds, 20,000 -100,000 tonnes material moved
	Construction 25,000 - 100,000m ³ building volume, dusty material e.g. concrete, on site concrete batching
	Trackout 10 - 50 HDVs out / day, moderately dusty surface material (e.g. clay), 50 -100m unpaved roads

Dust Emission Magnitude	Activity
Small	Demolition <20,000m ³ building demolished, non-dusty material (e.g. metal cladding), <10m above ground level, work during wetter months
	Earthworks <2,500m ² site area, soil with large grain size (e.g. sand), <5 earth moving vehicles active simultaneously, <4m high bunds, <20,000 tonnes material moved, earthworks during wetter months
	Construction <25,000m ³ , non-dusty material (e.g. metal cladding or timber)
	Trackout <10 HDVs out / day, non-dusty soil, < 50m unpaved roads

STEP 2B – DEFINE THE SENSITIVITY OF THE AREA

The tables below present the IAQM assessment methodology to determine the sensitivity of the area to dust soiling, human health and ecological impacts respectively. The IAQM guidance provides guidance to allow the sensitivity of individual receptors to dust soiling and health effects to assist in the assessment of the overall sensitivity of the study area.

Table C2- Sensitivity of the Area to Dust Soiling Effects

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

Table C3 - Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM ₁₀ Concentrations (µg/m ³)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low

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

Table C4 - Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance From The Sources (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

STEP 2C – DEFINE THE RISK OF IMPACTS

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts without mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table C5 - Risk of Dust Impacts

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks and Construction			

Sensitivity of Surrounding Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

STEP 3 – SITE SPECIFIC MITIGATION

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

STEP 4 – DETERMINE SIGNIFICANT EFFECTS

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible.

Appendix D

TRAFFIC DATA



Table 8 – 2015 Verification/Baseline Traffic Data

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
1A	New Bailey Street	15	8,760	11.0	0.149095	0.005664	0.003712
1B	New Bailey Street	32	8,760	11.0	0.095941	0.005080	0.003157
1C	New Bailey Street	15	8,760	11.0	0.149095	0.005664	0.003712
2A	New Quay Street	15	12,391	2.1	0.098745	0.005896	0.003727
2B	New Quay Street	32	12,391	2.1	0.071092	0.005502	0.003353
2C	New Quay Street	15	12,391	2.1	0.098745	0.005896	0.003727
2D	New Quay Street	15	12,391	2.1	0.098745	0.005896	0.003727
2E	New Quay Street	15	12,391	2.1	0.098745	0.005896	0.003727
2F	New Quay Street	32	12,391	2.1	0.071092	0.005502	0.003353
2G	New Quay Street	15	12,391	2.1	0.098745	0.005896	0.003727
3A	Deansgate	15	9,551	4.4	0.098140	0.004960	0.003172
3B	Deansgate	32	9,551	4.6	0.068744	0.004604	0.002825
3C	Deansgate	15	9,551	4.8	0.102340	0.005039	0.003229
4A	John Dalton Street	15	8,554	12.1	0.155101	0.005710	0.003754
4B	John Dalton Street	32	8,554	12.1	0.099166	0.005103	0.003177
4C	John Dalton Street	15	8,554	12.1	0.155101	0.005710	0.003754
5A	Mount Street	15	5,346	7.1	0.069668	0.003054	0.001976
5B	Mount Street	32	5,346	7.1	0.046266	0.002780	0.001715
5C	Mount Street	15	5,346	7.1	0.069668	0.003054	0.001976
6A	Peter Street	15	8,765	4.9	0.094979	0.004645	0.002978
6B	Peter Street	15	8,765	4.9	0.094979	0.004645	0.002978
7A	Oxford Street	15	8,485	6.0	0.101070	0.004668	0.003007
7B	Oxford Street	15	8,485	6.0	0.101070	0.004668	0.003007
8A	Portland Street	15	12,036	19.4	0.307064	0.009710	0.006488
8B	Portland Street	32	12,036	19.4	0.190712	0.008515	0.005352
8C	Portland Street	15	12,036	19.4	0.307064	0.009710	0.006488
9A	Princess Street	15	8,873	6.3	0.108711	0.004939	0.003185
9B	Princess Street	32	8,873	6.3	0.072803	0.004510	0.002778
9C	Princess Street	15	8,873	6.3	0.108711	0.004939	0.003185
10A	Princess Street	15	8,005	6.6	0.099999	0.004492	0.002900
10B	Princess Street	32	8,005	6.6	0.066789	0.004098	0.002525
10C	Princess Street	15	8,005	6.6	0.099999	0.004492	0.002900
11A	Peter Street	15	9,672	3.5	0.090411	0.004854	0.003091

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
11B	Peter Street	32	9,672	3.5	0.063175	0.004495	0.002750
11C	Peter Street	15	9,672	3.5	0.090411	0.004854	0.003091

Table 9 – 2022 Without Development Traffic Data

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
1A	New Bailey Street	15	9,731	10.5	0.086130	0.004909	0.002829
1B	New Bailey Street	32	9,731	10.5	0.056139	0.004706	0.002637
1C	New Bailey Street	15	9,731	10.5	0.086130	0.004909	0.002829
2A	New Quay Street	15	13,764	2.0	0.076279	0.005531	0.003171
2B	New Quay Street	32	13,764	2.0	0.056944	0.005360	0.003008
2C	New Quay Street	15	13,764	2.0	0.076279	0.005531	0.003171
2D	New Quay Street	15	13,764	2.0	0.076279	0.005531	0.003171
2E	New Quay Street	15	13,764	2.0	0.076279	0.005531	0.003171
2F	New Quay Street	32	13,764	2.0	0.056944	0.005360	0.003008
2G	New Quay Street	15	13,764	2.0	0.076279	0.005531	0.003171
3A	Deansgate	15	10,609	4.2	0.067760	0.004541	0.002608
3B	Deansgate	32	10,609	4.2	0.048313	0.004386	0.002460
3C	Deansgate	15	10,609	4.2	0.067760	0.004541	0.002608
4A	John Dalton Street	15	9,502	11.5	0.087976	0.004913	0.002833
4B	John Dalton Street	32	9,502	11.5	0.056727	0.004706	0.002636
4C	John Dalton Street	15	9,502	11.5	0.087976	0.004913	0.002833
5A	Mount Street	15	5,938	6.7	0.043922	0.002728	0.001569
5B	Mount Street	32	5,938	6.7	0.029998	0.002626	0.001472
5C	Mount Street	15	5,938	6.7	0.043922	0.002728	0.001569
6A	Peter Street	15	9,736	4.7	0.064153	0.004229	0.002429
6B	Peter Street	15	9,736	4.7	0.064153	0.004229	0.002429
7A	Oxford Street	15	9,425	5.7	0.065844	0.004209	0.002419
7B	Oxford Street	15	9,425	5.7	0.065844	0.004209	0.002419
8A	Portland Street	15	13,369	18.4	0.159897	0.008032	0.004644
8B	Portland Street	32	13,369	18.4	0.097624	0.007650	0.004280
8C	Portland Street	15	13,369	18.4	0.159897	0.008032	0.004644

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
9A	Princess Street	15	9,857	6.0	0.070053	0.004439	0.002552
9B	Princess Street	32	9,857	6.0	0.048387	0.004278	0.002398
9C	Princess Street	15	9,857	6.0	0.070053	0.004439	0.002552
10A	Princess Street	15	8,892	6.2	0.064012	0.004030	0.002317
10B	Princess Street	32	8,892	6.2	0.044053	0.003882	0.002177
10C	Princess Street	15	8,892	6.2	0.064012	0.004030	0.002317
11A	Peter Street	15	10,744	3.3	0.064958	0.004485	0.002574
11B	Peter Street	32	10,744	3.3	0.047120	0.004338	0.002434
11C	Peter Street	15	10,744	3.3	0.064958	0.004485	0.002574

Table 10 – 2022 With Development Scenario Traffic Data

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
1A	New Bailey Street	15	10,047	10.3	0.088270	0.005048	0.002909
1B	New Bailey Street	32	10,047	10.3	0.057638	0.004840	0.002712
1C	New Bailey Street	15	10,047	10.3	0.088270	0.005048	0.002909
2A	New Quay Street	15	14,080	2.1	0.078409	0.005670	0.003251
2B	New Quay Street	32	14,080	2.1	0.058438	0.005493	0.003083
2C	New Quay Street	15	14,080	2.1	0.078409	0.005670	0.003251
2D	New Quay Street	15	14,080	2.1	0.078409	0.005670	0.003251
2E	New Quay Street	15	14,080	2.1	0.078409	0.005670	0.003251

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
2F	New Quay Street	32	14,080	2.1	0.058438	0.005493	0.003083
2G	New Quay Street	15	14,080	2.1	0.078409	0.005670	0.003251
3A	Deansgate	15	11,347	4.2	0.072706	0.004864	0.002793
3B	Deansgate	32	11,347	4.2	0.051788	0.004698	0.002635
3C	Deansgate	15	11,347	4.2	0.072706	0.004864	0.002793
4A	John Dalton Street	15	9,502	11.5	0.087986	0.004913	0.002833
4B	John Dalton Street	32	9,502	11.5	0.056732	0.004706	0.002636
4C	John Dalton Street	15	9,502	11.5	0.087986	0.004913	0.002833
5A	Mount Street	15	6,254	6.6	0.046029	0.002866	0.001648
5B	Mount Street	32	6,254	6.6	0.031481	0.002759	0.001547
5C	Mount Street	15	6,254	6.6	0.046029	0.002866	0.001648
6A	Peter Street	15	10,052	4.7	0.066294	0.004368	0.002509
6B	Peter Street	15	10,052	4.7	0.066294	0.004368	0.002509
7A	Oxford Street	15	9,741	5.7	0.067951	0.004347	0.002499
7B	Oxford Street	15	9,741	5.7	0.067951	0.004347	0.002499
8A	Portland Street	15	13,686	18.1	0.162015	0.008171	0.004723
8B	Portland Street	32	13,686	18.1	0.099114	0.007783	0.004355
8C	Portland Street	15	13,686	18.1	0.162015	0.008171	0.004723
9A	Princess Street	15	10,173	6.0	0.072195	0.004578	0.002632

Road Link	Name	Speed (km/h)	AADT (Total vehicles)	% HDV	NO _x Emission Factor (CURED, g/km/s)	PM ₁₀ Emission Factor (g/km/s)	PM _{2.5} Emission Factors (g/km/s)
9B	Princess Street	32	10,173	6.0	0.049887	0.004412	0.002474
9C	Princess Street	15	10,173	6.0	0.072195	0.004578	0.002632
10A	Princess Street	15	9,208	6.2	0.066116	0.004168	0.002396
10B	Princess Street	32	9,208	6.2	0.045535	0.004015	0.002251
10C	Princess Street	15	9,208	6.2	0.066116	0.004168	0.002396
11A	Peter Street	15	11,060	3.3	0.067088	0.004624	0.002654
11B	Peter Street	32	11,060	3.3	0.048615	0.004472	0.002509
11C	Peter Street	15	11,060	3.3	0.067088	0.004624	0.002654

Appendix E

MODEL VERIFICATION



INTRODUCTION

The comparison of modelled concentrations with local monitored concentrations is a process termed “verification”. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

- i Estimates of background pollutant concentrations;
- i Meteorological data uncertainties;
- i Traffic data uncertainties;
- i Model input parameters, such as ‘roughness length’; and,
- i Overall limitations of the dispersion model.

NITROGEN DIOXIDE

Most nitrogen dioxide is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of the primary pollutant emissions of nitrogen oxides ($\text{NO}_x = \text{NO} + \text{NO}_2$), in line with the guidance provided within LAQM.TG16.

The model has been run to predict the 2015 annual mean road- NO_x contribution at two roadside diffusion tubes within the modelled road network. The model outputs of road- NO_x have been compared with the ‘measured’ road- NO_x , which was determined from the NO_2 concentrations measured using diffusion tubes at the monitoring locations, utilising the NO_x from NO_2 calculator provided by Defra and the NO_2 background concentration (from the Defra background map). As discussed in the methodology section, the most recent suitable data available for model verification purposes is 2015 data.

Table D1 - Model Verification

Site ID	2015 Monitored Total NO_2 ($\mu\text{g}/\text{m}^3$)	2015 Background NO_2 ($\mu\text{g}/\text{m}^3$)	2015 Monitored Road Contribution NO_x ($\mu\text{g}/\text{m}^3$)	2015 Modelled Contribution NO_x ($\mu\text{g}/\text{m}^3$)	Ratio
24 – Princess Street	55.24	33.80	50.92	21.75	2.34

The road- NO_x adjustment factor of 2.34 was applied to the modelled road- NO_x concentration for the monitoring site to provide adjusted modelled road- NO_x concentrations. The total nitrogen dioxide concentration was then determined by inputting the adjusted modelled road- NO_x concentration and the background NO_2 concentration into the NO_x to NO_2 calculator.

PM₁₀ AND PM_{2.5}

There are no local PM₁₀ or PM_{2.5} monitoring data against which the model could be verified. Consequently, the verification factor determined above for adjusting the road- NO_x contribution has been applied to the predicted road-PM₁₀ and road-PM_{2.5} contributions, consistent with guidance set out in LAQM.TG16.

MODEL UNCERTAINTY

An evaluation of model performance has been undertaken to establish confidence in model results. LAQM.TG16 identifies a number of statistical procedures that are appropriate to evaluate model performance and assess the uncertainty. These include:

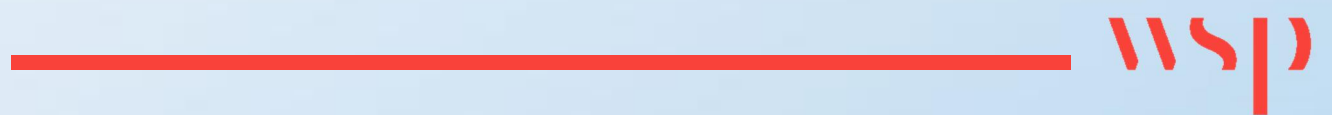
- a) Root mean square error (RMSE);
- b) Fractional bias (FB); and
- c) Correlation coefficient (CC).

These parameters estimate how the model results agree or diverge from the observations. These calculations can be carried out prior to, and after adjustment, or based on different options for adjustment, and can provide useful information on model improvement. Further details can be found in Box 7.17 of LAQM.TG16.

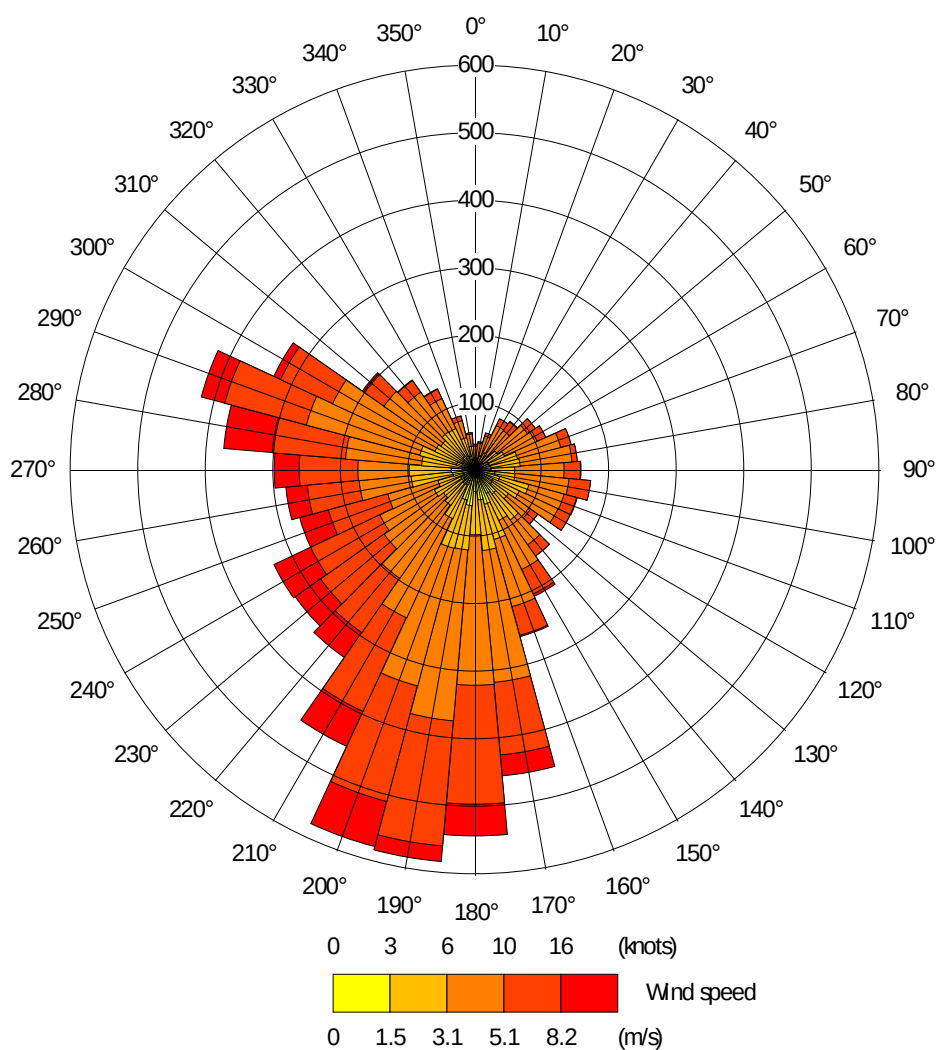
As data from only one diffusion tubes have been used to verify the model evaluation of model performance has not been undertaken.

Appendix F

WIND ROSE



WIND ROSE FOR MANCHESTER AIRPORT (RINGWAY) 2015



Appendix G

MODEL RESULTS



TABLE G1 - ANNUAL MEAN NO₂ CONCENTRATIONS (µg/m³)

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
1	39.2	33.3	33.4	84	0.1	0%	Negligible
2	39.4	33.3	33.5	84	0.2	1%	Negligible
3	42.9	36.3	36.7	92	0.4	1%	Negligible
4	45.0	36.9	37.2	93	0.3	1%	Negligible
5	45.7	37.9	38.1	95	0.2	1%	Negligible
6	45.9	38.0	38.3	96	0.3	1%	Negligible
7	41.7	34.2	34.4	86	0.2	1%	Negligible
8	38.7	32.0	32.2	81	0.2	1%	Negligible
9	40.9	34.2	34.5	86	0.3	1%	Negligible
10	33.4	28.4	28.4	71	0.0	0%	Negligible
11	33.1	28.1	28.2	71	0.1	0%	Negligible
12	41.2	35.0	35.3	88	0.3	1%	Negligible
PWNW_0	-	-	32.0	-	-	-	-
PWNW_1	-	-	31.7	-	-	-	-
PWNW_2	-	-	31.4	-	-	-	-
PWNW_3	-	-	31.1	-	-	-	-
PWNW_4	-	-	30.8	-	-	-	-
PWNW_5	-	-	30.6	-	-	-	-
PWNE_0	-	-	31.5	-	-	-	-
PWNE_1	-	-	31.4	-	-	-	-
PWNE_2	-	-	31.2	-	-	-	-
PWNE_3	-	-	31.0	-	-	-	-
PWNE_4	-	-	30.8	-	-	-	-
PWNE_5	-	-	30.6	-	-	-	-
PWSE_0	-	-	32.1	-	-	-	-
PWSE_1	-	-	31.8	-	-	-	-
PWSE_2	-	-	31.4	-	-	-	-
PWSE_3	-	-	31.1	-	-	-	-
PWSE_4	-	-	30.8	-	-	-	-
PWSE_5	-	-	30.5	-	-	-	-
PWSW_0	-	-	32.6	-	-	-	-
PWSW_1	-	-	32.1	-	-	-	-
PWSW_2	-	-	31.7	-	-	-	-
PWSW_3	-	-	31.2	-	-	-	-
PWSW_4	-	-	30.9	-	-	-	-
PWSW_5	-	-	30.6	-	-	-	-

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PENW_0	-	-	31.5	-	-	-	-
PENW_1	-	-	31.3	-	-	-	-
PENW_2	-	-	31.2	-	-	-	-
PENW_3	-	-	31.0	-	-	-	-
PENW_4	-	-	30.8	-	-	-	-
PENW_5	-	-	30.6	-	-	-	-
PENE_0	-	-	31.6	-	-	-	-
PENE_1	-	-	31.4	-	-	-	-
PENE_2	-	-	31.2	-	-	-	-
PENE_3	-	-	31.0	-	-	-	-
PENE_4	-	-	30.8	-	-	-	-
PENE_5	-	-	30.6	-	-	-	-
PESE_0	-	-	29.5	-	-	-	-
PESE_1	-	-	29.1	-	-	-	-
PESE_2	-	-	28.7	-	-	-	-
PESE_3	-	-	28.4	-	-	-	-
PESE_4	-	-	28.1	-	-	-	-
PESE_5	-	-	27.8	-	-	-	-
PESW_0	-	-	32.1	-	-	-	-
PESW_1	-	-	31.7	-	-	-	-
PESW_2	-	-	31.4	-	-	-	-
PESW_3	-	-	31.1	-	-	-	-
PESW_4	-	-	30.8	-	-	-	-
PESW_5	-	-	30.5	-	-	-	-
PWTN_6	-	-	30.4	-	-	-	-
PWTN_7	-	-	30.2	-	-	-	-
PWTN_8	-	-	30.1	-	-	-	-
PWTN_9	-	-	30.0	-	-	-	-
PWTN_10	-	-	29.9	-	-	-	-
PWTN_11	-	-	29.8	-	-	-	-
PWTN_12	-	-	29.8	-	-	-	-
PWTN_13	-	-	29.7	-	-	-	-
PWTN_14	-	-	29.7	-	-	-	-
PWTN_15	-	-	29.7	-	-	-	-
PWTN_16	-	-	29.7	-	-	-	-
PWTN_17	-	-	29.6	-	-	-	-
PWTN_18	-	-	29.6	-	-	-	-

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTN_19	-	-	29.6	-	-	-	-
PWTN_20	-	-	29.6	-	-	-	-
PWTN_21	-	-	29.6	-	-	-	-
PWTN_22	-	-	29.6	-	-	-	-
PWTN_23	-	-	29.6	-	-	-	-
PWTN_24	-	-	29.6	-	-	-	-
PWTN_25	-	-	29.6	-	-	-	-
PWTN_26	-	-	29.6	-	-	-	-
PWTN_27	-	-	29.6	-	-	-	-
PWTN_28	-	-	29.5	-	-	-	-
PWTN_29	-	-	29.5	-	-	-	-
PWTN_30	-	-	29.5	-	-	-	-
PWTN_31	-	-	29.5	-	-	-	-
PWTN_32	-	-	29.5	-	-	-	-
PWTN_33	-	-	29.5	-	-	-	-
PWTN_34	-	-	29.5	-	-	-	-
PWTN_35	-	-	29.5	-	-	-	-
PWTN_36	-	-	29.5	-	-	-	-
PWTN_37	-	-	29.5	-	-	-	-
PWTN_38	-	-	29.5	-	-	-	-
PWTN_39	-	-	29.5	-	-	-	-
PWTN_40	-	-	29.5	-	-	-	-
PWTE_6	-	-	30.4	-	-	-	-
PWTE_7	-	-	30.2	-	-	-	-
PWTE_8	-	-	30.1	-	-	-	-
PWTE_9	-	-	30.0	-	-	-	-
PWTE_10	-	-	29.9	-	-	-	-
PWTE_11	-	-	29.8	-	-	-	-
PWTE_12	-	-	29.8	-	-	-	-
PWTE_13	-	-	29.7	-	-	-	-
PWTE_14	-	-	29.7	-	-	-	-
PWTE_15	-	-	29.7	-	-	-	-
PWTE_16	-	-	29.7	-	-	-	-
PWTE_17	-	-	29.6	-	-	-	-
PWTE_18	-	-	29.6	-	-	-	-
PWTE_19	-	-	29.6	-	-	-	-
PWTE_20	-	-	29.6	-	-	-	-

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTE_21	-	-	29.6	-	-	-	-
PWTE_22	-	-	29.6	-	-	-	-
PWTE_23	-	-	29.6	-	-	-	-
PWTE_24	-	-	29.6	-	-	-	-
PWTE_25	-	-	29.6	-	-	-	-
PWTE_26	-	-	29.6	-	-	-	-
PWTE_27	-	-	29.6	-	-	-	-
PWTE_28	-	-	29.5	-	-	-	-
PWTE_29	-	-	29.5	-	-	-	-
PWTE_30	-	-	29.5	-	-	-	-
PWTE_31	-	-	29.5	-	-	-	-
PWTE_32	-	-	29.5	-	-	-	-
PWTE_33	-	-	29.5	-	-	-	-
PWTE_34	-	-	29.5	-	-	-	-
PWTE_35	-	-	29.5	-	-	-	-
PWTE_36	-	-	29.5	-	-	-	-
PWTE_37	-	-	29.5	-	-	-	-
PWTE_38	-	-	29.5	-	-	-	-
PWTE_39	-	-	29.5	-	-	-	-
PWTE_40	-	-	29.5	-	-	-	-
PWTS_6	-	-	30.4	-	-	-	-
PWTS_7	-	-	30.2	-	-	-	-
PWTS_8	-	-	30.1	-	-	-	-
PWTS_9	-	-	30.0	-	-	-	-
PWTS_10	-	-	29.9	-	-	-	-
PWTS_11	-	-	29.8	-	-	-	-
PWTS_12	-	-	29.8	-	-	-	-
PWTS_13	-	-	29.7	-	-	-	-
PWTS_14	-	-	29.7	-	-	-	-
PWTS_15	-	-	29.7	-	-	-	-
PWTS_16	-	-	29.7	-	-	-	-
PWTS_17	-	-	29.6	-	-	-	-
PWTS_18	-	-	29.6	-	-	-	-
PWTS_19	-	-	29.6	-	-	-	-
PWTS_20	-	-	29.6	-	-	-	-
PWTS_21	-	-	29.6	-	-	-	-
PWTS_22	-	-	29.6	-	-	-	-

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTS_23	-	-	29.6	-	-	-	-
PWTS_24	-	-	29.6	-	-	-	-
PWTS_25	-	-	29.6	-	-	-	-
PWTS_26	-	-	29.6	-	-	-	-
PWTS_27	-	-	29.5	-	-	-	-
PWTS_28	-	-	29.5	-	-	-	-
PWTS_29	-	-	29.5	-	-	-	-
PWTS_30	-	-	29.5	-	-	-	-
PWTS_31	-	-	29.5	-	-	-	-
PWTS_32	-	-	29.5	-	-	-	-
PWTS_33	-	-	29.5	-	-	-	-
PWTS_34	-	-	29.5	-	-	-	-
PWTS_35	-	-	29.5	-	-	-	-
PWTS_36	-	-	29.5	-	-	-	-
PWTS_37	-	-	29.5	-	-	-	-
PWTS_38	-	-	29.5	-	-	-	-
PWTS_39	-	-	29.5	-	-	-	-
PWTS_40	-	-	29.5	-	-	-	-
PWTW_6	-	-	30.4	-	-	-	-
PWTW_7	-	-	30.2	-	-	-	-
PWTW_8	-	-	30.1	-	-	-	-
PWTW_9	-	-	30.0	-	-	-	-
PWTW_10	-	-	29.9	-	-	-	-
PWTW_11	-	-	29.8	-	-	-	-
PWTW_12	-	-	29.8	-	-	-	-
PWTW_13	-	-	29.7	-	-	-	-
PWTW_14	-	-	29.7	-	-	-	-
PWTW_15	-	-	29.7	-	-	-	-
PWTW_16	-	-	29.7	-	-	-	-
PWTW_17	-	-	29.6	-	-	-	-
PWTW_18	-	-	29.6	-	-	-	-
PWTW_19	-	-	29.6	-	-	-	-
PWTW_20	-	-	29.6	-	-	-	-
PWTW_21	-	-	29.6	-	-	-	-
PWTW_22	-	-	29.6	-	-	-	-
PWTW_23	-	-	29.6	-	-	-	-
PWTW_24	-	-	29.6	-	-	-	-

ANNUAL MEAN NO ₂ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTW_25	-	-	29.6	-	-	-	-
PWTW_26	-	-	29.6	-	-	-	-
PWTW_27	-	-	29.6	-	-	-	-
PWTW_28	-	-	29.5	-	-	-	-
PWTW_29	-	-	29.5	-	-	-	-
PWTW_30	-	-	29.5	-	-	-	-
PWTW_31	-	-	29.5	-	-	-	-
PWTW_32	-	-	29.5	-	-	-	-
PWTW_33	-	-	29.5	-	-	-	-
PWTW_34	-	-	29.5	-	-	-	-
PWTW_35	-	-	29.5	-	-	-	-
PWTW_36	-	-	29.5	-	-	-	-
PWTW_37	-	-	29.5	-	-	-	-
PWTW_38	-	-	29.5	-	-	-	-
PWTW_39	-	-	29.5	-	-	-	-
PWTW_40	-	-	29.5	-	-	-	-

TABLE G2 - ANNUAL MEAN PM₁₀ CONCENTRATIONS (µg/m³)

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
1	17.8	16.6	16.7	42	0.1	0%	Negligible
2	17.8	16.6	16.7	42	0.1	0%	Negligible
3	18.4	17.2	17.3	43	0.1	0%	Negligible
4	18.2	17.0	17.1	43	0.1	0%	Negligible
5	18.6	17.4	17.5	44	0.1	0%	Negligible
6	18.7	17.5	17.6	44	0.1	0%	Negligible
7	19.1	18.0	18.0	45	0.0	0%	Negligible
8	17.9	16.9	16.9	42	0.0	0%	Negligible
9	18.5	17.5	17.6	44	0.1	0%	Negligible
10	17.4	16.5	16.5	41	0.0	0%	Negligible
11	17.3	16.4	16.4	41	0.0	0%	Negligible
12	18.0	16.9	16.9	42	0.0	0%	Negligible
PWNW_0	-	-	16.4	-	-	-	-
PWNW_1	-	-	16.4	-	-	-	-
PWNW_2	-	-	16.3	-	-	-	-
PWNW_3	-	-	16.3	-	-	-	-
PWNW_4	-	-	16.2	-	-	-	-
PWNW_5	-	-	16.2	-	-	-	-
PWNE_0	-	-	16.3	-	-	-	-
PWNE_1	-	-	16.3	-	-	-	-
PWNE_2	-	-	16.3	-	-	-	-
PWNE_3	-	-	16.2	-	-	-	-
PWNE_4	-	-	16.2	-	-	-	-
PWNE_5	-	-	16.2	-	-	-	-
PWSE_0	-	-	16.4	-	-	-	-
PWSE_1	-	-	16.4	-	-	-	-
PWSE_2	-	-	16.3	-	-	-	-
PWSE_3	-	-	16.3	-	-	-	-
PWSE_4	-	-	16.2	-	-	-	-
PWSE_5	-	-	16.2	-	-	-	-
PWSW_0	-	-	16.5	-	-	-	-
PWSW_1	-	-	16.4	-	-	-	-
PWSW_2	-	-	16.4	-	-	-	-
PWSW_3	-	-	16.3	-	-	-	-
PWSW_4	-	-	16.2	-	-	-	-
PWSW_5	-	-	16.2	-	-	-	-

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PENW_0	-	-	16.3	-	-	-	-
PENW_1	-	-	16.3	-	-	-	-
PENW_2	-	-	16.3	-	-	-	-
PENW_3	-	-	16.2	-	-	-	-
PENW_4	-	-	16.2	-	-	-	-
PENW_5	-	-	16.2	-	-	-	-
PENE_0	-	-	16.3	-	-	-	-
PENE_1	-	-	16.3	-	-	-	-
PENE_2	-	-	16.3	-	-	-	-
PENE_3	-	-	16.2	-	-	-	-
PENE_4	-	-	16.2	-	-	-	-
PENE_5	-	-	16.2	-	-	-	-
PESE_0	-	-	16.6	-	-	-	-
PESE_1	-	-	16.6	-	-	-	-
PESE_2	-	-	16.5	-	-	-	-
PESE_3	-	-	16.5	-	-	-	-
PESE_4	-	-	16.4	-	-	-	-
PESE_5	-	-	16.4	-	-	-	-
PESW_0	-	-	16.4	-	-	-	-
PESW_1	-	-	16.4	-	-	-	-
PESW_2	-	-	16.3	-	-	-	-
PESW_3	-	-	16.3	-	-	-	-
PESW_4	-	-	16.2	-	-	-	-
PESW_5	-	-	16.2	-	-	-	-
PWTN_6	-	-	16.1	-	-	-	-
PWTN_7	-	-	16.1	-	-	-	-
PWTN_8	-	-	16.1	-	-	-	-
PWTN_9	-	-	16.1	-	-	-	-
PWTN_10	-	-	16.1	-	-	-	-
PWTN_11	-	-	16.1	-	-	-	-
PWTN_12	-	-	16.0	-	-	-	-
PWTN_13	-	-	16.0	-	-	-	-
PWTN_14	-	-	16.0	-	-	-	-
PWTN_15	-	-	16.0	-	-	-	-
PWTN_16	-	-	16.0	-	-	-	-
PWTN_17	-	-	16.0	-	-	-	-
PWTN_18	-	-	16.0	-	-	-	-

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTN_19	-	-	16.0	-	-	-	-
PWTN_20	-	-	16.0	-	-	-	-
PWTN_21	-	-	16.0	-	-	-	-
PWTN_22	-	-	16.0	-	-	-	-
PWTN_23	-	-	16.0	-	-	-	-
PWTN_24	-	-	16.0	-	-	-	-
PWTN_25	-	-	16.0	-	-	-	-
PWTN_26	-	-	16.0	-	-	-	-
PWTN_27	-	-	16.0	-	-	-	-
PWTN_28	-	-	16.0	-	-	-	-
PWTN_29	-	-	16.0	-	-	-	-
PWTN_30	-	-	16.0	-	-	-	-
PWTN_31	-	-	16.0	-	-	-	-
PWTN_32	-	-	16.0	-	-	-	-
PWTN_33	-	-	16.0	-	-	-	-
PWTN_34	-	-	16.0	-	-	-	-
PWTN_35	-	-	16.0	-	-	-	-
PWTN_36	-	-	16.0	-	-	-	-
PWTN_37	-	-	16.0	-	-	-	-
PWTN_38	-	-	16.0	-	-	-	-
PWTN_39	-	-	16.0	-	-	-	-
PWTN_40	-	-	16.0	-	-	-	-
PWTE_6	-	-	16.1	-	-	-	-
PWTE_7	-	-	16.1	-	-	-	-
PWTE_8	-	-	16.1	-	-	-	-
PWTE_9	-	-	16.1	-	-	-	-
PWTE_10	-	-	16.1	-	-	-	-
PWTE_11	-	-	16.1	-	-	-	-
PWTE_12	-	-	16.0	-	-	-	-
PWTE_13	-	-	16.0	-	-	-	-
PWTE_14	-	-	16.0	-	-	-	-
PWTE_15	-	-	16.0	-	-	-	-
PWTE_16	-	-	16.0	-	-	-	-
PWTE_17	-	-	16.0	-	-	-	-
PWTE_18	-	-	16.0	-	-	-	-
PWTE_19	-	-	16.0	-	-	-	-
PWTE_20	-	-	16.0	-	-	-	-

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTE_21	-	-	16.0	-	-	-	-
PWTE_22	-	-	16.0	-	-	-	-
PWTE_23	-	-	16.0	-	-	-	-
PWTE_24	-	-	16.0	-	-	-	-
PWTE_25	-	-	16.0	-	-	-	-
PWTE_26	-	-	16.0	-	-	-	-
PWTE_27	-	-	16.0	-	-	-	-
PWTE_28	-	-	16.0	-	-	-	-
PWTE_29	-	-	16.0	-	-	-	-
PWTE_30	-	-	16.0	-	-	-	-
PWTE_31	-	-	16.0	-	-	-	-
PWTE_32	-	-	16.0	-	-	-	-
PWTE_33	-	-	16.0	-	-	-	-
PWTE_34	-	-	16.0	-	-	-	-
PWTE_35	-	-	16.0	-	-	-	-
PWTE_36	-	-	16.0	-	-	-	-
PWTE_37	-	-	16.0	-	-	-	-
PWTE_38	-	-	16.0	-	-	-	-
PWTE_39	-	-	16.0	-	-	-	-
PWTE_40	-	-	16.0	-	-	-	-
PWTS_6	-	-	16.1	-	-	-	-
PWTS_7	-	-	16.1	-	-	-	-
PWTS_8	-	-	16.1	-	-	-	-
PWTS_9	-	-	16.1	-	-	-	-
PWTS_10	-	-	16.1	-	-	-	-
PWTS_11	-	-	16.0	-	-	-	-
PWTS_12	-	-	16.0	-	-	-	-
PWTS_13	-	-	16.0	-	-	-	-
PWTS_14	-	-	16.0	-	-	-	-
PWTS_15	-	-	16.0	-	-	-	-
PWTS_16	-	-	16.0	-	-	-	-
PWTS_17	-	-	16.0	-	-	-	-
PWTS_18	-	-	16.0	-	-	-	-
PWTS_19	-	-	16.0	-	-	-	-
PWTS_20	-	-	16.0	-	-	-	-
PWTS_21	-	-	16.0	-	-	-	-
PWTS_22	-	-	16.0	-	-	-	-

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTS_23	-	-	16.0	-	-	-	-
PWTS_24	-	-	16.0	-	-	-	-
PWTS_25	-	-	16.0	-	-	-	-
PWTS_26	-	-	16.0	-	-	-	-
PWTS_27	-	-	16.0	-	-	-	-
PWTS_28	-	-	16.0	-	-	-	-
PWTS_29	-	-	16.0	-	-	-	-
PWTS_30	-	-	16.0	-	-	-	-
PWTS_31	-	-	16.0	-	-	-	-
PWTS_32	-	-	16.0	-	-	-	-
PWTS_33	-	-	16.0	-	-	-	-
PWTS_34	-	-	16.0	-	-	-	-
PWTS_35	-	-	16.0	-	-	-	-
PWTS_36	-	-	16.0	-	-	-	-
PWTS_37	-	-	16.0	-	-	-	-
PWTS_38	-	-	16.0	-	-	-	-
PWTS_39	-	-	16.0	-	-	-	-
PWTS_40	-	-	16.0	-	-	-	-
PWTW_6	-	-	16.1	-	-	-	-
PWTW_7	-	-	16.1	-	-	-	-
PWTW_8	-	-	16.1	-	-	-	-
PWTW_9	-	-	16.1	-	-	-	-
PWTW_10	-	-	16.1	-	-	-	-
PWTW_11	-	-	16.1	-	-	-	-
PWTW_12	-	-	16.0	-	-	-	-
PWTW_13	-	-	16.0	-	-	-	-
PWTW_14	-	-	16.0	-	-	-	-
PWTW_15	-	-	16.0	-	-	-	-
PWTW_16	-	-	16.0	-	-	-	-
PWTW_17	-	-	16.0	-	-	-	-
PWTW_18	-	-	16.0	-	-	-	-
PWTW_19	-	-	16.0	-	-	-	-
PWTW_20	-	-	16.0	-	-	-	-
PWTW_21	-	-	16.0	-	-	-	-
PWTW_22	-	-	16.0	-	-	-	-
PWTW_23	-	-	16.0	-	-	-	-
PWTW_24	-	-	16.0	-	-	-	-

ANNUAL MEAN PM ₁₀ CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTW_25	-	-	16.0	-	-	-	-
PWTW_26	-	-	16.0	-	-	-	-
PWTW_27	-	-	16.0	-	-	-	-
PWTW_28	-	-	16.0	-	-	-	-
PWTW_29	-	-	16.0	-	-	-	-
PWTW_30	-	-	16.0	-	-	-	-
PWTW_31	-	-	16.0	-	-	-	-
PWTW_32	-	-	16.0	-	-	-	-
PWTW_33	-	-	16.0	-	-	-	-
PWTW_34	-	-	16.0	-	-	-	-
PWTW_35	-	-	16.0	-	-	-	-
PWTW_36	-	-	16.0	-	-	-	-
PWTW_37	-	-	16.0	-	-	-	-
PWTW_38	-	-	16.0	-	-	-	-
PWTW_39	-	-	16.0	-	-	-	-
PWTW_40	-	-	16.0	-	-	-	-

TABLE G3 - DAILY PM₁₀ (NO. OF DAYS OF EXCEEDANCE)

DAILY MEAN PM ₁₀ (NO. OF DAYS OF EXCEEDANCE)				
Receptor	2015 Base (Days)	2022 Base (Days)	2022 With Dev (Days)	Change
1	1	1	1	0
2	1	1	1	0
3	2	1	1	0
4	2	1	1	0
5	2	1	1	0
6	2	1	1	0
7	2	1	1	0
8	1	1	1	0
9	2	1	1	0
10	1	0	0	0
11	1	0	0	0
12	1	1	1	0
PWNW_0	-	-	0	-
PWNW_1	-	-	0	-
PWNW_2	-	-	0	-
PWNW_3	-	-	0	-
PWNW_4	-	-	0	-
PWNW_5	-	-	0	-
PWNE_0	-	-	0	-
PWNE_1	-	-	0	-
PWNE_2	-	-	0	-
PWNE_3	-	-	0	-
PWNE_4	-	-	0	-
PWNE_5	-	-	0	-
PWSE_0	-	-	0	-
PWSE_1	-	-	0	-
PWSE_2	-	-	0	-
PWSE_3	-	-	0	-
PWSE_4	-	-	0	-
PWSE_5	-	-	0	-
PWSW_0	-	-	1	-
PWSW_1	-	-	0	-
PWSW_2	-	-	0	-
PWSW_3	-	-	0	-
PWSW_4	-	-	0	-
PWSW_5	-	-	0	-
PENW_0	-	-	0	-
PENW_1	-	-	0	-
PENW_2	-	-	0	-
PENW_3	-	-	0	-
PENW_4	-	-	0	-
PENW_5	-	-	0	-
PENE_0	-	-	0	-
PENE_1	-	-	0	-
PENE_2	-	-	0	-

DAILY MEAN PM ₁₀ (NO. OF DAYS OF EXCEEDANCE)				
Receptor	2015 Base (Days)	2022 Base (Days)	2022 With Dev (Days)	Change
PENE_3	-	-	0	-
PENE_4	-	-	0	-
PENE_5	-	-	0	-
PESE_0	-	-	1	-
PESE_1	-	-	1	-
PESE_2	-	-	1	-
PESE_3	-	-	0	-
PESE_4	-	-	0	-
PESE_5	-	-	0	-
PESW_0	-	-	0	-
PESW_1	-	-	0	-
PESW_2	-	-	0	-
PESW_3	-	-	0	-
PESW_4	-	-	0	-
PESW_5	-	-	0	-
PWTN_6	-	-	0	-
PWTN_7	-	-	0	-
PWTN_8	-	-	0	-
PWTN_9	-	-	0	-
PWTN_10	-	-	0	-
PWTN_11	-	-	0	-
PWTN_12	-	-	0	-
PWTN_13	-	-	0	-
PWTN_14	-	-	0	-
PWTN_15	-	-	0	-
PWTN_16	-	-	0	-
PWTN_17	-	-	0	-
PWTN_18	-	-	0	-
PWTN_19	-	-	0	-
PWTN_20	-	-	0	-
PWTN_21	-	-	0	-
PWTN_22	-	-	0	-
PWTN_23	-	-	0	-
PWTN_24	-	-	0	-
PWTN_25	-	-	0	-
PWTN_26	-	-	0	-
PWTN_27	-	-	0	-
PWTN_28	-	-	0	-
PWTN_29	-	-	0	-
PWTN_30	-	-	0	-
PWTN_31	-	-	0	-
PWTN_32	-	-	0	-
PWTN_33	-	-	0	-
PWTN_34	-	-	0	-
PWTN_35	-	-	0	-
PWTN_36	-	-	0	-

DAILY MEAN PM ₁₀ (NO. OF DAYS OF EXCEEDANCE)				
Receptor	2015 Base (Days)	2022 Base (Days)	2022 With Dev (Days)	Change
PWTN_37	-	-	0	-
PWTN_38	-	-	0	-
PWTN_39	-	-	0	-
PWTN_40	-	-	0	-
PWTE_6	-	-	0	-
PWTE_7	-	-	0	-
PWTE_8	-	-	0	-
PWTE_9	-	-	0	-
PWTE_10	-	-	0	-
PWTE_11	-	-	0	-
PWTE_12	-	-	0	-
PWTE_13	-	-	0	-
PWTE_14	-	-	0	-
PWTE_15	-	-	0	-
PWTE_16	-	-	0	-
PWTE_17	-	-	0	-
PWTE_18	-	-	0	-
PWTE_19	-	-	0	-
PWTE_20	-	-	0	-
PWTE_21	-	-	0	-
PWTE_22	-	-	0	-
PWTE_23	-	-	0	-
PWTE_24	-	-	0	-
PWTE_25	-	-	0	-
PWTE_26	-	-	0	-
PWTE_27	-	-	0	-
PWTE_28	-	-	0	-
PWTE_29	-	-	0	-
PWTE_30	-	-	0	-
PWTE_31	-	-	0	-
PWTE_32	-	-	0	-
PWTE_33	-	-	0	-
PWTE_34	-	-	0	-
PWTE_35	-	-	0	-
PWTE_36	-	-	0	-
PWTE_37	-	-	0	-
PWTE_38	-	-	0	-
PWTE_39	-	-	0	-
PWTE_40	-	-	0	-
PWTS_6	-	-	0	-
PWTS_7	-	-	0	-
PWTS_8	-	-	0	-
PWTS_9	-	-	0	-
PWTS_10	-	-	0	-
PWTS_11	-	-	0	-
PWTS_12	-	-	0	-

DAILY MEAN PM ₁₀ (NO. OF DAYS OF EXCEEDANCE)				
Receptor	2015 Base (Days)	2022 Base (Days)	2022 With Dev (Days)	Change
PWTS_13	-	-	0	-
PWTS_14	-	-	0	-
PWTS_15	-	-	0	-
PWTS_16	-	-	0	-
PWTS_17	-	-	0	-
PWTS_18	-	-	0	-
PWTS_19	-	-	0	-
PWTS_20	-	-	0	-
PWTS_21	-	-	0	-
PWTS_22	-	-	0	-
PWTS_23	-	-	0	-
PWTS_24	-	-	0	-
PWTS_25	-	-	0	-
PWTS_26	-	-	0	-
PWTS_27	-	-	0	-
PWTS_28	-	-	0	-
PWTS_29	-	-	0	-
PWTS_30	-	-	0	-
PWTS_31	-	-	0	-
PWTS_32	-	-	0	-
PWTS_33	-	-	0	-
PWTS_34	-	-	0	-
PWTS_35	-	-	0	-
PWTS_36	-	-	0	-
PWTS_37	-	-	0	-
PWTS_38	-	-	0	-
PWTS_39	-	-	0	-
PWTS_40	-	-	0	-
PWTW_6	-	-	0	-
PWTW_7	-	-	0	-
PWTW_8	-	-	0	-
PWTW_9	-	-	0	-
PWTW_10	-	-	0	-
PWTW_11	-	-	0	-
PWTW_12	-	-	0	-
PWTW_13	-	-	0	-
PWTW_14	-	-	0	-
PWTW_15	-	-	0	-
PWTW_16	-	-	0	-
PWTW_17	-	-	0	-
PWTW_18	-	-	0	-
PWTW_19	-	-	0	-
PWTW_20	-	-	0	-
PWTW_21	-	-	0	-
PWTW_22	-	-	0	-
PWTW_23	-	-	0	-

DAILY MEAN PM ₁₀ (NO. OF DAYS OF EXCEEDANCE)				
Receptor	2015 Base (Days)	2022 Base (Days)	2022 With Dev (Days)	Change
PWTW_24	-	-	0	-
PWTW_25	-	-	0	-
PWTW_26	-	-	0	-
PWTW_27	-	-	0	-
PWTW_28	-	-	0	-
PWTW_29	-	-	0	-
PWTW_30	-	-	0	-
PWTW_31	-	-	0	-
PWTW_32	-	-	0	-
PWTW_33	-	-	0	-
PWTW_34	-	-	0	-
PWTW_35	-	-	0	-
PWTW_36	-	-	0	-
PWTW_37	-	-	0	-
PWTW_38	-	-	0	-
PWTW_39	-	-	0	-
PWTW_40	-	-	0	-

TABLE G4 - ANNUAL MEAN PM_{2.5} CONCENTRATIONS (µg/m³)

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
1	12.7	11.6	11.6	46	0.0	0%	Negligible
2	12.7	11.6	11.6	46	0.0	0%	Negligible
3	13.1	11.9	11.9	48	0.0	0%	Negligible
4	13.0	11.8	11.8	47	0.0	0%	Negligible
5	13.3	12.0	12.0	48	0.0	0%	Negligible
6	13.3	12.0	12.1	48	0.1	0%	Negligible
7	13.3	12.2	12.3	49	0.1	0%	Negligible
8	12.6	11.6	11.6	46	0.0	0%	Negligible
9	12.9	11.9	12.0	48	0.1	0%	Negligible
10	12.3	11.3	11.3	45	0.0	0%	Negligible
11	12.2	11.3	11.3	45	0.0	0%	Negligible
12	12.9	11.7	11.7	47	0.0	0%	Negligible
PWNW_0	-	-	11.4	-	-	-	-
PWNW_1	-	-	11.4	-	-	-	-
PWNW_2	-	-	11.4	-	-	-	-
PWNW_3	-	-	11.4	-	-	-	-
PWNW_4	-	-	11.3	-	-	-	-
PWNW_5	-	-	11.3	-	-	-	-
PWNE_0	-	-	11.4	-	-	-	-
PWNE_1	-	-	11.4	-	-	-	-
PWNE_2	-	-	11.4	-	-	-	-
PWNE_3	-	-	11.3	-	-	-	-
PWNE_4	-	-	11.3	-	-	-	-
PWNE_5	-	-	11.3	-	-	-	-
PWSE_0	-	-	11.5	-	-	-	-
PWSE_1	-	-	11.4	-	-	-	-
PWSE_2	-	-	11.4	-	-	-	-
PWSE_3	-	-	11.3	-	-	-	-
PWSE_4	-	-	11.3	-	-	-	-
PWSE_5	-	-	11.3	-	-	-	-
PWSW_0	-	-	11.5	-	-	-	-
PWSW_1	-	-	11.4	-	-	-	-
PWSW_2	-	-	11.4	-	-	-	-
PWSW_3	-	-	11.4	-	-	-	-
PWSW_4	-	-	11.3	-	-	-	-
PWSW_5	-	-	11.3	-	-	-	-

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PENW_0	-	-	11.4	-	-	-	-
PENW_1	-	-	11.4	-	-	-	-
PENW_2	-	-	11.4	-	-	-	-
PENW_3	-	-	11.3	-	-	-	-
PENW_4	-	-	11.3	-	-	-	-
PENW_5	-	-	11.3	-	-	-	-
PENE_0	-	-	11.4	-	-	-	-
PENE_1	-	-	11.4	-	-	-	-
PENE_2	-	-	11.4	-	-	-	-
PENE_3	-	-	11.3	-	-	-	-
PENE_4	-	-	11.3	-	-	-	-
PENE_5	-	-	11.3	-	-	-	-
PESE_0	-	-	11.4	-	-	-	-
PESE_1	-	-	11.4	-	-	-	-
PESE_2	-	-	11.4	-	-	-	-
PESE_3	-	-	11.3	-	-	-	-
PESE_4	-	-	11.3	-	-	-	-
PESE_5	-	-	11.3	-	-	-	-
PESW_0	-	-	11.4	-	-	-	-
PESW_1	-	-	11.4	-	-	-	-
PESW_2	-	-	11.4	-	-	-	-
PESW_3	-	-	11.3	-	-	-	-
PESW_4	-	-	11.3	-	-	-	-
PESW_5	-	-	11.3	-	-	-	-
PWTN_6	-	-	11.3	-	-	-	-
PWTN_7	-	-	11.3	-	-	-	-
PWTN_8	-	-	11.3	-	-	-	-
PWTN_9	-	-	11.2	-	-	-	-
PWTN_10	-	-	11.2	-	-	-	-
PWTN_11	-	-	11.2	-	-	-	-
PWTN_12	-	-	11.2	-	-	-	-
PWTN_13	-	-	11.2	-	-	-	-
PWTN_14	-	-	11.2	-	-	-	-
PWTN_15	-	-	11.2	-	-	-	-
PWTN_16	-	-	11.2	-	-	-	-
PWTN_17	-	-	11.2	-	-	-	-
PWTN_18	-	-	11.2	-	-	-	-

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTN_19	-	-	11.2	-	-	-	-
PWTN_20	-	-	11.2	-	-	-	-
PWTN_21	-	-	11.2	-	-	-	-
PWTN_22	-	-	11.2	-	-	-	-
PWTN_23	-	-	11.2	-	-	-	-
PWTN_24	-	-	11.2	-	-	-	-
PWTN_25	-	-	11.2	-	-	-	-
PWTN_26	-	-	11.2	-	-	-	-
PWTN_27	-	-	11.2	-	-	-	-
PWTN_28	-	-	11.2	-	-	-	-
PWTN_29	-	-	11.2	-	-	-	-
PWTN_30	-	-	11.2	-	-	-	-
PWTN_31	-	-	11.2	-	-	-	-
PWTN_32	-	-	11.2	-	-	-	-
PWTN_33	-	-	11.2	-	-	-	-
PWTN_34	-	-	11.2	-	-	-	-
PWTN_35	-	-	11.2	-	-	-	-
PWTN_36	-	-	11.2	-	-	-	-
PWTN_37	-	-	11.2	-	-	-	-
PWTN_38	-	-	11.2	-	-	-	-
PWTN_39	-	-	11.2	-	-	-	-
PWTN_40	-	-	11.2	-	-	-	-
PWTE_6	-	-	11.3	-	-	-	-
PWTE_7	-	-	11.3	-	-	-	-
PWTE_8	-	-	11.3	-	-	-	-
PWTE_9	-	-	11.2	-	-	-	-
PWTE_10	-	-	11.2	-	-	-	-
PWTE_11	-	-	11.2	-	-	-	-
PWTE_12	-	-	11.2	-	-	-	-
PWTE_13	-	-	11.2	-	-	-	-
PWTE_14	-	-	11.2	-	-	-	-
PWTE_15	-	-	11.2	-	-	-	-
PWTE_16	-	-	11.2	-	-	-	-
PWTE_17	-	-	11.2	-	-	-	-
PWTE_18	-	-	11.2	-	-	-	-
PWTE_19	-	-	11.2	-	-	-	-
PWTE_20	-	-	11.2	-	-	-	-

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTE_21	-	-	11.2	-	-	-	-
PWTE_22	-	-	11.2	-	-	-	-
PWTE_23	-	-	11.2	-	-	-	-
PWTE_24	-	-	11.2	-	-	-	-
PWTE_25	-	-	11.2	-	-	-	-
PWTE_26	-	-	11.2	-	-	-	-
PWTE_27	-	-	11.2	-	-	-	-
PWTE_28	-	-	11.2	-	-	-	-
PWTE_29	-	-	11.2	-	-	-	-
PWTE_30	-	-	11.2	-	-	-	-
PWTE_31	-	-	11.2	-	-	-	-
PWTE_32	-	-	11.2	-	-	-	-
PWTE_33	-	-	11.2	-	-	-	-
PWTE_34	-	-	11.2	-	-	-	-
PWTE_35	-	-	11.2	-	-	-	-
PWTE_36	-	-	11.2	-	-	-	-
PWTE_37	-	-	11.2	-	-	-	-
PWTE_38	-	-	11.2	-	-	-	-
PWTE_39	-	-	11.2	-	-	-	-
PWTE_40	-	-	11.2	-	-	-	-
PWTS_6	-	-	11.3	-	-	-	-
PWTS_7	-	-	11.3	-	-	-	-
PWTS_8	-	-	11.2	-	-	-	-
PWTS_9	-	-	11.2	-	-	-	-
PWTS_10	-	-	11.2	-	-	-	-
PWTS_11	-	-	11.2	-	-	-	-
PWTS_12	-	-	11.2	-	-	-	-
PWTS_13	-	-	11.2	-	-	-	-
PWTS_14	-	-	11.2	-	-	-	-
PWTS_15	-	-	11.2	-	-	-	-
PWTS_16	-	-	11.2	-	-	-	-
PWTS_17	-	-	11.2	-	-	-	-
PWTS_18	-	-	11.2	-	-	-	-
PWTS_19	-	-	11.2	-	-	-	-
PWTS_20	-	-	11.2	-	-	-	-
PWTS_21	-	-	11.2	-	-	-	-
PWTS_22	-	-	11.2	-	-	-	-

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTS_23	-	-	11.2	-	-	-	-
PWTS_24	-	-	11.2	-	-	-	-
PWTS_25	-	-	11.2	-	-	-	-
PWTS_26	-	-	11.2	-	-	-	-
PWTS_27	-	-	11.2	-	-	-	-
PWTS_28	-	-	11.2	-	-	-	-
PWTS_29	-	-	11.2	-	-	-	-
PWTS_30	-	-	11.2	-	-	-	-
PWTS_31	-	-	11.2	-	-	-	-
PWTS_32	-	-	11.2	-	-	-	-
PWTS_33	-	-	11.2	-	-	-	-
PWTS_34	-	-	11.2	-	-	-	-
PWTS_35	-	-	11.2	-	-	-	-
PWTS_36	-	-	11.2	-	-	-	-
PWTS_37	-	-	11.2	-	-	-	-
PWTS_38	-	-	11.2	-	-	-	-
PWTS_39	-	-	11.2	-	-	-	-
PWTS_40	-	-	11.2	-	-	-	-
PWTW_6	-	-	11.3	-	-	-	-
PWTW_7	-	-	11.3	-	-	-	-
PWTW_8	-	-	11.3	-	-	-	-
PWTW_9	-	-	11.2	-	-	-	-
PWTW_10	-	-	11.2	-	-	-	-
PWTW_11	-	-	11.2	-	-	-	-
PWTW_12	-	-	11.2	-	-	-	-
PWTW_13	-	-	11.2	-	-	-	-
PWTW_14	-	-	11.2	-	-	-	-
PWTW_15	-	-	11.2	-	-	-	-
PWTW_16	-	-	11.2	-	-	-	-
PWTW_17	-	-	11.2	-	-	-	-
PWTW_18	-	-	11.2	-	-	-	-
PWTW_19	-	-	11.2	-	-	-	-
PWTW_20	-	-	11.2	-	-	-	-
PWTW_21	-	-	11.2	-	-	-	-
PWTW_22	-	-	11.2	-	-	-	-
PWTW_23	-	-	11.2	-	-	-	-
PWTW_24	-	-	11.2	-	-	-	-

ANNUAL MEAN PM _{2.5} CONCENTRATIONS							
Receptor	2015 Base (µg/m ³)	2022 Base (µg/m ³)	2022 With Dev (µg/m ³)	% of AQAL	Change (µg/m ³)	% of AQO	Impact
PWTW_25	-	-	11.2	-	-	-	-
PWTW_26	-	-	11.2	-	-	-	-
PWTW_27	-	-	11.2	-	-	-	-
PWTW_28	-	-	11.2	-	-	-	-
PWTW_29	-	-	11.2	-	-	-	-
PWTW_30	-	-	11.2	-	-	-	-
PWTW_31	-	-	11.2	-	-	-	-
PWTW_32	-	-	11.2	-	-	-	-
PWTW_33	-	-	11.2	-	-	-	-
PWTW_34	-	-	11.2	-	-	-	-
PWTW_35	-	-	11.2	-	-	-	-
PWTW_36	-	-	11.2	-	-	-	-
PWTW_37	-	-	11.2	-	-	-	-
PWTW_38	-	-	11.2	-	-	-	-
PWTW_39	-	-	11.2	-	-	-	-
PWTW_40	-	-	11.2	-	-	-	-



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