

Project

2-4 Whitworth Street, Manchester
Detailed Air Quality Assessment

Prepared for

Glenbrook WWS Limited
Union
2-10 Albert Square
Manchester
M2 LW

Maizelands Limited
20 Churchill Place
London
E14 5HJ

Arringford Limited
20 Churchill Place
London
E14 5HJ

By

Tom Conboy BA (Hons) AMIEnvSc AIAQM

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Client Address:	Glenbrook WWS Limited Union 2-10 Albert Square Manchester M2 6LW	Maizelands Limited, Arringford Limited 20 Churchill Place London E14 5HJ
Author:	Tom Conboy BA (Hons) AMIEnvSc AIAQM	
Additional information:		

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P2	27/11/24	Updates Following Client Comments	Dave Clarke
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Summary

The proposal is for the construction of a build to rent residential tower at 2-4 Whitworth Street in Manchester. The tower will provide 364 apartments over up to 44 floors. The ground floor will include residential amenity, main front of house entrance & reception area, private resident's gym, plus associated back of house facilities (bin storage, cleaners store etc). Levels 1 and 2 also provide additional residential amenity space.

Construction activity associated with the proposed development is assessed to be high risk for dust soiling and medium risk for human health effects. The adverse impacts of construction on air quality are likely to be negligible through good site practice and by adopting the mitigation measures in **Section 7.1**.

Occupants of the development will likely be exposed to acceptable nitrogen dioxide (NO₂) and particulate matter (PM₁₀, and PM_{2.5}) concentrations. Measures to reduce air pollution and limit exposure to poor air quality are in **Section 7.2**.

Construction phase and operational phase traffic generated by the proposed development will have a negligible impact on air quality at new and existing sensitive receptors. The impact of construction phase and operational phase traffic with cumulative traffic considered is also negligible. The proposed development complies with local and national policy and no air quality constraints have been identified, based on the results of the assessment.

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1.0 Introduction

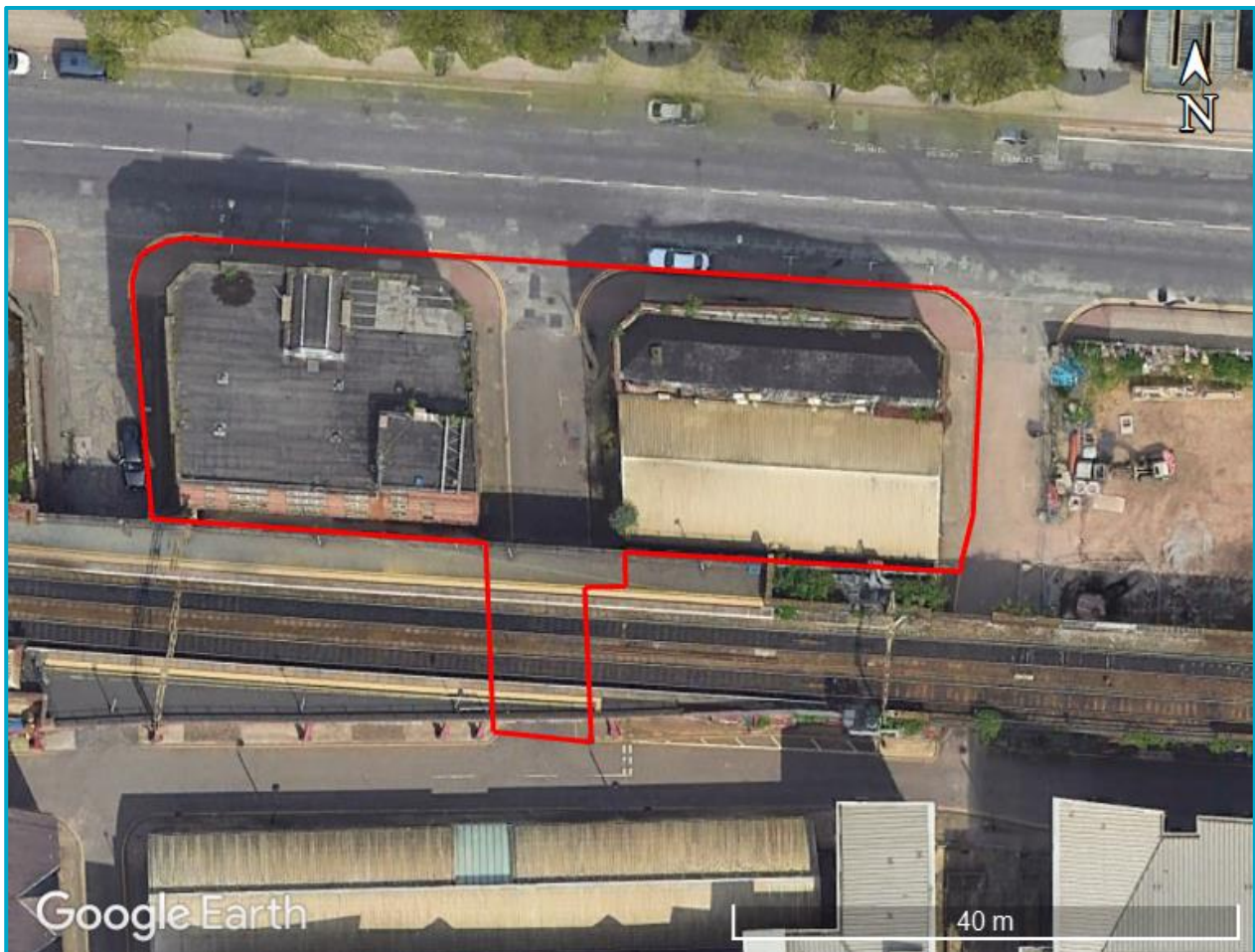
The proposal is for the construction of a build to rent residential tower at 2-4 Whitworth Street in Manchester. The tower will provide 364 apartments over up to 44 floors. The ground floor will include residential amenity, main front of house entrance & reception area, private resident's gym, plus associated back of house facilities (bin storage, cleaners store etc). Levels 1 and 2 also provide additional residential amenity space.

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

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

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

Figure 1. Site Area



2.0 Relevant Policy and Guidance

The Air Quality Strategy

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

Local Air Quality Management (LAQM)

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

National Planning Policy Framework (NPPF)

The NPPF (2023)² sets out the Government's planning policies for England and outlines how they are expected to be applied to achieve the Government's aim of sustainable development. The NPPF states in paragraph 191 that:

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

And at paragraph 192:

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

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

² Ministry of Housing, Communities and Local Government (2023).

Greater Manchester Air Quality Action Plan

Action 1.2 in the Greater Manchester Air Quality Action Plan³ states:

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

Manchester Local Development Framework: Core Strategy Development Plan Document

Manchester City Council state in Policy EN 16⁴:

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

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

Places for Everyone Joint Development Plan

Policy 2.33 in the Places for Everyone Joint Development Plan⁵ states the following goal:

“Deliver the highest possible quality of life for all our residents and address existing problems such as health disparities and air quality that currently detract from it.”

Guidance

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

- Local Air Quality Management Technical Guidance (LAQM.TG(22))⁶
- Land-Use Planning and Development Control: Planning for Air Quality. VI.2⁷
- National Planning Practice Guidance - Air Quality⁸
- Guidance on the Assessment of Dust from Demolition and Construction⁹

³ Greater Manchester Air Quality Action Plan (2016).

⁴ Manchester City Council (2012). Core Strategy Development Plan Document.

⁵ Greater Manchester Combined Authority (2024). Places for Everyone Joint Development Plan 2022 to 2039.

⁶ DEFRA (2021). Part IV of the Environment Act 1995 Environment (Northern Ireland) Order 2002 Part III Local Air Quality Management Technical Guidance (TG22).

⁷ Environmental Protection UK / Institute of Air Quality Management (2017).

⁸ Department of Communities and Local Government (DCLG) (2014).

⁹ Institute of Air Quality Management (2024).

3.0 Existing Conditions

3.1 Existing Air Quality Conditions

Existing air quality conditions near to the site have been assessed and show the following:

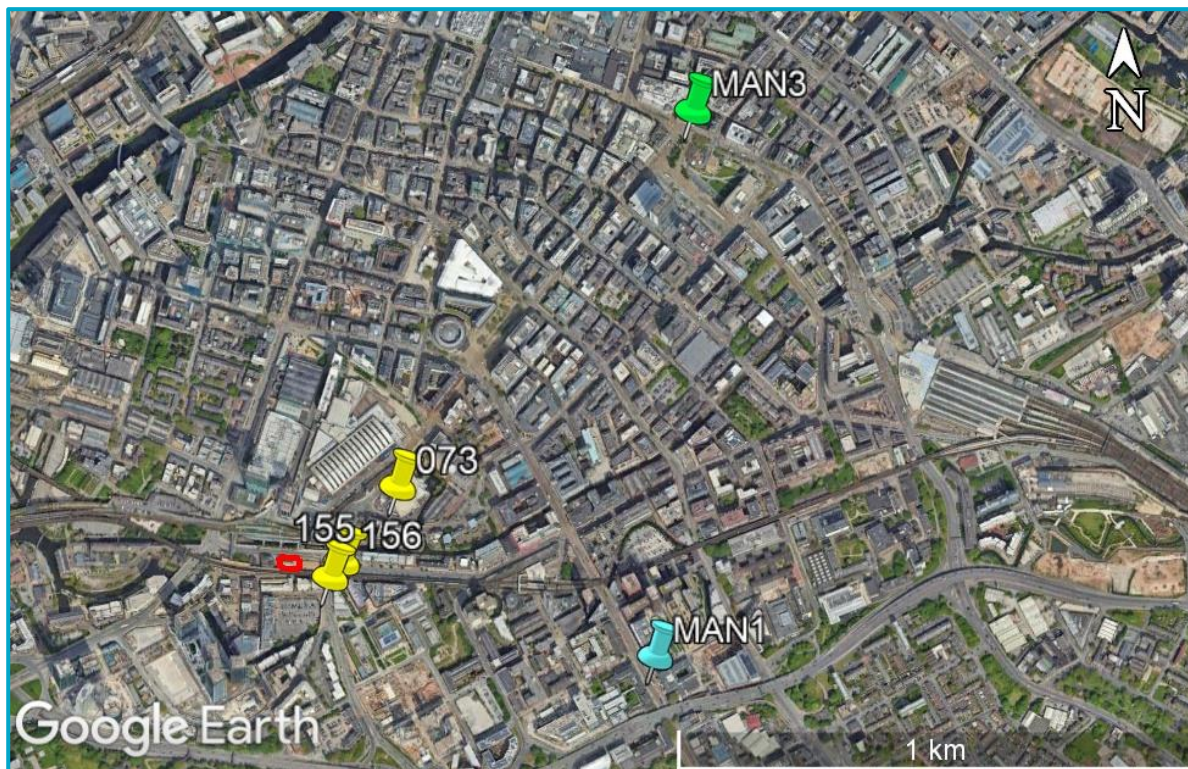
- Users of the development will likely be exposed to acceptable NO_2 , PM_{10} , and $\text{PM}_{2.5}$ concentrations.
- The prevailing wind direction at the site is likely to be southerly.
- The nearest industrial point source to the site is Manchester Metropolitan University approximately 1 km southeast. Emissions will predominantly be transported away from the site, due to the prevailing wind direction.
- A rail line runs immediately south of the site. Only the “Northern” line runs on this rail line, with approximately 10 trains travelling on it per hour on weekdays. Emissions from these trains will influence air quality at the site.

Further detail on existing air quality conditions is available in **Appendix C**.

3.2 Monitoring Locations

Figure 2 shows the most relevant monitoring locations to the site.

Figure 2. Site area (red), in relation to diffusion tubes (yellow), PM_{10} monitor (blue), and $\text{PM}_{2.5}$ monitor (green)



4.0 Dust Risk Assessment

4.1 Dust Emission Magnitude

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

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

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.

4.1.1 Demolition

The two existing buildings on site will be demolished. The total volume of building to be demolished will likely be between 12,000m³ and 75,000m³, based on maps. The main materials being demolished will likely be concrete and brickwork. Demolition works will occur above 12m height, based on the building heights. The potential dust emission magnitude from demolition is judged to be medium, following IAQM guidance.

4.1.2 Earthworks

The site area is 1,750m². The site geology is *sand to sandy loam*¹⁰; sand is made up of coarse particles and is therefore less prone to suspension in the air clay and silt. It is possible up to 10 earth-moving vehicles will operate on site at one time, based on the size of the site. The potential dust emission magnitude from earthworks is judged to be small, following IAQM guidance.

4.1.3 Construction

The total construction volume is likely to exceed 75,000m³, based on the site area and proposed building height (135m). The main construction materials will likely be concrete and brickwork. The potential dust emission magnitude from construction is judged to be large, following IAQM guidance.

4.1.4 Trackout

The number of HDVs generated by the site during the construction phase is currently unknown. As a worst-case scenario, there may be up to 50 outward HDV movements per day during the construction phase. These vehicles will likely travel over less than 50m of unpaved road length, based on the size of the site and the existing road network around the site. The potential dust emission magnitude from trackout is judged to be medium, following IAQM guidance.

¹⁰ UK Soil Observatory (2024). Accessed via <https://mapapps2.bgs.ac.uk/ukso/home.html>.

4.1.5 Summary of Dust Emission Magnitude

Table 5 summarises the dust emission magnitude of each activity.

Table 5. Dust Emission Magnitude

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

4.2 Sensitivity of the Study Area

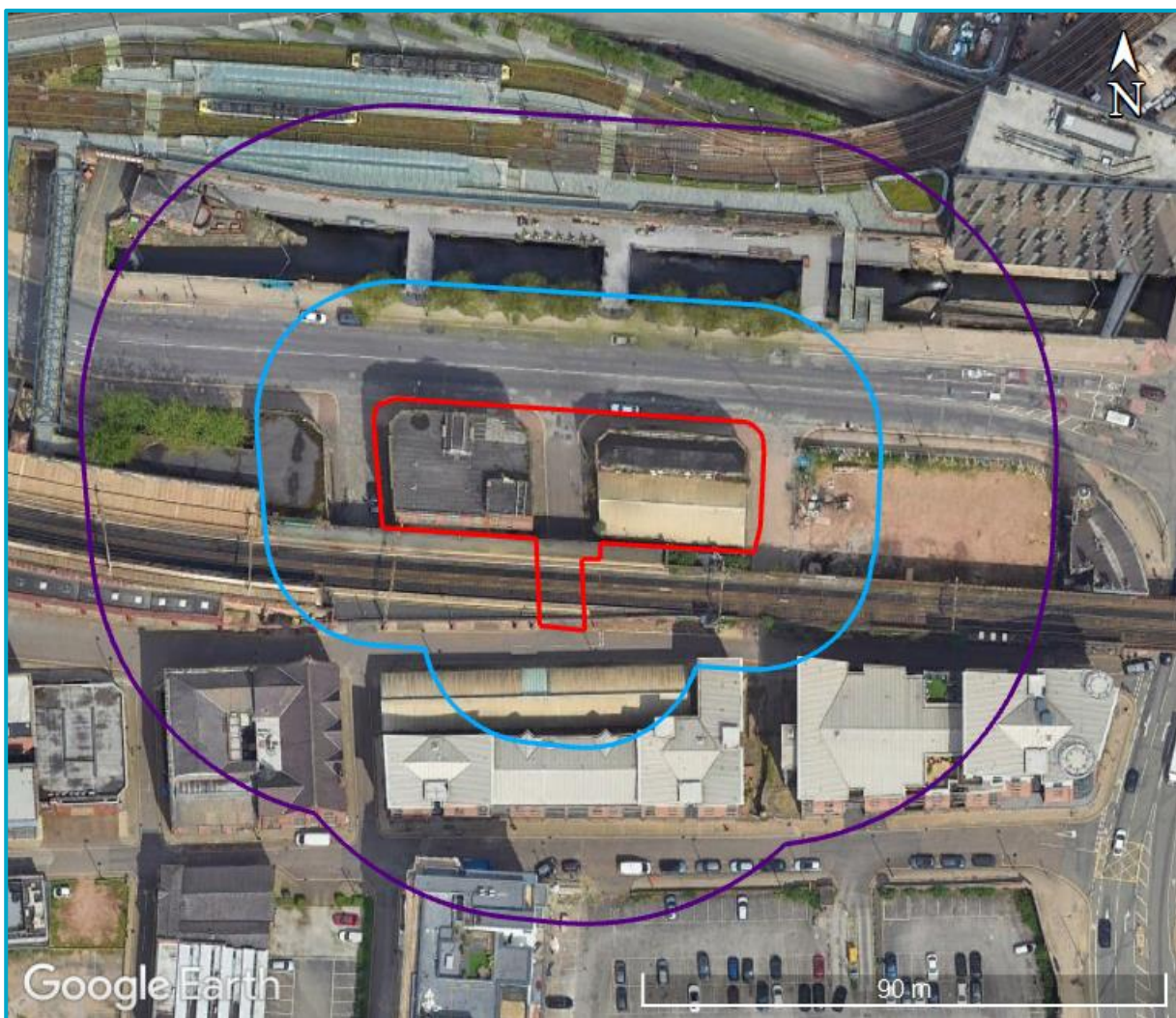
4.2.1 Dust Soiling Effects

1) Demolition, Earthworks, and Construction

Demolition, earthworks, and construction are considered together as they will occur across the same area.

Ropeworks Apartment Block A is within 20m of the demolition, earthworks, and construction boundary, as well as several commercial receptors such as Deansgate Station, Rebellion, and Manchester School of Acting (**Figure 3**). Ropeworks Apartment Block B is within 50m, as well as several more commercial receptors such as MC2, Popworld, and Revolution. The sensitivity of the local area to dust soiling effects due to demolition, earthworks, and construction are judged to be high.

Figure 3. Demolition, Earthworks, and Construction Area (red) with 20m (blue) and 50m (purple) Buffers



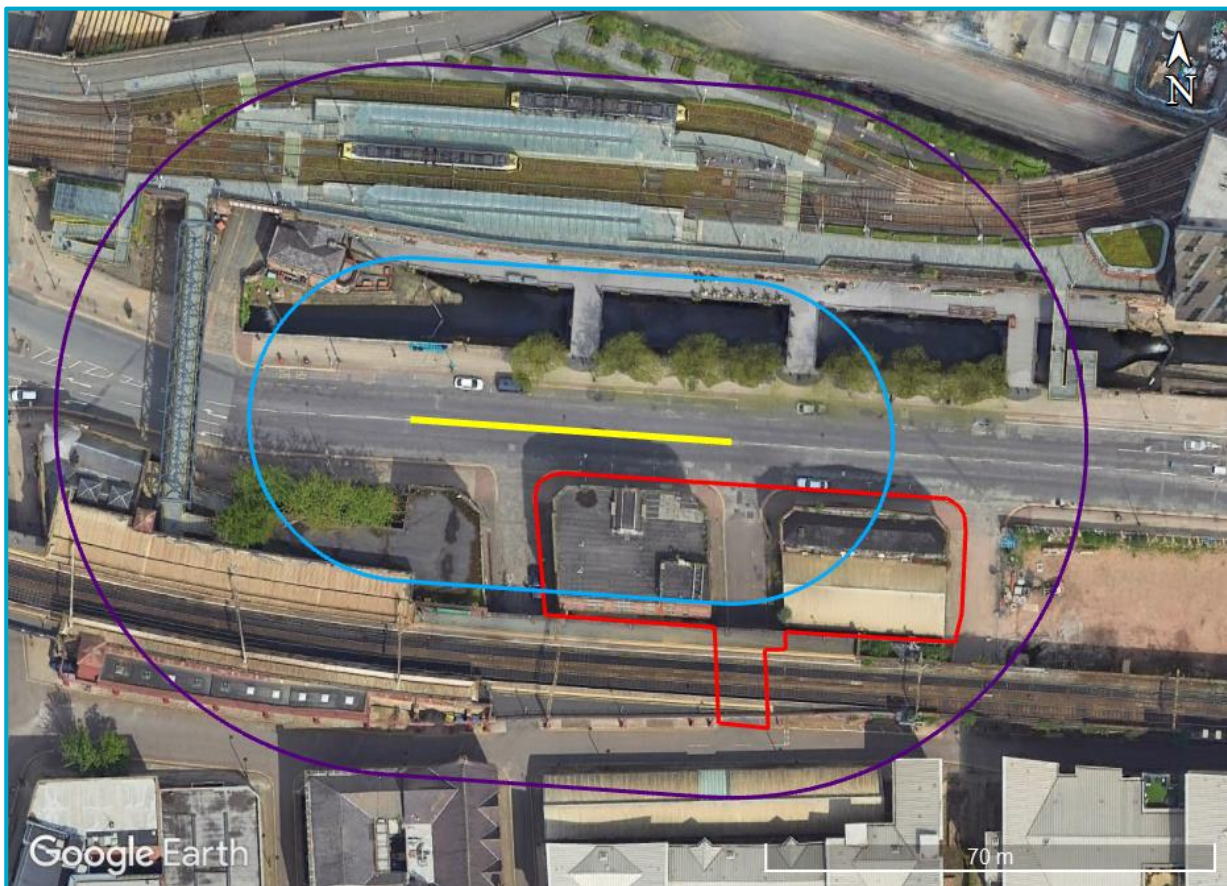
2) Trackout

The site size is small, following the IAQM guidance. The guidance recommends assessing trackout effects on the first 50m of public road from the site exit for small sites.

Construction traffic will likely travel west on B6469 Whitworth Street towards the A57(M) when leaving the site (**Figure 5**).

Deansgate Station, Rebellion, and Lock 91 are within 20m of the trackout route. Several commercial receptors are within 50m, such as Manchester School of Acting, Popworld, and Revolution. The sensitivity of the local area to dust soiling effects due to trackout is judged to be medium.

Figure 5. Assumed Trackout Route (yellow) with 20m (blue) and 50m (purple) Buffers



4.2.2 Health Effects of PM₁₀

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

The PM₁₀ data in **Section 3.7** show the concentration was likely no more than 18µg/m³ in 2022, which is below the annual mean objective of 40µg/m³, as well as the 24µg/m³ regime defined in the IAQM guidance.

1) Demolition, Earthworks, and Construction

Ropeworks Apartment Block A is within 20m of the demolition, earthworks, and construction boundary, as well as several commercial receptors such as Deansgate Station, Rebellion, and Manchester School of Acting. Ropeworks Apartment Block B is within 50m, as well as several more commercial receptors such as MC2, Popworld, and Revolution. With receptors likely exposed to no more than 18µg/m³ of PM₁₀, the health effects due to demolition, earthworks, and construction are judged to be medium.

2) Trackout

Deansgate Station, Rebellion, and Lock 91 are within 20m of the trackout route. Several commercial receptors are within 50m, such as Manchester School of Acting, Popworld, and Revolution. With receptors likely exposed to no more than 18µg/m³ of PM₁₀, the health effects due to trackout are judged to be low.

4.2.3 Ecological Effects

There are no ecological designations with 50m of the site, not within 50m of roads likely to be affected by trackout. Therefore, ecological effects relating to air quality are scoped out.

4.2.4 Summary of Sensitivity to Dust Effects

Table 6 summarises the sensitivities assessed for the area. The highest sensitivities assessed are recorded within the table and will be taken forward in the assessment.

Table 6. Sensitivity of Area

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

4.3 Overall Dust Impact Risk

The predicted dust emission magnitude (**Table 5**) has been combined with the sensitivity of the area (**Table 6**) to determine the risk of impacts during the construction phase, prior to mitigation. **Table 7** summarises the risk of dust impacts for the proposed development. The risk category identified for each construction activity has been used to determine the level of mitigation required.

Table 7. Summary of Dust Risk Impacts

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium Risk	Low Risk	High Risk	Medium Risk
Human Health	Medium Risk	Low Risk	Medium Risk	Low Risk
Ecological	N/A	N/A	N/A	N/A

5.0 Construction and Operational Phase Air Quality Impacts

5.1 Construction Vehicles and Plant

The project transport consultant, Curtins, has stated there could be up to 65 construction vehicle movements per day during peak construction. This exceeds the IAQM/EPUK threshold of 25 movements per day. Therefore, the potential impact of these vehicles on local air quality has been quantitatively assessed in this assessment.

5.2 Operational Road Traffic

No car parking is proposed with the development. Curtins has stated there will be 181 vehicle movements generated by the operational development per day. 140 of these movements will consist of taxis, drop-offs, servicing, and deliveries. The remaining 41 movements will occur at off-site car parks. Therefore, the IAQM/EPUK threshold of 100 LDV movements per day will be exceeded. The potential impact of these vehicles on local air quality has been quantitatively assessed in this assessment.

5.3 Modelling Scenarios

Seven scenarios have been modelled:

- 2022 - Model verification and baseline
- 2025 - Future baseline
- 2025 - Peak construction year with construction phase traffic
- 2025 - Peak construction year with construction phase traffic and cumulative traffic
- 2027 - Future baseline
- 2027 - Future baseline with operational phase traffic
- 2027 - Future baseline with operational phase traffic and cumulative traffic.

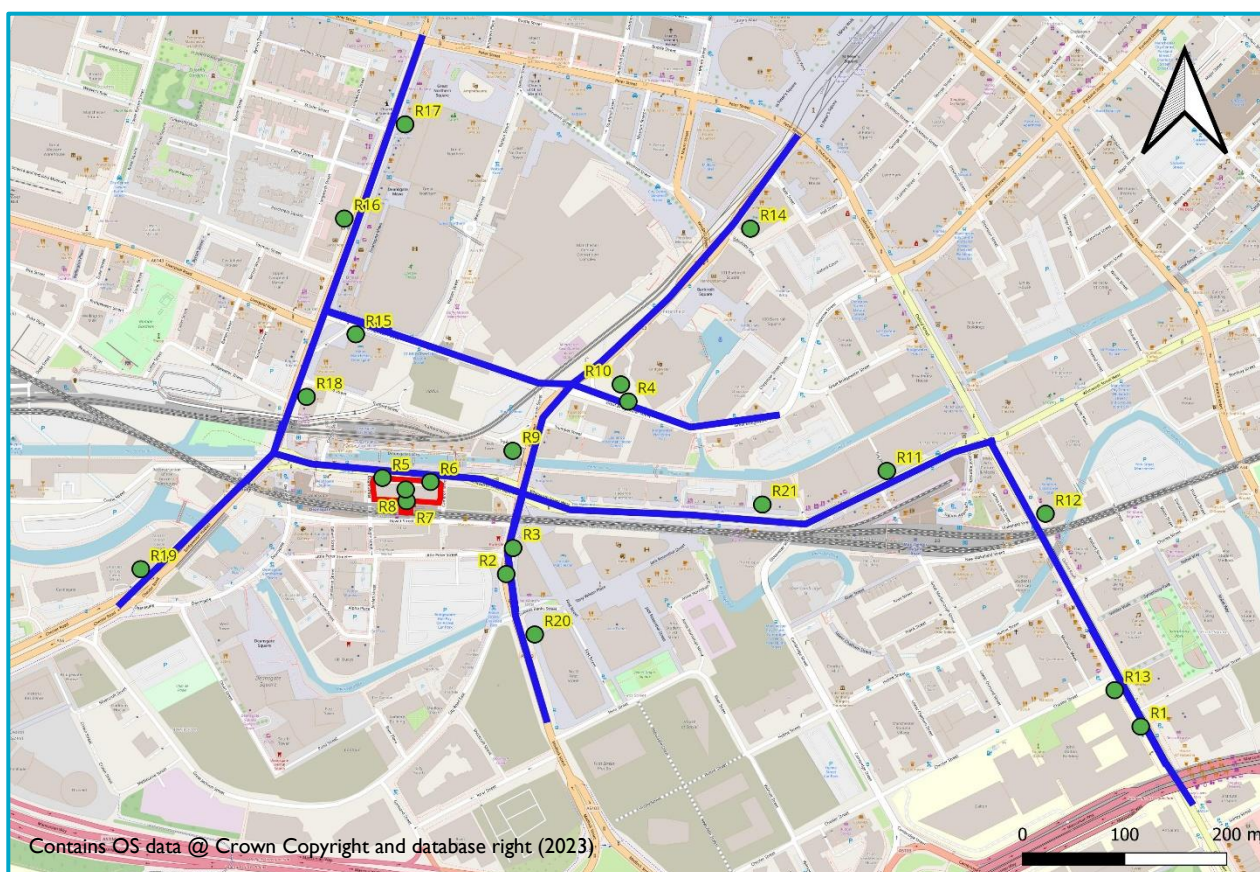
Further details of the methodology used in the assessment are set out in **Appendix F**. Traffic data and emissions used in the assessment are set out in **Appendix G**. Full results of the assessment are detailed in **Appendix H** and are summarised below.

6.0 NO₂, PM₁₀, and PM_{2.5} Concentrations

6.1 Modelled Receptors

Figure 6 shows the receptors included in the dispersion model.

Figure 6. Modelled Receptors



6.2 Annual and Hourly Mean NO₂ Concentrations

6.2.1 2025 Future with Construction Phase Traffic

The highest modelled NO₂ concentration at the sensitive receptors during the construction phase was at R10, with an annual mean NO₂ concentration of 23.45µg/m³. The highest modelled NO₂ concentration at the proposed site was at R6, with an annual mean NO₂ concentration of 22.21µg/m³. These are below the annual mean objective limit of 40µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean NO₂ concentrations.

The largest NO₂ increase was also at R10, with a 0.12µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

It is unlikely that the hourly mean NO₂ objective of 200µg/m³ will be exceeded, based on the relationship between hourly and annual mean NO₂ concentrations¹¹, as all predicted annual mean concentrations are well below 60µg/m³. Therefore, the impact during the construction phase on hourly mean NO₂ concentrations at new and existing receptors is judged to be negligible.

Table 8. Modelled NO₂ Concentrations (selected)

Receptor ID	Receptor Name	2025 Baseline	2025 With Construction Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	22.16	22.21	0.05	0	56	Negligible
R10	Bridgewater Hall	23.33	23.45	0.12	0	59	Negligible
R11	Kimpton Clocktower	22.14	22.20	0.06	0	56	Negligible
R17	The Covenant Nation	22.38	22.43	0.05	0	56	Negligible

¹¹ The hourly mean objective is unlikely to be exceeded where the annual mean NO₂ concentration is less than 60µg/m³, and where the predominant source of emissions is road traffic (Defra, 2018).

6.2.2 2025 Future with Construction Phase and Cumulative Traffic

The highest modelled NO₂ concentration at the sensitive receptors during the construction phase with cumulative traffic was at R10, with an annual mean NO₂ concentration of 24.15µg/m³. The highest modelled NO₂ concentration at the proposed site was at R6, with an annual mean NO₂ concentration of 22.55µg/m³. These are below the annual mean objective limit of 40µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean NO₂ concentrations.

The largest NO₂ increase was also at R10, with a 0.82µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

It is unlikely that the hourly mean NO₂ objective of 200µg/m³ will be exceeded, based on the relationship between hourly and annual mean NO₂ concentrations¹², as all predicted annual mean concentrations are well below 60µg/m³. Therefore, the impact during the construction phase with cumulative traffic on hourly mean NO₂ concentrations at new and existing receptors is judged to be negligible.

Table 9. Modelled NO₂ Concentrations (selected)

Receptor ID	Receptor Name	2025 Baseline	20256 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	22.16	22.21	0.05	0	56	Negligible
R9	Hiltop Serviced Apartments	22.93	23.44	0.51	1	59	Negligible
R10	Bridgewater Hall	23.33	23.45	0.12	0	59	Negligible

¹² The hourly mean objective is unlikely to be exceeded where the annual mean NO₂ concentration is less than 60µg/m³, and where the predominant source of emissions is road traffic (Defra, 2018).

6.2.3 2027 Future with Operational Phase Traffic

The highest modelled NO₂ concentration at the sensitive receptors during the operational phase was at R10, with an annual mean NO₂ concentration of 21.90µg/m³. The highest modelled NO₂ concentration at the proposed site was at R6, with an annual mean NO₂ concentration of 20.91µg/m³. These are below the annual mean objective limit of 40µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean NO₂ concentrations.

The largest NO₂ increases were at R9, R10, R11, and R21 with a 0.03µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

It is unlikely that the hourly mean NO₂ objective of 200µg/m³ will be exceeded, based on the relationship between hourly and annual mean NO₂ concentrations¹³, as all predicted annual mean concentrations are well below 60µg/m³. Therefore, the impact during the operational phase on hourly mean NO₂ concentrations at new and existing receptors is judged to be negligible.

Table 10. Modelled NO₂ Concentrations (selected)

Receptor ID	Receptor Name	2027 Baseline	2027 With Operational Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	20.89	20.91	0.02	0	52	Negligible
R9	Hiltop Serviced Apartments	21.53	21.56	0.03	0	54	Negligible
R10	Bridgewater Hall	21.87	21.90	0.03	0	55	Negligible
R11	O2 Ritz	20.87	20.90	0.03	0	52	Negligible
R21	Bridgewater Bank South	20.74	20.77	0.03	0	52	Negligible

¹³ The hourly mean objective is unlikely to be exceeded where the annual mean NO₂ concentration is less than 60µg/m³, and where the predominant source of emissions is road traffic (Defra, 2018).

6.2.4 2027 Future with Operational Phase and Cumulative Traffic

The highest modelled NO₂ concentration at the sensitive receptors during the operational phase with cumulative traffic applied was at R10, with an annual mean NO₂ concentration of 22.55µg/m³. The highest modelled NO₂ concentration at the proposed site was at R6, with an annual mean NO₂ concentration of 21.04µg/m³. These are below the annual mean objective limit of 40µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean NO₂ concentrations.

The largest NO₂ increase was also at R10, with a 0.38µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

It is unlikely that the hourly mean NO₂ objective of 200µg/m³ will be exceeded, based on the relationship between hourly and annual mean NO₂ concentrations¹⁴, as all predicted annual mean concentrations are well below 60µg/m³. Therefore, the impact during the construction phase with cumulative traffic on hourly mean NO₂ concentrations at new and existing receptors is judged to be negligible.

Table 11. Modelled NO₂ Concentrations (selected)

Receptor ID	Receptor Name	2027 Future Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	20.89	21.04	0.15	0	53	Negligible
R9	Hiltop Serviced Apartments	21.53	21.76	0.23	1	54	Negligible
R10	Bridgewater Hall	21.87	22.25	0.38	1	56	Negligible

¹⁴ The hourly mean objective is unlikely to be exceeded where the annual mean NO₂ concentration is less than 60µg/m³, and where the predominant source of emissions is road traffic (Defra, 2018).

6.3 Annual and Daily Mean PM₁₀ Concentrations

6.3.1 2025 Future with Construction Phase Traffic

The highest modelled PM₁₀ concentration at the sensitive receptors during the construction phase was at R10, with an annual mean PM₁₀ concentration of 13.24µg/m³; the highest modelled PM₁₀ concentration at the proposed site was at R6, with an annual mean PM₁₀ concentration of 13.02µg/m³. These are below the annual mean objective limit of 40µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM₁₀ concentrations.

The largest PM₁₀ increases were at R9, R10, R11, R12, R16, and R18 with a 0.02µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

There are no days where PM₁₀ concentrations exceed 50µg/m³ at any sensitive receptors; therefore, the impact of construction traffic on daily mean PM₁₀ concentrations is judged to be negligible.

Table 12. Modelled PM₁₀ Concentrations (selected)

Receptor ID	Receptor Name	2025 Baseline	2025 With Construction Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	13.01	13.02	0.01	0	33	Negligible
R9	Hiltop Serviced Apartments	13.19	13.21	0.02	0	33	Negligible
R10	Bridgewater Hall	13.22	13.24	0.02	0	33	Negligible
R11	O2 Ritz	13.02	13.04	0.02	0	33	Negligible
R12	Kimpton Clocktower	12.77	12.79	0.02	0	32	Negligible
R16	Sovereign House	12.94	12.96	0.02	0	32	Negligible
R18	The Deansgate	12.92	12.94	0.02	0	32	Negligible

6.3.2 2025 Future with Construction Phase and Cumulative Traffic

The highest modelled PM_{10} concentration at the sensitive receptors during the construction phase and cumulative traffic applied was at R10, with an annual mean PM_{10} concentration of $13.33\mu g/m^3$. The highest modelled PM_{10} concentration at the proposed site was at R6, with an annual mean PM_{10} concentration of $13.09\mu g/m^3$. These are below the annual mean objective limit of $40\mu g/m^3$. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{10} concentrations.

The largest PM_{10} increases were at R9 and R10, with a $0.11\mu g/m^3$ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

There are no days where PM_{10} concentrations exceed $50\mu g/m^3$ at any sensitive receptors; therefore, the impact of construction traffic and cumulative construction traffic on daily mean PM_{10} concentrations is judged to be negligible.

Table 13. Modelled PM_{10} Concentrations (selected)

Receptor ID	Receptor Name	2025 Future Baseline	2025 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	13.01	13.09	0.08	0	33	Negligible
R9	Hiltop Serviced Apartments	13.19	13.30	0.11	0	33	Negligible
R10	Bridgewater Hall	13.22	13.33	0.11	0	33	Negligible

6.3.3 2027 Future with Operational Phase Traffic

The highest modelled PM_{10} concentration at the sensitive receptors during the operational phase was at R10, with an annual mean PM_{10} concentration of $13.13\mu g/m^3$. The highest modelled PM_{10} concentration at the proposed site was at R6, with an annual mean PM_{10} concentration of $12.93\mu g/m^3$. These are below the annual mean objective limit of $40\mu g/m^3$. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{10} concentrations.

The largest PM_{10} increases were at R6, R8, R9, R10, R11, R12, R13, R15, R16, R17, and R18 with a $0.01\mu g/m^3$ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

There are no days where PM_{10} concentrations exceed $50\mu g/m^3$ at any sensitive receptors; therefore, the impact of the operational traffic on daily mean PM_{10} concentrations is judged to be negligible.

Table 14. Modelled PM_{10} Concentrations (selected)

Receptor ID	Receptor Name	2027 Baseline	2027 With Operational Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	12.92	12.93	0.01	0	32	Negligible
R9	Hiltop Serviced Apartments	13.10	13.11	0.01	0	33	Negligible
R10	Bridgewater Hall	13.13	13.14	0.01	0	33	Negligible

6.3.4 2027 Future with Operational Phase and Cumulative Traffic

The highest modelled PM_{10} concentration at the sensitive receptors during the operational phase with cumulative traffic was at R10, with an annual mean PM_{10} concentration of $13.25\mu g/m^3$; the highest modelled PM_{10} concentration at the proposed site was at R6, with an annual mean PM_{10} concentration of $12.97\mu g/m^3$. These are below the annual mean objective limit of $40\mu g/m^3$. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{10} concentrations.

The largest PM_{10} increase was also at R10, with a $0.12\mu g/m^3$ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

There are no days where PM_{10} concentrations exceed $50\mu g/m^3$ at any sensitive receptors; therefore, the impact of operational traffic and cumulative operational traffic on daily mean PM_{10} concentrations is judged to be negligible.

Table 15. Modelled PM_{10} Concentrations (selected)

Receptor ID	Receptor Name	2027 Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	12.92	12.97	0.05	0	32	Negligible
R9	Hiltop Serviced Apartments	13.10	13.19	0.09	0	33	Negligible
R10	Bridgewater Hall	13.13	13.25	0.12	0	33	Negligible

6.4 Annual Mean PM_{2.5} Concentrations

6.4.1 2025 Future with Construction Phase Traffic

The highest modelled PM_{2.5} concentration at the sensitive receptors during the construction phase was at R10, with an annual mean PM_{2.5} concentration of 8.36µg/m³; the highest modelled PM_{2.5} concentration at the proposed site was at R6, with an annual mean PM_{2.5} concentration of 8.24µg/m³. These are below the annual mean objective limit of 20µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{2.5} concentrations.

The largest PM_{2.5} increases were at R10, R11, R13, R16, R18, R20, and R21 with a 0.01µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

Table 16. Modelled PM_{2.5} Concentrations (selected)

Receptor ID	Receptor Name	2025 Baseline	2025 With Construction Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	8.23	8.24	0.01	0	41	Negligible
R10	Bridgewater Hall	8.35	8.36	0.01	0	42	Negligible
R11	O2 Ritz	8.24	8.25	0.01	0	41	Negligible
R13	Dalton Building	8.33	8.34	0.01	0	42	Negligible
R16	Sovereign House	8.26	8.27	0.01	0	41	Negligible
R18	The Deansgate	8.25	8.26	0.01	0	41	Negligible
R20	Pure Gym First Street	8.26	8.27	0.01	0	41	Negligible
R21	Bridgewater Bank South	8.21	8.22	0.01	0	41	Negligible

6.4.2 2025 Future with Construction Phase and Cumulative Traffic

The highest modelled PM_{2.5} concentration at the sensitive receptors during the construction phase with cumulative traffic was at R10, with an annual mean PM_{2.5} concentration of 8.42µg/m³; the highest modelled PM_{2.5} concentration at the proposed site was at R6, with an annual mean PM_{2.5} concentration of 8.28µg/m³. These are below the annual mean objective limit of 20µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{2.5} concentrations.

The largest PM_{2.5} increase was at R10, with a 0.07µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

Table 17. Modelled PM_{2.5} Concentrations (selected)

Receptor ID	Receptor Name	2025 Future Baseline	2025 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	8.23	8.28	0.05	0	33	Negligible
R9	Hiltop Serviced Apartments	8.34	8.39	0.05	0	34	Negligible
R10	Bridgewater Hall	8.35	8.42	0.07	0	34	Negligible

6.4.3 2027 Future with Operational Phase Traffic

The highest modelled $PM_{2.5}$ concentration at the sensitive receptors during the operational phase was at R10, with an annual mean $PM_{2.5}$ concentration of $8.36\mu g/m^3$; the highest modelled $PM_{2.5}$ concentration at the proposed site was at R6, with an annual mean $PM_{2.5}$ concentration of $8.24\mu g/m^3$. These are below the annual mean objective limit of $20\mu g/m^3$. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean $PM_{2.5}$ concentrations.

The largest $PM_{2.5}$ increases were at R9, R11, R17, and R19 with a $0.01\mu g/m^3$ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

Table 18. Modelled $PM_{2.5}$ Concentrations (selected)

Receptor ID	Receptor Name	2027 Baseline	2027 With Operational Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	8.24	8.24	0	0	41	Negligible
R9	Hiltop Serviced Apartments	8.34	8.35	0.01	0	42	Negligible
R10	Bridgewater Hall	8.36	8.36	0	0	42	Negligible
R11	O2 Ritz	8.24	8.25	0.01	0	41	Negligible
R17	The Covenant Nation	8.29	8.30	0.01	0	42	Negligible
R19	Castlefield Wharf Complex	8.17	8.18	0.01	0	41	Negligible

6.4.4 2027 Future with Operational Phase and Cumulative Traffic

The highest modelled PM_{2.5} concentration at the sensitive receptors during the operational phase with cumulative traffic was at R10, with an annual mean PM_{2.5} concentration of 8.43µg/m³; the highest modelled PM_{2.5} concentration at the proposed site was at R6, with an annual mean PM_{2.5} concentration of 8.27µg/m³. These are below the annual mean objective limit of 20µg/m³. Therefore, nearby sensitive receptors and the proposed development will likely be exposed to acceptable annual mean PM_{2.5} concentrations.

The largest PM_{2.5} increase was also at R10, with a 0.07µg/m³ increase. The significance of this increase is negligible, in line with the IAQM/EPUK guidance.

Table 19. Modelled NO₂ Concentrations (selected)

Receptor ID	Receptor Name	2027 Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R6	Site East	8.24	8.27	0.03	0	33	Negligible
R9	Hiltop Serviced Apartments	8.34	8.39	0.05	0	34	Negligible
R10	Bridgewater Hall	8.36	8.43	0.07	0	34	Negligible

7.0 Mitigation

7.1 Construction Phase Mitigation Measures

The assessment of potential construction phase impacts has found that the proposed development is high risk for dust soiling and medium risk for human health effects. **Tables 20-23** presents mitigation measures that should be used to reduce the risk of air quality impacts during the construction phase of the proposed development.

Table 20. General Dust Mitigation Measures

Communications
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
Display the head or regional office contact information.
Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site.
Site Management
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
Make the complaints log available to the local authority when asked.
Record any exceptional incidents that cause dust and/or air emissions, either on- or off site, and the action taken to resolve the situation in the logbook.
Hold regular liaison meetings with other high risk construction sites within 500 m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.
Monitoring
Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100 m of site boundary, with cleaning to be provided if necessary.
Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.

Communications
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
Agree dust deposition, dust flux, or real-time PM ₁₀ continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it is a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.
Preparing and Maintaining the Site
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
Avoid site runoff of water or mud.
Keep site fencing, barriers and scaffolding clean using wet methods.
Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
Cover, seed, or fence stockpiles to prevent wind whipping.
Operating Vehicle/Machinery and Sustainable Travel
Ensure all vehicles switch off engines when stationary - no idling vehicles.
Avoid the use of diesel- or petrol-powered generators and use mains electricity or battery powered equipment where practicable.
Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing).
Operations
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.

Communications
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
Use enclosed chutes and conveyors and covered skips.
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste Management
Avoid bonfires and burning of waste materials.

Table 21. Dust Mitigation Measures Specific to Demolition

Measures Specific to Demolition
Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).
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.
Avoid explosive blasting, using appropriate manual or mechanical alternatives
Bag and remove any biological debris or damp down such material before demolition.

Table 22. Dust Mitigation Measures Specific to Construction

Measures Specific to Construction
Avoid scabbling (roughening of concrete surfaces) if possible.
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
For smaller supplies of fine powder materials, ensure bags are sealed after use and are stored appropriately to prevent dust.

Table 23. Dust Mitigation Measures Specific to Trackout

Measures Specific to Trackout
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
Avoid dry sweeping of large areas.
Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
Record all inspections of haul routes and any subsequent action in a site logbook.
Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible.

7.2 Operational Phase Mitigation Measures

Although the impact of the development on local air quality is likely to be negligible, the following measures in Section 5.10 of the IAQM/EPUK guidance must be followed where practicable.

“Design Phase:

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

Operational Phase:

- *Where development generates significant additional traffic, provision of a detailed travel plan (with provision to measures its implementation and effect) which sets out measures to encourage sustainable means of transport (public, cycling and walking) via subsidised or free-ticketing, improved links to bus stops, improved infrastructure and layouts to improve accessibility and safety*
- *All gas-fired boilers to meet a minimum standard of <40mgNO_x/kWh*
- *All gas-fired CHP plant to meet a minimum emission standard of:*
 - *Spark ignition engine: 250mgNO_x/Nm³*
 - *Compression ignition engine: 400mgNO_x/Nm³*
 - *Gas turbine: 50mgNO_x/Nm³*
- *A presumption should be to use natural gas-fired installations. Where biomass is proposed within an urban area it is to meet minimum emissions standards of:*
 - *Solid biomass boiler: 275mgNO_x/Nm³ and 25mgPM/Nm³”*

Appendix A – Glossary

Table AI. Definitions

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

Appendix B – Air Quality Objective Limits

Table B1. Pollutant objectives

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

Appendix C – Existing Air Quality Conditions

CI. Existing Conditions

1) AQMAs

The site is within Manchester Air Quality Management Area (AQMA), defined by GMCA for annual mean NO₂ exceedances.

2) Wind Direction

The nearest meteorological monitoring station to the site is the Manchester monitor approximately 14km south¹⁵. The prevailing wind direction at this monitor is southerly, which is likely to be the same at the site.

3) Nearby Pollution Sources

A review of the NAEI point source inventory shows the nearest industrial point source to the site is Manchester Metropolitan University approximately 1km southeast¹⁶. Emissions will predominantly be transported away from the site, due to the prevailing wind direction.

A rail line runs immediately south of the site. Only the “Northern” line runs on this rail line, with approximately 10 trains travelling on it per hour on weekdays. Emissions from these trains will influence air quality at the site.

4) Background Pollutant Concentrations

Table CI summarises the background NO₂, PM₁₀, and PM_{2.5} concentrations used in the assessment. The concentrations have been taken from the most recent version of DEFRA's background maps. 2022 is the base year because it is the most recently reported monitoring dataset for the GMCA area. 2025 is the assumed peak construction year. 2027 is the first year of operation.

Table CI. Background Pollutant Concentrations (µg/m³)

Grid Square	NO ₂			PM ₁₀			PM _{2.5}		
	2022	2025	2027	2022	2025	2027	2022	2025	2027
383500, 397500 (Site)	22.8	20.6	19.6	12.9	12.6	12.5	8.3	8.0	8.0
383500, 396500	18.0	16.2	15.4	12.9	12.5	12.5	8.2	8.0	8.0
382500, 397500	19.8	17.7	16.7	12.6	12.3	12.3	8.2	7.9	7.9
382500, 396500	17.7	15.9	15.1	12.2	11.9	11.8	8.1	7.8	7.8
Annual Mean Objective Limits	40µg/m ³			40µg/m ³			20µg/m ³		

¹⁵ ADM Ltd (2023) Accessed via: [Met Data Search - ADM \(aboutair.com\)](https://aboutair.com/)

¹⁶ NAEI (2023) Accessed via: [UK Emissions Interactive Map \(beis.gov.uk\)](https://beis.gov.uk/)

5) NO₂ Monitoring

Table C2 shows data from the NO₂ monitors closest to the site.

Table C2. NO₂ Monitoring Data

Monitoring Site ID	Site Type	OS Grid Ref.	Height (m)	Annual Mean NO ₂ Concentrations (µg/m ³)				
				2018	2019	2020	2021	2022
Automatic								
MANI	Kerbside	384233, 397287	2.0	62	59	36	44	43
Diffusion Tube								
CAP_MANC_I55	Roadside	383603, 397441	2.0	-	-	-	-	33.5
CAP_MANC_I56	Roadside	383626, 397471	2.0	-	-	-	-	35.7
CAP_MANC_073	Roadside	383737, 397617	2.2	-	43.6	25.8	29.3	34.8
Objective								
40µg/m ³								

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

Although GMCA measures NO₂ at multiple automatic monitoring sites, NO₂ concentrations from the nearest of these to the site (MANI), is not considered representative of NO₂ concentrations at the site because it is located on a much busier road (Oxford Road) and is located within close proximity to the A57(M), meaning NO₂ concentrations at this monitor will likely be higher than the site.

Both CAP_MANC_I55 and CAP_MANC_I56 are not considered representative of the NO₂ concentration at the site because they are roadside of the A1503. This means more traffic will likely pass these monitors compared to the proposed site, and therefore the NO₂ concentration at these monitors is likely to be higher than at the site.

Monitor CAP_MANC_073 cannot be considered representative of the site, as it located near to the junction of the A1503 and Great Bridgewater Street. Therefore, this monitor is likely to experience a more slow-moving traffic than the site, and therefore higher concentrations of NO₂.

Conclusions about the NO₂ concentration at the site can be drawn from this data, however. The NO₂ concentration at all the diffusion tubes are below the annual mean objective limit and given the NO₂ concentration at the site is likely to be lower than at these monitors, the NO₂ concentration at the site is likely to be below the annual mean objective limit. Therefore, users of the development will likely be exposed to acceptable NO₂ concentrations.

6) PM₁₀ Monitoring

GMCA monitors PM₁₀ at multiple locations within their administrative area. Data from the most relevant monitor are shown in **Table C3**.

Table C3. PM₁₀ Monitoring Data

Monitoring Site ID	Site Type	OS Grid Ref.	Height (m)	Annual Mean PM ₁₀ Concentrations (µg/m³)				
				2018	2019	2020	2021	2022
Automatic								
MAN1	Kerbside	384233, 397287	2.0	30	26	18	18	18
Objective								
40µg/m³								

MAN1 is not comparable to the site for the reasons outlined in **Section 3.6**. However, the PM₁₀ concentration measured in 2022 was well below the objective limit. As the monitor is located on a significantly busier road and is located within close proximity to the A57(M), the PM₁₀ at the proposed site is also likely to be below the objective limit. Therefore, users of the development will likely be exposed to acceptable PM₁₀ concentrations.

7) PM_{2.5} Monitoring

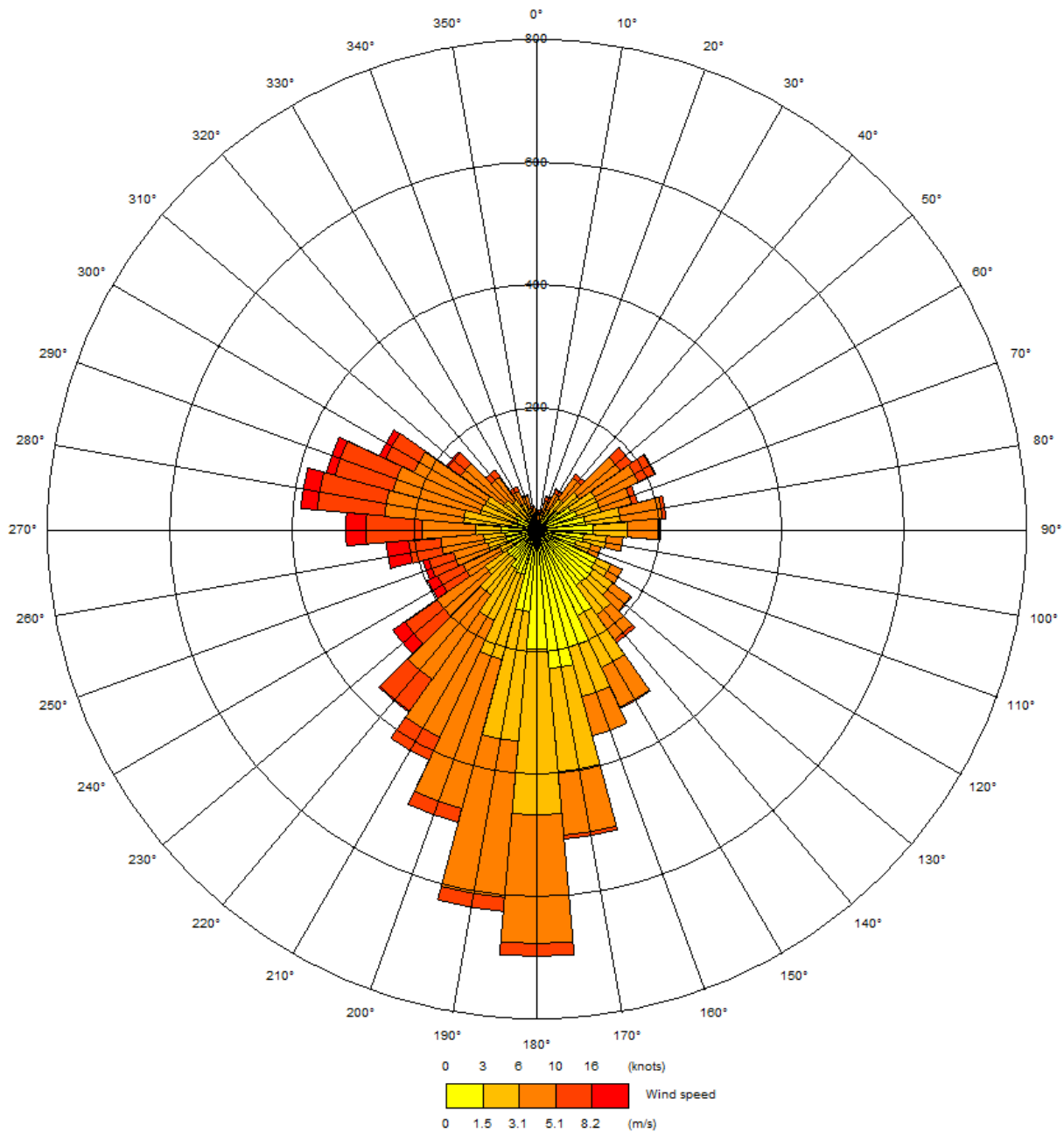
GMCA monitors PM_{2.5} at multiple locations within their administrative area. Data from the most relevant monitor are shown in **Table C4**.

Table C4. PM_{2.5} Monitoring Data

Monitoring Site ID	Site Type	OS Grid Ref.	Height (m)	Annual Mean PM _{2.5} Concentrations (µg/m³)				
				2018	2019	2020	2021	2022
Automatic								
MAN3	Urban Centre	384310, 398337	2.0	11	12	8	9	10
Objective								
20µg/m³								

The PM_{2.5} concentration at the closest monitor (MAN3) is not comparable to the proposed site, as it is located in a pedestrianised area. Therefore, the site is likely to experience more traffic than this monitor, and therefore higher PM_{2.5} concentrations, as it is adjacent to the B6469. However, the PM_{2.5} concentration is not expected to be much higher than the monitor that it exceeds the annual mean objective limit. Therefore, users of the development will likely be exposed to acceptable PM_{2.5} concentrations.

Appendix D – Windrose from Manchester meteorological station, 2022



Appendix E – Committed Developments

Table E1 lists all committed developments within a 500m radius of the proposed development and the traffic each will generate that is relevant to this assessment. All traffic information in **Table E1** is from the air quality and or transport assessment submitted with each application.

Table E1. Nearby committed developments

Location	Planning Application Ref	Construction Traffic Movements	Operational Traffic Movements
Existing Baseline			
70 Great Bridgewater Street (Havelock)	I29081/FO/2021	<i>“Less than 10 HDV movements anticipated per day.”</i>	<i>“The proposed development will reduce the number of car parking spaces provided and therefore, reduce the number of trips associated with the Site.”</i>
Square Gardens	I25573/FO/2019 I38831/FO/2023	<i>“The results of the Transport Assessment indicate that the aforementioned EPUK/IAQM thresholds are not expected to be exceeded.”</i>	No more than 152 movements on any one road based on data provided in air quality assessment.
Plot 9a First Street	I32600/FO/2021	Traffic from this application not modelled on roads relevant to this assessment.	
St. Michaels	I14664/FO/2016 I37873/JO/2023 (Amendment App)	No air quality assessment available on planning portal.	
StayCity Deansgate	I25804/FO/2019	<i>“The Proposed Development quantum is not anticipated to result in a significant increase in movements above the EPUK and IAQM criterion.”</i>	B6469 – 63 LDVs A34 – 63 LDVs A5103 – 189 LDVs A56 – 84 LDVs Great Bridgewater Street – 84 LDVs
Plot 10b First Street	I36170/FO/2023	Traffic from this application not modelled on roads relevant to this assessment.	
Deansgate South	I29406/FO/2021	No data available on planning portal documents.	<i>“The proposals are car-free therefore the non-vehicular trip generation proposed land-use has been considered.”</i> No operational traffic generation assumed.

Location	Planning Application Ref	Construction Traffic Movements	Operational Traffic Movements
Barclay House	118033/P3OPA/2017 128804/FO/2020	No air quality assessment available on planning portal.	
Contour	132199/FO/2021	<i>“The maximum number of vehicles travelling to the Site during the construction phase is 90 AADT”.</i>	A56 – Up to 456 LDVs
Viadux Phase I	133998/JO/2022	No figure in air quality assessment.	<i>“The office development could be expected to generate 154 arrivals and 5 departures in the morning peak hour, and 16 arrivals and 154 departures in the evening peak hour.”</i>
Committed Development			
Vision Tower	111003/FO/2016/C1	<i>“It is estimated that construction vehicle movements would not exceed 5 two way movements during any one hour period.”</i>	<i>“This development is anticipated to have limited effect on the traffic.”</i>
Bridgewater House Great Jackson Street	134694/FO/2022	<i>“There are likely to be less than 10 HDV outward movements in any one day.”</i>	<i>“The proposed development will produce a worst-case increase in vehicles to the road network of 59 AADT and 2 HGV as it is car-free.”</i>
1 City Road	128002/FO/2020	<i>“No increase in HDV flows is predicted.”</i>	Traffic from this application not modelled on roads relevant to this assessment.
Land Bounded By Deansgate, Great Bridgewater Street, Watson Street & Peter Street	135565/FO/2022	<i>“It is estimated that there would be >50 HDV movements per day at the peak of construction.”</i>	A34 – 131 LDVs A56 – 576 LDVs Great Bridgewater Street – 1672 LDVs
Land Bounded By Trumpet Street, Albion Street & Great Bridgewater Street	133172/FO/2022 133176/FO/2022	No figure provided.	<i>“It is considered that the development does not have the potential to generate any significant material transport impact on the local highway</i>

Location	Planning Application Ref	Construction Traffic Movements	Operational Traffic Movements
			<i>network due to the low level of car parking on site."</i>
One Medlock Street	135419/FO/2022	A5103 – 89 HDVs	A5103 – 123 LDVs
First Street Plot 10a	136043/FO/2023	Traffic from this application not modelled on roads relevant to this assessment.	
The Green	137226/FO/2023	<i>"A maximum 24hr AADT of 90 HDV movements would be generated on the local road network."</i>	B6469 – 144 LDVs A5103 – 493 LDVs A56 – 361 LDVs
The Lighthouse	137227/FO/2023	<i>"A maximum 24hr AADT of 90 HDV movements would be generated on the local road network."</i>	B6469 – 144 LDVs A5103 – 493 LDVs A56 – 361 LDVs
Viadux Phase 2	139715/FO/2024	<i>"It is expected that there would be between 10-50 HDVs outwards movements from the Site each day."</i>	Great Bridgewater Street – 128 LDVs, 10 HDVs
Hotspur House	138805/FO/2023	<i>"The construction vehicular movements are predicted to be ca. 28 vehicular movements per day (9 HGVs and 19 LGVs)."</i>	B6469 – 15 LDVs A34 – 8 LDVs A5103 – 15 LDVs

Table E2 shows the total cumulative traffic figures included in the 2025 - Peak construction year with construction phase traffic and cumulative traffic and 2027 - Future baseline with operational phase traffic and cumulative traffic models.

Table E2. Cumulative traffic figures

Cumulative HDVs per Hour					Cumulative LDVs per Hour				
B6469	A34	A5103	A56	Great Bridgewater Street	B6469	A34	A5103	A56	Great Bridgewater Street
18	18	21	18	18	38	31	77	99	101

Appendix F – Assessment Methodology

F1. Assessment Methodology

Pollutant concentrations have been predicted at existing receptor locations using the dispersion model ADMS Roads (version 5.0.1.3) which is widely used for this type of modelling. The model allows concentrations to be predicted at user defined locations (receptors), taking account of local conditions (road geometry, width and height, and local meteorological conditions).

Meteorological data from the Manchester meteorological station for 2022 have been used in the model.

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

- 2022 - Model verification and existing baseline
- 2025 - Future baseline
- 2025 - Peak construction year with construction phase traffic
- 2025 - Peak construction year with construction phase traffic and cumulative traffic
- 2027 - Future baseline
- 2027 - Future baseline with operational phase traffic
- 2027 - Future baseline with operational phase traffic and cumulative traffic.

2025 is the assumed peak construction year. This will also represent the worst case scenario in terms of pollutants concentrations because background pollutant concentrations and vehicle emission factors are projected to decrease in the years following 2025.

F2. Vehicle Emission Factors

Vehicle emission factors for NO_x, PM₁₀, and PM_{2.5} used in the assessment were taken from the latest version of DEFRA's Emissions Factor Toolkit (EFT) (v8.0.1) which predicts emissions from 2017 to 2030.

F3. Background Concentrations

The latest version of DEFRA's background maps was used to obtain background concentrations for the assessment. These provide estimated background concentrations across the UK at 1km x 1km grid resolution for years between 2017 and 2030.

F4. Model verification

Whilst ADMS Roads is widely validated for use in this type of assessment, model verification for the area around the site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results at a representative monitoring location is to be done in line with methodology specific in LAQM.TG(22). This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run to predict the 2022 annual mean road-NO_x contribution at the four nearby monitoring locations. The modelled road-NO_x output has been compared to the 2022 'measured' road-NO_x, which was determined from the NO₂ concentration measured at the monitoring location, utilising the most recent version of the NO_x from NO₂ calculator provided by DEFRA, and DEFRA NO₂ background concentrations (v8.1). **Table F1** presents data used in the verification.

Table F1. Verification data

Monitoring Site	Receptor ID	Measured Annual Mean NO ₂ Concentration (µg/m ³)	Background NO ₂ (µg/m ³)	Measured Road-NO _x (µg/m ³) (from NO _x :NO ₂ Calculator)	Modelled Road-NO _x	Ratio (Measured / Modelled)
MANI	R1	43.0	18.04	52.19	49.17	1.06
I55	R2	33.5	18.04	30.88	33.53	0.92
I56	R3	35.7	18.04	35.64	36.85	0.97
73	R4	34.8	22.80	24.09	23.15	1.04
Average						1.00

Processed results were compared against the relevant objectives set out in **Table B1** in **Appendix B**. LAQM.TG(22) advises that, where road traffic is the predominant source, an exceedance of the 1-hour mean NO₂ objective is unlikely to occur where the annual mean concentration is below 60µg/m³. This concentration has been used to screen whether the hourly mean NO₂ objective is likely to be achieved.

No verification factor has been used because the measured to modelled ratio of all monitors used for verification is within 10%.

F5. Sensitive Receptors

Relevant sensitive receptor locations for the assessment are places where the public may be expected to be regularly present for the averaging period of the objective. Based on guidance in LAQM.TG(22), existing residential dwellings, shops and commercial units are sensitive receptors to the annual mean and short-term objectives.

Several existing receptors were chosen at locations adjacent to the local road network affected by traffic associated with the proposed development and in close proximity to the proposed development works; the receptors are summarised in **Table F2** and are shown in **Figure 6**.

Table F2. Receptor locations

Receptor ID	Receptor Name	Receptor Description	Height (m)	X	Y
R1	MANI	Diffusion Tube	2.0	384235.97	397285.64
R2	CAP_MANC_I55	Diffusion Tube	2.0	383615.18	397441.46
R3	CAP_MANC_I56	Diffusion Tube	2.0	383622.05	397467.72
R4	CAP_MANC_073	Diffusion Tube	2.2	383735.23	397615.03
R5	Site West	Proposed Development	1.5	383494.38	397538.81
R6	Site East	Proposed Development	1.5	383541.41	397534.62
R7	Site South	Proposed Development	1.5	383517.88	397515.31
R8	Site Central (raised)	Proposed Development	10.0	383517.06	397527.06
R9	Hiltop Serviced Apartments	Residential	1.5	383622.00	397565.69
R10	Bridgewater Hall	Commercial	1.5	383728.16	397632.22
R11	O2 Ritz	Commercial	1.5	383988.19	397544.19
R12	Kimpton Clocktower	Hotel	1.5	384143.38	397500.53
R13	Dalton Building	Education	1.5	384210.59	397322.47
R14	Premier Inn Manchester Central	Hotel	1.5	383855.47	397788.78
R15	Hilton Manchester Deansgate	Hotel	1.5	383468.72	397683.66

Receptor ID	Receptor Name	Receptor Description	Height (m)	X	Y
R16	Sovereign House	Residential	1.5	383457.88	397800.28
R17	The Covenant Nation	Church	1.5	383517.66	397895.00
R18	The Deansgate	Commercial	1.5	383420.31	397620.72
R19	Castlefield Wharf Complex	Residential	1.5	383257.38	397447.72
R20	Pure Gym First Street	Commercial	1.5	383642.88	397380.53
R21	Bridgewater Bank South	Residential	1.5	383866.19	397510.69

F6. Significance Criteria

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

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

Table F3 sets out the significance criteria used in this assessment.

Table F3. Impact descriptors for individual receptors

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2 - 5	6 - 10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76 - 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 - 102% of AQAL	Slight	Moderate	Moderate	Substantial
103 - 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
Notes: The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5% will be described as Negligible. The table is only designed to be used with annual mean concentrations. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration for an increase. Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.				

F7. Limitations and Assumptions

There are uncertainties associated with both measured and predicted concentrations. The model relies on input data (including projected traffic flows), which also have uncertainties associated with them. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS Roads model will not consider.

Street canyons, traffic queues, and a time-varying profile were included to make the model more representative of the Manchester area.

Construction and operational vehicles generated by the development have been added to all modelled roads to represent a worst-case scenario.

Where traffic generated by the committed developments was not attributed to specific roads in their respective air quality assessments, the total traffic generated by each development was added to all roads in this assessment as a worst-case scenario.

Traffic was not included from committed developments where the traffic generated was not modelled on roads relevant to this assessment.

Appendix G – Traffic Data and Emissions

Table G1. 2022 baseline

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	8,232	1.5	25	2.97×10^{-2}	3.25×10^{-3}	1.86×10^{-3}
A34	2,808	2.6	25	9.19×10^{-3}	1.13×10^{-3}	6.4×10^{-4}
A5103	10,968	1.1	25	3.88×10^{-2}	4.28×10^{-3}	2.46×10^{-3}
A56	13,992	1.5	30	4.78×10^{-2}	5.50×10^{-3}	3.14×10^{-3}
Great Bridgewater Street	8,232	1.5	15	3.66×10^{-2}	3.32×10^{-3}	1.94×10^{-3}
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.93×10^{-1}	1.24×10^{-2}	7.40×10^{-3}
Great Bridgewater Street Queue	30,000	1.4	5	1.91×10^{-1}	1.24×10^{-2}	7.38×10^{-3}
A34 Queue	30,000	2.6	5	2.25×10^{-1}	1.29×10^{-2}	7.65×10^{-3}
A5103 Queue	30,000	1.1	5	1.81×10^{-1}	1.23×10^{-2}	7.30×10^{-3}
A5103 Lunch Queue	30,000	1.1	5	1.81×10^{-1}	1.23×10^{-2}	7.30×10^{-3}
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.91×10^{-1}	1.24×10^{-2}	7.38×10^{-3}
A34 Lunch Queue	30,000	2.6	5	2.25×10^{-1}	1.29×10^{-2}	7.65×10^{-3}

Table G2. 2025 peak construction year baseline

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	8545	1.5	25	2.24×10^{-2}	3.29×10^{-3}	1.86×10^{-3}
A34	2915	2.6	25	6.88×10^{-3}	1.14×10^{-3}	6.88×10^{-4}
A5103	11385	1.1	25	2.94×10^{-2}	4.34×10^{-3}	2.45×10^{-3}
A56	14524	1.5	30	3.61×10^{-2}	5.58×10^{-3}	3.14×10^{-3}
Great Bridgewater Street	8545	1.5	15	2.76×10^{-2}	3.35×10^{-3}	1.92×10^{-3}
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.49×10^{-1}	1.21×10^{-2}	7.04×10^{-3}
Great Bridgewater Street Queue	30,000	1.4	5	1.46×10^{-1}	1.21×10^{-2}	7.02×10^{-3}
A34 Queue	30,000	2.6	5	1.76×10^{-1}	1.25×10^{-2}	7.26×10^{-3}
A5103 Queue	30,000	1.1	5	1.38×10^{-1}	1.19×10^{-2}	6.96×10^{-3}
A5103 Lunch Queue	30,000	1.1	5	1.38×10^{-1}	1.19×10^{-2}	6.96×10^{-3}
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.46×10^{-1}	1.21×10^{-2}	7.02×10^{-3}
A34 Lunch Queue	30,000	2.6	5	1.76×10^{-1}	1.25×10^{-2}	7.26×10^{-3}

Traffic growth factors have been calculated using TEMPro 8.0, a traffic growth projection program developed by DfT. Using TEMPro 8.0, a traffic growth factor of 1.038 from 2022 to 2025 has been calculated. This factor has been applied to all roads to account for traffic growth between 2022 and 2025.

Table G3. 2025 peak construction year with construction traffic

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	8,610	1.5	25	2.34×10^{-2}	3.40×10^{-3}	1.92×10^{-3}
A34	2,980	2.6	25	7.53×10^{-3}	1.25×10^{-3}	6.95×10^{-4}
A5103	11,450	1.1	25	3.04×10^{-2}	4.44×10^{-3}	2.51×10^{-3}
A56	14,589	1.5	30	3.71×10^{-2}	5.69×10^{-3}	3.20×10^{-3}
Great Bridgewater Street	8,610	1.5	15	2.95×10^{-2}	3.47×10^{-3}	1.99×10^{-3}
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.49×10^{-1}	1.21×10^{-2}	7.04×10^{-3}
Great Bridgewater Street Queue	30,000	1.4	5	1.46×10^{-1}	1.21×10^{-2}	7.02×10^{-3}
A34 Queue	30,000	2.6	5	1.76×10^{-1}	1.25×10^{-2}	7.26×10^{-3}
A5103 Queue	30,000	1.1	5	1.38×10^{-1}	1.19×10^{-2}	6.96×10^{-3}
A5103 Lunch Queue	30,000	1.1	5	1.38×10^{-1}	1.19×10^{-2}	6.96×10^{-3}
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.46×10^{-1}	1.21×10^{-2}	7.02×10^{-3}
A34 Lunch Queue	30,000	2.6	5	1.76×10^{-1}	1.25×10^{-2}	7.26×10^{-3}

Table G4. 2025 peak construction year with construction traffic and cumulative traffic

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	9,034	1.5	25	2.92x10 ⁻²	4.04x10 ⁻³	2.27x10 ⁻³
A34	3,404	2.6	25	1.14x10 ⁻²	1.87x10 ⁻³	1.04x10 ⁻³
A5103	11,963	1.1	25	3.71x10 ⁻²	5.19x10 ⁻³	2.92x10 ⁻³
A56	15,013	1.5	30	4.29x10 ⁻²	6.33x10 ⁻³	3.55x10 ⁻³
Great Bridgewater Street	9,034	1.5	15	4.09x10 ⁻²	4.15x10 ⁻³	2.38x10 ⁻³
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.49x10 ⁻¹	1.21x10 ⁻²	7.04x10 ⁻³
Great Bridgewater Street Queue	30,000	1.4	5	1.46x10 ⁻¹	1.21x10 ⁻²	7.02x10 ⁻³
A34 Queue	30,000	2.6	5	1.76x10 ⁻¹	1.25x10 ⁻²	7.26x10 ⁻³
A5103 Queue	30,000	1.1	5	1.38x10 ⁻¹	1.19x10 ⁻²	6.96x10 ⁻³
A5103 Lunch Queue	30,000	1.1	5	1.38x10 ⁻¹	1.19x10 ⁻²	6.96x10 ⁻³
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.46x10 ⁻¹	1.21x10 ⁻²	7.02x10 ⁻³
A34 Lunch Queue	30,000	2.6	5	1.76x10 ⁻¹	1.25x10 ⁻²	7.26x10 ⁻³

Table G5. 2027 baseline

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	8715	1.5	25	1.87×10^{-2}	3.37×10^{-3}	1.89×10^{-3}
A34	2973	2.6	25	5.80×10^{-3}	1.18×10^{-3}	6.60×10^{-4}
A5103	11612	1.1	25	2.44×10^{-2}	4.44×10^{-3}	2.49×10^{-3}
A56	14813	1.5	30	3.00×10^{-2}	5.73×10^{-3}	3.20×10^{-3}
Great Bridgewater Street	8715	1.5	15	2.30×10^{-2}	3.43×10^{-3}	1.95×10^{-3}
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.25×10^{-1}	1.20×10^{-2}	6.92×10^{-3}
Great Bridgewater Street Queue	30,000	1.4	5	1.23×10^{-1}	1.19×10^{-2}	6.90×10^{-3}
A34 Queue	30,000	2.6	5	1.51×10^{-1}	1.23×10^{-2}	7.12×10^{-3}
A5103 Queue	30,000	1.1	5	1.15×10^{-1}	1.18×10^{-2}	6.84×10^{-3}
A5103 Lunch Queue	30,000	1.1	5	1.15×10^{-1}	1.18×10^{-2}	6.84×10^{-3}
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.23×10^{-1}	1.19×10^{-2}	6.90×10^{-3}
A34 Lunch Queue	30,000	2.6	5	1.51×10^{-1}	1.23×10^{-2}	7.12×10^{-3}

Traffic growth factors have been calculated using TEMPro 8.0, a traffic growth projection program developed by DfT. Using TEMPro 8.0, a traffic growth factor of 1.0587 from 2022 to 2027 has been calculated. This factor has been applied to all roads to account for traffic growth between 2022 and 2027

Table G6. 2027 with development traffic

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	8,896	1.5	25	1.90×10^{-2}	3.44×10^{-3}	1.93×10^{-3}
A34	3,154	2.6	25	6.14×10^{-3}	1.26×10^{-3}	6.99×10^{-4}
A5103	11,793	1.1	25	2.48×10^{-2}	4.51×10^{-3}	2.53×10^{-3}
A56	14,994	1.5	30	3.04×10^{-2}	5.80×10^{-3}	3.24×10^{-3}
Great Bridgewater Street	8,896	1.5	15	2.35×10^{-2}	3.50×10^{-3}	1.99×10^{-3}
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.25×10^{-1}	1.20×10^{-2}	6.92×10^{-3}
Great Bridgewater Street Queue	30,000	1.4	5	1.23×10^{-1}	1.19×10^{-2}	6.90×10^{-3}
A34 Queue	30,000	2.6	5	1.51×10^{-1}	1.23×10^{-2}	7.12×10^{-3}
A5103 Queue	30,000	1.1	5	1.15×10^{-1}	1.18×10^{-2}	6.84×10^{-3}
A5103 Lunch Queue	30,000	1.1	5	1.15×10^{-1}	1.18×10^{-2}	6.84×10^{-3}
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.23×10^{-1}	1.19×10^{-2}	6.90×10^{-3}
A34 Lunch Queue	30,000	2.6	5	1.51×10^{-1}	1.23×10^{-2}	7.12×10^{-3}

Table G7. 2027 with development traffic and cumulative traffic

Road Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
B6469	9,802	1.5	25	2.09×10 ⁻²	3.78×10 ⁻²	2.12×10 ⁻³
A34	3,896	2.6	25	7.46×10 ⁻³	1.53×10 ⁻³	8.50×10 ⁻⁴
A5103	13,646	1.1	25	2.85×10 ⁻²	5.19×10 ⁻³	2.91×10 ⁻³
A56	17,372	1.5	30	3.49×10 ⁻²	6.66×10 ⁻³	3.73×10 ⁻³
Great Bridgewater Street	11,320	1.5	15	2.92×10 ⁻²	4.41×10 ⁻³	2.50×10 ⁻³
Queue Name	AADT	HDV%	Speed (kph)	NO _x Emissions (g/km/s)	PM ₁₀ Emissions (g/km/s)	PM _{2.5} Emissions (g/km/s)
A56 Queue	30,000	1.5	5	1.25×10 ⁻¹	1.20×10 ⁻²	6.92×10 ⁻³
Great Bridgewater Street Queue	30,000	1.4	5	1.23×10 ⁻¹	1.19×10 ⁻²	6.90×10 ⁻³
A34 Queue	30,000	2.6	5	1.51×10 ⁻¹	1.23×10 ⁻²	7.12×10 ⁻³
A5103 Queue	30,000	1.1	5	1.15×10 ⁻¹	1.18×10 ⁻²	6.84×10 ⁻³
A5103 Lunch Queue	30,000	1.1	5	1.15×10 ⁻¹	1.18×10 ⁻²	6.84×10 ⁻³
Great Bridgewater Street Lunch Queue	30,000	1.4	5	1.23×10 ⁻¹	1.19×10 ⁻²	6.90×10 ⁻³
A34 Lunch Queue	30,000	2.6	5	1.51×10 ⁻¹	1.23×10 ⁻²	7.12×10 ⁻³

Appendix H – Results

Table H1. Annual mean NO_x concentrations (µg/m³) – Construction Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction Traffic	Change
R1	49.17	38.31	38.61	0.30
R2	33.53	25.47	25.89	0.42
R3	36.85	27.99	28.47	0.48
R4	23.15	17.60	18.18	0.58
R5	3.48	2.63	2.73	0.10
R6	3.93	2.98	3.09	0.11
R7	1.86	1.41	1.46	0.05
R8	1.42	1.08	1.11	0.03
R9	5.91	4.48	4.61	0.13
R10	6.93	5.25	5.48	0.23
R11	3.89	2.94	3.06	0.12
R12	1.67	1.27	1.34	0.07
R13	9.33	7.27	7.32	0.05
R14	2.59	1.97	2.04	0.07
R15	5.93	4.51	4.64	0.13
R16	5.87	4.44	4.56	0.12
R17	4.51	3.41	3.50	0.09
R18	5.88	4.46	4.57	0.11
R19	5.63	4.25	4.36	0.11
R20	4.35	3.30	3.40	0.10
R21	3.49	2.64	2.75	0.11

Table H2. Annual mean NO_x concentrations (µg/m³) – Construction and Cumulative Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction and Cumulative Traffic	Change
R1	49.17	38.31	40.42	2.11
R2	33.53	25.47	28.82	3.35
R3	36.85	27.99	31.75	3.76
R4	23.15	17.60	21.69	4.09
R5	3.48	2.63	3.32	0.69
R6	3.93	2.98	3.73	0.75
R7	1.86	1.41	1.73	0.32
R8	1.42	1.08	1.31	0.23
R9	5.91	4.48	5.46	0.98
R10	6.93	5.25	6.86	1.61
R11	3.89	2.94	3.81	0.87
R12	1.67	1.27	1.8	0.53
R13	9.33	7.27	7.67	0.40
R14	2.59	1.97	2.5	0.53
R15	5.93	4.51	5.43	0.92
R16	5.87	4.44	5.28	0.84
R17	4.51	3.41	4.08	0.67
R18	5.88	4.46	5.26	0.80
R19	5.63	4.25	5.03	0.78
R20	4.35	3.30	4.08	0.78
R21	3.49	2.64	3.41	0.77

Table H3. Annual mean NO_x concentrations (µg/m³) – Operational Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational Traffic	Change
R1	49.17	32.92	33.08	0.16
R2	33.53	21.19	21.35	0.16
R3	36.85	23.29	23.47	0.18
R4	23.15	14.73	14.87	0.14
R5	3.48	2.19	2.23	0.04
R6	3.93	2.48	2.52	0.04
R7	1.86	1.18	1.19	0.01
R8	1.42	0.90	0.91	0.01
R9	5.91	3.73	3.78	0.05
R10	6.93	4.38	4.44	0.06
R11	3.89	2.45	2.50	0.05
R12	1.67	1.07	1.11	0.04
R13	9.33	6.24	6.27	0.03
R14	2.59	1.64	1.66	0.02
R15	5.93	3.77	3.81	0.04
R16	5.87	3.69	3.74	0.05
R17	4.51	2.84	2.87	0.03
R18	5.88	3.72	3.76	0.04
R19	5.63	3.53	3.58	0.05
R20	4.35	2.74	2.78	0.04
R21	3.49	2.20	2.24	0.04

Table H4. Annual mean NO_x concentrations (µg/m³) – Operational and Cumulative Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational and Cumulative Traffic	Change
R1	49.17	32.92	33.70	0.78
R2	33.53	21.19	22.93	1.74
R3	36.85	23.29	25.24	1.95
R4	23.15	14.73	16.6	1.87
R5	3.48	2.19	2.45	0.26
R6	3.93	2.48	2.77	0.29
R7	1.86	1.18	1.31	0.13
R8	1.42	0.90	1.00	0.10
R9	5.91	3.73	4.18	0.45
R10	6.93	4.38	5.13	0.75
R11	3.89	2.45	2.74	0.29
R12	1.67	1.07	1.27	0.20
R13	9.33	6.24	6.39	0.15
R14	2.59	1.64	1.91	0.27
R15	5.93	3.77	4.24	0.47
R16	5.87	3.69	4.24	0.55
R17	4.51	2.84	3.29	0.45
R18	5.88	3.72	4.22	0.50
R19	5.63	3.53	4.07	0.54
R20	4.35	2.74	3.15	0.41
R21	3.49	2.20	2.47	0.27

Table H5. Annual mean NO₂ concentrations (µg/m³) – Construction Traffic

Receptor ID	2022 Baseline	2025 Baseline	2025 With Construction Traffic	Change	% Change relative to AQUAL	% of AQUAL	Significance
R1	41.71	35.03	35.16	0.13	0	88	Negligible
R2	34.73	29.08	29.28	0.20	0	73	Negligible
R3	36.25	30.28	30.50	0.22	0	76	Negligible
R4	34.35	29.49	29.77	0.28	0	74	Negligible
R5	21.64	19.09	19.14	0.05	0	48	Negligible
R6	24.85	22.16	22.21	0.05	0	56	Negligible
R7	23.77	21.34	21.36	0.02	0	53	Negligible
R8	23.54	21.17	21.18	0.01	0	53	Negligible
R9	25.87	22.93	23.00	0.07	0	58	Negligible
R10	26.39	23.33	23.45	0.12	0	59	Negligible
R11	24.83	22.14	22.20	0.06	0	56	Negligible
R12	23.67	21.26	21.30	0.04	0	53	Negligible
R13	22.94	20.03	20.06	0.03	0	50	Negligible
R14	24.15	21.63	21.67	0.04	0	54	Negligible
R15	22.91	20.08	20.14	0.06	0	50	Negligible
R16	22.88	20.04	20.10	0.06	0	50	Negligible
R17	25.15	22.38	22.43	0.05	0	56	Negligible
R18	22.89	20.05	20.11	0.06	0	50	Negligible
R19	20.68	18.16	18.22	0.06	0	46	Negligible
R20	20.35	17.96	18.01	0.05	0	45	Negligible
R21	24.62	21.98	22.04	0.06	0	55	Negligible

Table H6. Annual mean NO₂ concentrations (µg/m³) – Construction and Cumulative Traffic

Receptor ID	2022 Baseline	2025 Baseline	2025 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	41.71	35.03	35.97	0.94	2	90	Slight
R2	34.73	29.08	30.67	1.59	4	77	Slight
R3	36.25	30.28	32.04	1.76	4	80	Slight
R4	34.35	29.49	31.46	1.97	5	79	Slight
R5	21.64	19.09	19.46	0.37	1	49	Negligible
R6	24.85	22.16	22.55	0.39	1	56	Negligible
R7	23.77	21.34	21.51	0.17	0	54	Negligible
R8	23.54	21.17	21.29	0.12	0	53	Negligible
R9	25.87	22.93	23.44	0.51	1	59	Negligible
R10	26.39	23.33	24.15	0.82	2	60	Negligible
R11	24.83	22.14	22.59	0.45	1	56	Negligible
R12	23.67	21.26	21.54	0.28	1	54	Negligible
R13	22.94	20.03	20.24	0.21	1	51	Negligible
R14	24.15	21.63	21.91	0.28	1	55	Negligible
R15	22.91	20.08	20.56	0.48	1	51	Negligible
R16	22.88	20.04	20.48	0.44	1	51	Negligible
R17	25.15	22.38	22.73	0.35	1	57	Negligible
R18	22.89	20.05	20.47	0.42	1	51	Negligible
R19	20.68	18.16	18.57	0.41	1	46	Negligible
R20	20.35	17.96	18.37	0.41	1	46	Negligible
R21	24.62	21.98	22.38	0.40	1	56	Negligible

Table H7. Annual mean NO₂ concentrations (µg/m³) – Operational Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Development Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	41.71	31.66	31.73	0.07	0	79	Negligible
R2	34.73	26.15	26.23	0.08	0	66	Negligible
R3	36.25	27.16	27.25	0.09	0	68	Negligible
R4	34.35	27.05	27.12	0.07	0	68	Negligible
R5	21.64	17.86	17.88	0.02	0	45	Negligible
R6	24.85	20.89	20.91	0.02	0	52	Negligible
R7	23.77	20.21	20.22	0.01	0	51	Negligible
R8	23.54	20.07	20.08	0.01	0	50	Negligible
R9	25.87	21.53	21.56	0.03	0	54	Negligible
R10	26.39	21.87	21.90	0.03	0	55	Negligible
R11	24.83	20.87	20.90	0.03	0	52	Negligible
R12	23.67	20.16	20.18	0.02	0	50	Negligible
R13	22.94	18.68	18.70	0.02	0	47	Negligible
R14	24.15	20.45	20.47	0.02	0	51	Negligible
R15	22.91	18.68	18.70	0.02	0	47	Negligible
R16	22.88	18.64	18.66	0.02	0	47	Negligible
R17	25.15	21.08	21.09	0.01	0	53	Negligible
R18	22.89	18.66	18.68	0.02	0	47	Negligible
R19	20.68	16.97	16.99	0.02	0	42	Negligible
R20	20.35	16.85	16.87	0.02	0	42	Negligible
R21	24.62	20.74	20.77	0.03	0	52	Negligible

Table H8. Annual mean NO₂ concentrations (µg/m³) – Operational and Cumulative Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	41.71	31.66	32.01	0.35	1	80	Negligible
R2	34.73	26.15	26.99	0.84	2	67	Negligible
R3	36.25	27.16	28.09	0.93	2	70	Negligible
R4	34.35	27.05	27.96	0.91	2	70	Negligible
R5	21.64	17.86	17.99	0.13	0	45	Negligible
R6	24.85	20.89	21.04	0.15	0	53	Negligible
R7	23.77	20.21	20.29	0.08	0	51	Negligible
R8	23.54	20.07	20.12	0.05	0	50	Negligible
R9	25.87	21.53	21.76	0.23	1	54	Negligible
R10	26.39	21.87	22.25	0.38	1	56	Negligible
R11	24.83	20.87	21.03	0.16	0	53	Negligible
R12	23.67	20.16	20.26	0.10	0	51	Negligible
R13	22.94	18.68	18.76	0.08	0	47	Negligible
R14	24.15	20.45	20.60	0.15	0	52	Negligible
R15	22.91	18.68	18.93	0.25	1	47	Negligible
R16	22.88	18.64	18.92	0.28	1	47	Negligible
R17	25.15	21.08	21.31	0.23	1	53	Negligible
R18	22.89	18.66	18.91	0.25	1	47	Negligible
R19	20.68	16.97	17.25	0.28	1	43	Negligible
R20	20.35	16.85	17.07	0.22	1	43	Negligible
R21	24.62	20.74	20.88	0.14	0	52	Negligible

Table H9. Annual mean PM₁₀ concentrations (µg/m³) – Construction Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction Traffic	Change	% Change relative to AQUAL	% of AQUAL	Significance
R1	16.00	15.52	15.57	0.05	0	39	Negligible
R2	15.90	15.49	15.54	0.05	0	39	Negligible
R3	16.21	15.81	15.86	0.05	0	40	Negligible
R4	14.74	14.43	14.47	0.04	0	36	Negligible
R5	12.96	12.67	12.68	0.01	0	32	Negligible
R6	13.31	13.01	13.02	0.01	0	33	Negligible
R7	13.09	12.79	12.79	0	0	32	Negligible
R8	13.04	12.74	12.75	0.01	0	32	Negligible
R9	13.49	13.19	13.21	0.02	0	33	Negligible
R10	13.52	13.22	13.24	0.02	0	33	Negligible
R11	13.32	13.02	13.04	0.02	0	33	Negligible
R12	13.07	12.77	12.79	0.02	0	32	Negligible
R13	13.49	13.08	13.08	0	0	33	Negligible
R14	13.18	12.88	12.89	0.01	0	32	Negligible
R15	13.12	12.82	12.83	0.01	0	32	Negligible
R16	13.24	12.94	12.96	0.02	0	32	Negligible
R17	13.40	13.11	13.12	0.01	0	33	Negligible
R18	13.22	12.92	12.94	0.02	0	32	Negligible
R19	12.84	12.55	12.56	0.01	0	31	Negligible
R20	13.36	12.97	12.98	0.01	0	32	Negligible
R21	13.27	12.98	12.99	0.01	0	32	Negligible

Table H10. Annual mean PM₁₀ concentrations (µg/m³) – Construction and Cumulative Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	16.00	15.52	15.86	0.34	1	40	Negligible
R2	15.90	15.49	15.86	0.37	1	40	Negligible
R3	16.21	15.81	16.22	0.41	1	41	Negligible
R4	14.74	14.43	14.69	0.26	1	37	Negligible
R5	12.96	12.67	12.74	0.07	0	32	Negligible
R6	13.31	13.01	13.09	0.08	0	33	Negligible
R7	13.09	12.79	12.82	0.03	0	32	Negligible
R8	13.04	12.74	12.77	0.03	0	32	Negligible
R9	13.49	13.19	13.30	0.11	0	33	Negligible
R10	13.52	13.22	13.33	0.11	0	33	Negligible
R11	13.32	13.02	13.12	0.10	0	33	Negligible
R12	13.07	12.77	12.86	0.09	0	32	Negligible
R13	13.49	13.08	13.14	0.06	0	33	Negligible
R14	13.18	12.88	12.94	0.06	0	32	Negligible
R15	13.12	12.82	12.89	0.07	0	32	Negligible
R16	13.24	12.94	13.03	0.09	0	33	Negligible
R17	13.40	13.11	13.18	0.07	0	33	Negligible
R18	13.22	12.92	13.01	0.09	0	33	Negligible
R19	12.84	12.55	12.64	0.09	0	32	Negligible
R20	13.36	12.97	13.05	0.08	0	33	Negligible
R21	13.27	12.98	13.06	0.08	0	33	Negligible

Table H11. Annual mean PM₁₀ concentrations (µg/m³) – Operational Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational Traffic	Change	% Change relative to AQUAL	% of AQUAL	Significance
R1	16.00	15.52	15.55	0.03	0	39	Negligible
R2	15.90	15.52	15.55	0.03	0	39	Negligible
R3	16.21	15.84	15.88	0.04	0	40	Negligible
R4	14.74	14.35	14.37	0.02	0	36	Negligible
R5	12.96	12.68	12.68	0	0	32	Negligible
R6	13.31	12.92	12.93	0.01	0	32	Negligible
R7	13.09	12.69	12.69	0	0	32	Negligible
R8	13.04	12.64	12.65	0.01	0	32	Negligible
R9	13.49	13.10	13.11	0.01	0	33	Negligible
R10	13.52	13.13	13.14	0.01	0	33	Negligible
R11	13.32	12.93	12.94	0.01	0	32	Negligible
R12	13.07	12.68	12.69	0.01	0	32	Negligible
R13	13.49	13.07	13.08	0.01	0	33	Negligible
R14	13.18	12.79	12.79	0	0	32	Negligible
R15	13.12	12.83	12.84	0.01	0	32	Negligible
R16	13.24	12.96	12.97	0.01	0	32	Negligible
R17	13.40	13.02	13.03	0.01	0	33	Negligible
R18	13.22	12.94	12.95	0.01	0	32	Negligible
R19	12.84	12.47	12.47	0	0	31	Negligible
R20	13.36	12.98	12.98	0	0	32	Negligible
R21	13.27	12.89	12.89	0	0	32	Negligible

Table H12. Annual mean PM₁₀ concentrations (µg/m³) – Operational and Cumulative Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	16.00	15.52	15.68	0.16	0	39	Negligible
R2	15.90	15.52	15.85	0.33	1	40	Negligible
R3	16.21	15.84	16.20	0.36	1	41	Negligible
R4	14.74	14.35	14.65	0.30	1	37	Negligible
R5	12.96	12.68	12.73	0.05	0	32	Negligible
R6	13.31	12.92	12.97	0.05	0	32	Negligible
R7	13.09	12.69	12.72	0.03	0	32	Negligible
R8	13.04	12.64	12.66	0.02	0	32	Negligible
R9	13.49	13.10	13.19	0.09	0	33	Negligible
R10	13.52	13.13	13.25	0.12	0	33	Negligible
R11	13.32	12.93	12.99	0.06	0	32	Negligible
R12	13.07	12.68	12.72	0.04	0	32	Negligible
R13	13.49	13.07	13.10	0.03	0	33	Negligible
R14	13.18	12.79	12.84	0.05	0	32	Negligible
R15	13.12	12.83	12.91	0.08	0	32	Negligible
R16	13.24	12.96	13.06	0.10	0	33	Negligible
R17	13.40	13.02	13.11	0.09	0	33	Negligible
R18	13.22	12.94	13.03	0.09	0	33	Negligible
R19	12.84	12.47	12.57	0.10	0	31	Negligible
R20	13.36	12.98	13.05	0.07	0	33	Negligible
R21	13.27	12.89	12.94	0.05	0	32	Negligible

Table H13. Number of days with PM₁₀ concentrations exceeding 50µg/m³ – Construction Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction Traffic	Change
R1	0	0	0	0
R2	0	0	0	0
R3	0	0	0	0
R4	0	0	0	0
R5	0	0	0	0
R6	0	0	0	0
R7	0	0	0	0
R8	0	0	0	0
R9	0	0	0	0
R10	0	0	0	0
R11	0	0	0	0
R12	0	0	0	0
R13	0	0	0	0
R14	0	0	0	0
R15	0	0	0	0
R16	0	0	0	0
R17	0	0	0	0
R18	0	0	0	0
R19	0	0	0	0
R20	0	0	0	0
R21	0	0	0	0

Table H14. Number of days with PM₁₀ concentrations exceeding 50µg/m³ – Construction and Cumulative Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction Traffic	Change
R1	0	0	0	0
R2	0	0	0	0
R3	0	0	0	0
R4	0	0	0	0
R5	0	0	0	0
R6	0	0	0	0
R7	0	0	0	0
R8	0	0	0	0
R9	0	0	0	0
R10	0	0	0	0
R11	0	0	0	0
R12	0	0	0	0
R13	0	0	0	0
R14	0	0	0	0
R15	0	0	0	0
R16	0	0	0	0
R17	0	0	0	0
R18	0	0	0	0
R19	0	0	0	0
R20	0	0	0	0
R21	0	0	0	0

Table H15. Number of days with PM₁₀ concentrations exceeding 50µg/m³ – Operational Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational Traffic	Change
R1	0	0	0	0
R2	0	0	0	0
R3	0	0	0	0
R4	0	0	0	0
R5	0	0	0	0
R6	0	0	0	0
R7	0	0	0	0
R8	0	0	0	0
R9	0	0	0	0
R10	0	0	0	0
R11	0	0	0	0
R12	0	0	0	0
R13	0	0	0	0
R14	0	0	0	0
R15	0	0	0	0
R16	0	0	0	0
R17	0	0	0	0
R18	0	0	0	0
R19	0	0	0	0
R20	0	0	0	0
R21	0	0	0	0

Table H16. Number of days with PM₁₀ concentrations exceeding 50µg/m³ – Operational and Cumulative Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational and Cumulative Traffic	Change
R1	0	0	0	0
R2	0	0	0	0
R3	0	0	0	0
R4	0	0	0	0
R5	0	0	0	0
R6	0	0	0	0
R7	0	0	0	0
R8	0	0	0	0
R9	0	0	0	0
R10	0	0	0	0
R11	0	0	0	0
R12	0	0	0	0
R13	0	0	0	0
R14	0	0	0	0
R15	0	0	0	0
R16	0	0	0	0
R17	0	0	0	0
R18	0	0	0	0
R19	0	0	0	0
R20	0	0	0	0
R21	0	0	0	0

Table H17. Annual mean PM_{2.5} concentrations (µg/m³) – Construction Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction Traffic	Change	% Change relative to AQUAL	% of AQUAL	Significance
R1	10.03	9.75	9.78	0.03	0	49	Negligible
R2	9.94	9.71	9.73	0.02	0	49	Negligible
R3	10.12	9.89	9.92	0.03	0	50	Negligible
R4	9.38	9.05	9.07	0.02	0	45	Negligible
R5	8.41	8.11	8.11	0	0	41	Negligible
R6	8.53	8.23	8.24	0.01	0	41	Negligible
R7	8.41	8.11	8.11	0	0	41	Negligible
R8	8.38	8.08	8.08	0	0	40	Negligible
R9	8.64	8.34	8.34	0	0	42	Negligible
R10	8.66	8.35	8.36	0.01	0	42	Negligible
R11	8.54	8.24	8.25	0.01	0	41	Negligible
R12	8.40	8.10	8.10	0	0	41	Negligible
R13	8.55	8.33	8.34	0.01	0	42	Negligible
R14	8.46	8.16	8.16	0	0	41	Negligible
R15	8.50	8.20	8.20	0	0	41	Negligible
R16	8.57	8.26	8.27	0.01	0	41	Negligible
R17	8.59	8.29	8.29	0	0	41	Negligible
R18	8.56	8.25	8.26	0.01	0	41	Negligible
R19	8.47	8.17	8.17	0	0	41	Negligible
R20	8.46	8.26	8.27	0.01	0	41	Negligible
R21	8.51	8.21	8.22	0.01	0	41	Negligible

Table H18. Annual mean PM_{2.5} concentrations (µg/m³) – Construction and Cumulative Traffic

Receptor ID	2022 Baseline	2025 Future Baseline	2025 With Construction and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	10.03	9.75	9.94	0.19	1	40	Negligible
R2	9.94	9.71	9.91	0.20	1	40	Negligible
R3	10.12	9.89	10.12	0.23	1	40	Negligible
R4	9.38	9.05	9.20	0.15	1	37	Negligible
R5	8.41	8.11	8.15	0.04	0	33	Negligible
R6	8.53	8.23	8.28	0.05	0	33	Negligible
R7	8.41	8.11	8.12	0.01	0	32	Negligible
R8	8.38	8.08	8.09	0.01	0	32	Negligible
R9	8.64	8.34	8.39	0.05	0	34	Negligible
R10	8.66	8.35	8.42	0.07	0	34	Negligible
R11	8.54	8.24	8.29	0.05	0	33	Negligible
R12	8.40	8.10	8.14	0.04	0	33	Negligible
R13	8.55	8.33	8.37	0.04	0	33	Negligible
R14	8.46	8.16	8.19	0.03	0	33	Negligible
R15	8.50	8.20	8.24	0.04	0	33	Negligible
R16	8.57	8.26	8.31	0.05	0	33	Negligible
R17	8.59	8.29	8.33	0.04	0	33	Negligible
R18	8.56	8.25	8.30	0.05	0	33	Negligible
R19	8.47	8.17	8.21	0.04	0	33	Negligible
R20	8.46	8.26	8.31	0.05	0	33	Negligible
R21	8.51	8.21	8.26	0.05	0	33	Negligible

Table H19. Annual mean PM_{2.5} concentrations (µg/m³) – Operational Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	10.03	9.73	9.75	0.02	0	49	Negligible
R2	9.94	9.71	9.73	0.02	0	49	Negligible
R3	10.12	9.90	9.92	0.02	0	50	Negligible
R4	9.38	9.06	9.07	0.01	0	45	Negligible
R5	8.41	8.11	8.12	0.01	0	41	Negligible
R6	8.53	8.24	8.24	0	0	41	Negligible
R7	8.41	8.11	8.11	0	0	41	Negligible
R8	8.38	8.08	8.08	0	0	40	Negligible
R9	8.64	8.34	8.35	0.01	0	42	Negligible
R10	8.66	8.36	8.36	0	0	42	Negligible
R11	8.54	8.24	8.25	0.01	0	41	Negligible
R12	8.40	8.10	8.10	0	0	41	Negligible
R13	8.55	8.33	8.33	0	0	42	Negligible
R14	8.46	8.16	8.16	0	0	41	Negligible
R15	8.50	8.20	8.20	0	0	41	Negligible
R16	8.57	8.27	8.27	0	0	41	Negligible
R17	8.59	8.29	8.30	0.01	0	42	Negligible
R18	8.56	8.26	8.26	0	0	41	Negligible
R19	8.47	8.17	8.18	0.01	0	41	Negligible
R20	8.46	8.27	8.27	0	0	41	Negligible
R21	8.51	8.22	8.22	0	0	41	Negligible

Table H20. Annual mean PM_{2.5} concentrations (µg/m³) – Operational and Cumulative Traffic

Receptor ID	2022 Baseline	2027 Baseline	2027 With Operational and Cumulative Traffic	Change	% Change relative to AQAL	% of AQAL	Significance
R1	10.03	9.73	9.82	0.09	0	39	Negligible
R2	9.94	9.71	9.90	0.19	1	40	Negligible
R3	10.12	9.90	10.10	0.20	1	40	Negligible
R4	9.38	9.06	9.23	0.17	1	37	Negligible
R5	8.41	8.11	8.14	0.03	0	33	Negligible
R6	8.53	8.24	8.27	0.03	0	33	Negligible
R7	8.41	8.11	8.12	0.01	0	32	Negligible
R8	8.38	8.08	8.09	0.01	0	32	Negligible
R9	8.64	8.34	8.39	0.05	0	34	Negligible
R10	8.66	8.36	8.43	0.07	0	34	Negligible
R11	8.54	8.24	8.27	0.03	0	33	Negligible
R12	8.40	8.10	8.12	0.02	0	32	Negligible
R13	8.55	8.33	8.35	0.02	0	33	Negligible
R14	8.46	8.16	8.19	0.03	0	33	Negligible
R15	8.50	8.20	8.25	0.05	0	33	Negligible
R16	8.57	8.27	8.33	0.06	0	33	Negligible
R17	8.59	8.29	8.34	0.05	0	33	Negligible
R18	8.56	8.26	8.31	0.05	0	33	Negligible
R19	8.47	8.17	8.23	0.06	0	33	Negligible
R20	8.46	8.27	8.31	0.04	0	33	Negligible
R21	8.51	8.22	8.24	0.02	0	33	Negligible