

Chapter 9: Air Quality

9. Air Quality

9.1. Introduction

9.1.1. Author

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Emily is a Senior Air Quality Consultant with over four years' experience in the air quality sector. She has been responsible for conducting air quality studies for a range of projects, including residential, commercial, employment and industrial schemes. Emily has experience in a range of air quality impact assessments for standalone planning applications and environmental impact assessment (EIA), which involves the protection of both human health and ecosystems.

Contributions to the ES chapter have been made by Jethro Redmore. Jethro is the Director of Redmore Environmental and has worked as a professional environmental scientist for approximately 17 years. He has been responsible for conducting environmental studies for major road improvement and construction schemes, power stations, oil refineries and other major industrial complexes. In addition, he has undertaken air quality assessments for a wide variety of residential schemes, from individual properties to large scale 'eco-towns'. As such, Jethro has experience in a range of air quality impact assessments for standalone assessments required to support a planning application and EIAs in accordance with relevant industry guidance produced by the Department for Environment, Food and Rural Affairs (DEFRA) and the Institute of Air Quality Management (IAQM), amongst others.

9.1.2. Chapter Purpose

This chapter of the ES reports the outcome of the assessment of the likely significant air quality effects of the proposed development during the demolition and construction stage and completed development stage. The chapter and supporting appendices describe the planning policy context, the assessment methodology; the baseline conditions at the application site and surroundings; the likely significant effects; the mitigation measures required to prevent, reduce or offset any significant adverse effects; the likely residual effects after these measures have been employed; and the inter-project cumulative effects. In summary, the objectives of the chapter are to:

- Assess road traffic exhaust emissions from vehicles travelling to and from the proposed development during the demolition and construction stage and completed development stage;
- Quantify levels of pollutants at sensitive receptor locations (humans & ecological receptors) as a result of changes to traffic flows; and
- Identify any mitigation necessary to reduce potential air quality effects from the demolition and construction stage and completed development stage of the proposed development to an acceptable level.

9.1.3. Figures

The following figures are included in this ES chapter:

- Figure 9.3.1: Demolition and Construction Stage and Completed Development Stage Sensitive Human Receptor Locations.

All other figures are included in Appendix 9.1, ES Volume IV.

9.1.4. Appendices

The chapter is supported by the following technical appendices in **ES Volume IV**:

- Appendix 9.1: Air Quality Assessment.

9.2. Methodology

9.2.1. Guidance

- Local Air Quality Management (LAQM) Technical Guidance (TG22), DEFRA, 2022 (1);
- Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017 (2);
- NEA001 'Natural England (NE)'s approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations' (2018) (3) (which is utilised by Natural Resources Wales); and
- Highways England 'LA 105: Air Quality' (2019) (4).

The above guidance documents have been used to inform the methodology of this air quality assessment and are therefore referred to in additional detail throughout the chapter and associated technical appendix, **Appendix 9.1, ES Volume IV**.

9.2.2. Legislation and Policy

National Legislation and Policy:

- Planning Policy Wales (5);
- The Air Quality Standards Regulations (2010) (6);
- The Environment (Miscellaneous Amendments) (EU Exit) Regulations (2020) (7);
- The Air Quality Strategy (2007) (8);
- The Environmental Improvement Plan 2023 (9);
- The Environment Act (2021) (10); and
- Part III of the Environmental Protection Act (1990) (11).

Local Policy:

- Wrexham Unitary Development Plan 1996 - 2011 (12); and,
- Emerging Wrexham Local Development Plan 2013 to 2028 (13).

The above are discussed in more detail within **Appendix 9.1, ES Volume IV**.

9.2.3. Consultation

Prior to commencement of the EIA scoping exercise detailed below, consultation was undertaken via email with Paul Campini, the Enforcement Officer at Wrexham CBC, in December 2021 to discuss and agree the approach to the air quality assessment as presented in this chapter of the ES. The proposed methodology outlined during consultation was deemed acceptable as confirmed in an email from Paul Campini on 06 December 2022.

The EIA Scoping Report (**Appendix 2.1, ES Volume IV**) was submitted to Wrexham CBC on 02 November 2022. The proposed scope of the Air Quality ES chapter was set out in Chapter 5: Topics with Potential for Likely Significant Effects.

Wrexham CBC issued their final Scoping Opinion on 02 June 2023.

Table 9.2.1 summarises the key EIA Scoping Opinion comments with respect to the air quality assessment and how and where these have been addressed in the chapter.

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Table 9.2.1
Comments Provided in Scoping Opinion

Scoping Comments	How addressed in the ES chapter
Wrexham CBC (06 December 2022)	
The proposed methodology outlined in the scoping document is considered acceptable. Upon receipt of the planning application, Wrexham CBC will be recommending that a dust management scheme for the construction stage be required by condition: <i>No part of the development shall commence until an appropriate Dust Management Scheme has been submitted to, and approved in writing by, the Local Planning Authority. The dust mitigation measures as are approved shall be fully implemented for the entire duration of the construction phase.</i>	This is noted. The assessment presented herewithin has been undertaken in accordance with agreed methodology.
Natural Resource Wales (04 April 2023)	
NRW have advised that they consider the development is likely to have significant effects. They have commented that the site is within: – 2.6km of the River Dee Site of Special Scientific Interest (SSSI) – 2.7km of the River Dee and Bala Lake Special Area of Conservation (SAC) – 3.3km of Midlands Meres and Mosses Ramsar / Vicarage Moss SSSI – 4.8km of Sontley Marsh SSSI – 4.9km of Marford Quarry SSSI The project has the potential to affect air quality and have indirect effects on protected sites (e.g., SSSIs, SACs, Ramsar sites) during both the construction and operational phase (due to both air pollution and dust). NRW advise that the ES should fully assess impacts of air pollution and dust on protected sites. We would expect the ES to include an assessment of the amount of predicted pollution from the proposal against the relevant critical loads and critical levels for any designated sites that may be affected.	The potential for air quality impacts from the proposed development to indirectly impact ecological receptors has been addressed within this chapter. As set out in Section 9.2.7 and in line with NE guidance (which is utilised by NRW), only ecological designated sites that are within 200m of the proposed development and/or the affected road network have been considered.

9.2.4. Assessment Scope

Technical Scope

The technical scope of the assessment reported in this ES chapter comprises the following, as agreed through the EIA Scoping process:

- Changes to local air quality as a result of emissions from traffic generated during the demolition and construction stage and completed development stage of the proposed development.

The following elements have been excluded from the scope of this assessment, as confirmed through the EIA Scoping process and have therefore not been considered further within this chapter:

- Completed development stage combustion plant emissions; and,
- Air quality impacts as a result of dust from construction activities.

Although impacts as a result of dust emissions are not considered within this ES chapter, a separate Air Quality Assessment Report has been completed and presented in **Appendix 9.1, ES Volume IV**, which includes the construction dust assessment.

Spatial Scope

In accordance with the Design Manual for Roads and Bridges (DMRB) (4) on the likely limits of pollutant dispersion from road sources, the study area for assessment of road vehicle exhaust emissions was within 200 m of roads with associated sensitive receptor locations where there was a predicted change in traffic movements as a result of the proposed development. The IAQM (2) and NE guidance (3) was utilised to identify road links where the change in traffic flow had the potential to result in significant effects. Reference should be made to **Figure 9.1 in Appendix 9.1, ES Volume IV** for a map of the study area.

The study area used for the assessment of air quality impacts on sensitive ecological receptors is set out in Chapter 8: Biodiversity, ES Volume II.

9.2.5. Assessment Scenario

The assessment has been based on the following scenarios for both the demolition and construction and completed development stages:

- Scenario 1: 2019 Baseline – (Verification of model);
- Scenario 2: 2030 Future Baseline + Cumulative Schemes;
- Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic;
- Scenario 4: 2030 Future Baseline + Cumulative Schemes + Completed Development Traffic (Option 1 – Full B2/B8 use); and,
- Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses).

For the purpose of undertaking a conservative assessment, the assessment scenarios have been based on the following:

- Given that vehicular traffic is expected to increase on the road network over time, the final year of the construction stage (Q4 2030) is likely to be the worst case and therefore has been used for the demolition and construction stage assessment;
- Given that vehicular traffic is expected to increase on the road network over time, the fully operational opening year of the scheme (Q4 2030) has been used for the completed development stage assessment, rather than the first phase opening year (Q1 2028), as this is considered to be worst case in respect of vehicular traffic;
- Emission factors for 2019 have been used within the dispersion model in all scenarios to ensure a conservative approach given that air quality is predicted to improve in the future,;
- Cumulative traffic growth from other cumulative schemes has been considered within all future baseline scenarios (Scenario 2, Scenario 3, Scenario 4 and Scenario 5) to ensure emissions from all relevant vehicle trips were include in the predicted concentrations; and
- Due to the flexibility in potential uses being sought by the Applicant in respect of the outline component, two options have been considered for the completed development stage to ensure worst-case vehicular trip calculations have been assessed (refer to Section 9.2.7 Assessment Method for further information).

Reference should be made to **Appendix 9.1, ES Volume IV** for assessment input data and ES Chapter 7: Transport for further details of the calculations used for traffic data generation.

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9.2.6. Baseline Characterisation Approach

Data was obtained from the following sources through a desk-top study in order to establish the baseline conditions within the study area:

- The DEFRA air quality resource website (12);
- Pollutant monitoring results obtained from the 2021 Air Quality Progress Report prepared by Wood Group UK Limited on behalf of Wrexham CBC (13);
- The Multi Agency Geographic Information for the Countryside (MAGIC) website (14);
- Aerial photography available from Google Maps (15);
- Ordinance Survey feature maps (16); and,
- Shawbury Meteorological Data provided by Atmospheric Dispersion Modelling (ADM).

9.2.7. Assessment Method

The assessment has been based on the scheme information and planning application drawings presented in ES Chapter 4: Proposed Development and the construction methodology presented in ES Chapter 6: Construction Strategy & CEMP.

The proposed development has the potential to impact on existing air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the application site during both the demolition and construction stage and completed development stage. The predicted total daily vehicle trip generation from both stages is predicted to exceed the screening criteria set out in the IAQM guidance document (i.e., a change in Annual Average Daily Traffic (AADT) flow of more than 500 for LGV and/or 100 AADT for HGVs) (2). As such, a detailed assessment of the demolition and construction stage and completed development stage impacts has been undertaken. This utilised the ADMS-Roads dispersion model (version 5.0.1.3) and the assessment scenarios mentioned in Section 9.2.5 to determine changes in NO₂, PM₁₀ and PM_{2.5} concentrations at sensitive receptor locations.

The model required input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length (z₀); and,
- Monin-Obukhov length.

Further information on the air quality monitoring parameters used to inform the assessment is presented in **Appendix 9.1, ES Volume IV**. Details of the verification factor calculations are also presented in **Appendix 9.1**.

Human receptor locations sensitive to potential changes in pollutant concentrations were identified within 200m of the highway network in accordance with the guidance provided within the Design Manual for Roads and Bridges (DMRB) (4) on the likely limits of pollutant dispersion from road sources. The criteria provided within DEFRA guidance (1) on where the Air Quality Objectives (AQOs) apply was utilised to determine worst-case human receptor positions in the vicinity of road links likely to be affected by changes in traffic flows as a result of demolition and construction stage and completed development stage traffic.

The outline component may include a hotel within Zones A1 or A2. This is considered a future sensitive receptor in relation to the short term AQOs for nitrogen dioxide (NO₂) and particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀). Maximum concentrations predicted in either zone have therefore been identified for use in the assessment.

The AQOs and Interim Target utilised throughout the assessment are presented in **Appendix 9.1**.

Completed Development Stage

Due to the flexibility in the potential uses being sought by the Applicant in respect of the outline component, AADT traffic data has been provided for two options to ensure the worst-case trip calculations have been assessed. The two options are set out in Chapter 8 *Transport*, which comprise a fully industrial/storage & distribution scheme (Option 1) and an industrial/storage & distribution scheme including additional alternative land uses (e.g. hotel and petrol filling station) (Option 2). Concentrations have been predicted for both options and Option 2 has been identified to produce the highest change from the future baseline. As such, Option 2 traffic data has been used for the purpose of this assessment (refer to Section 9.7: Assessment of Effects). Reference should be made to **Appendix 9.1** results for both scenarios.

ECOLOGICAL RECEPTORS

The proposed development has the potential to impact on existing air quality at ecological receptors as a result of road traffic exhaust emissions associated with vehicles travelling to and from the proposed development during both the demolition and construction stage and completed development stage. These were assessed in accordance with the NE guidance 'Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations' (3), which is utilised by Natural Resources Wales and describes how competent authorities and others will assess plans and projects likely to generate road traffic emissions and subsequently affect international ecological designations. This provides a staged assessment methodology to provide consideration of potential air quality impacts from a development both alone and in-combination with other developments.

It should be noted that although the NE guidance only relates to potential air quality impacts on European designations, it has also been utilised to consider effects at national and local sites in lieu of alternative methods.

The approach can be summarised as follows:

- Stage 1a - Undertake a baseline study to determine the location of any ecological designations within 200m of a road link subject to changes in traffic flows as a result of the project. If there are any features within the relevant distance that are considered sensitive to changes in air quality then the assessment should proceed to Stage 1b; and
- Stage 1b - Determine the predicted change in Annual Average Daily Traffic (AADT) flow on road links situated within the relevant distance of sensitive ecological receptors as a result of the project alone. If the change is above 1,000 then there is a risk of a significant effect on air quality and further assessment is required. If the change is below 1,000 then it can be concluded that air quality impacts are not significant.
- Stage 2 - Should these criteria not be met, then the guidance note (3) considers that no further assessment is required. Should screening of the relevant data indicate that the above criteria are met, then potential impacts at sensitive ecological receptor locations can be assessed by calculating the change in pollutant concentrations as a result of the proposed development.

The following ecological designations were identified within 200m of a road link potentially subject to changes in traffic flows from the proposed development:

- Wrexham Industrial Estate Local Wildlife Site (LWS);
- Cefn Park LWS;
- Vicarage Moss Site of Special Scientific Interest (SSSI);
- Midlands Meres and Mosses Ramsar; and,
- River Dee Special Area of Conservation (SAC).

Given that the AADT flows on road links within the relevant distances of each of the sensitive ecological receptors do not exceed 1,000, it has been concluded that air quality impacts on said ecological receptors are not significant. As such, the Stage 2 assessment has not been required and ecological receptors have not been considered further within this chapter. **Table 9.2.2** sets out further information for the demolition and construction stage and **Table 9.2.3** for the completed development stage. It should be noted that the assessment of completed development stage impacts has been undertaken based on traffic generation from Option 2, as described previously.

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Table 9.2.2
Predicted Changes in 24-hour AADT Flow on Road Links within 200m of Ecological Receptors during Demolition and Construction Stage

Receptor(s) affected	Description of Impact
Wrexham Industrial Estate LWS	The proposed development has the potential to cause changes in pollution levels at Wrexham Industrial Estate LWS as a result of road vehicle exhaust emissions associated with the demolition and construction stage. The identified receptor is located within 200m of Bryn Lane and Ash Road (North). Predicted trip generation from the proposed development alone on Bryn Lane and Ash Road (North) was 0 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts as a result of the demolition and construction stage road vehicle exhaust emissions can be classified as not significant.
Cefn Park LWS	The proposed development has the potential to cause changes in pollution levels at Cefn Park LWS as a result of road vehicle exhaust emissions associated with the demolition and construction stage. The identified receptor is located within 200m of Sandy Lane. Predicted trip generation from the proposed development alone on Sandy Lane was 46 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts as a result of the demolition and construction stage road vehicle exhaust emissions can be classified as not significant.
Vicarage Moss SSSI	The proposed development has the potential to cause changes in pollution levels at Vicarage Moss SSSI as a result of road vehicle exhaust emissions associated with the demolition and construction stage. The identified receptor is located within 200m of Vicarage Lane. Predicted trip generation from the proposed development alone on Vicarage Lane was 0 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts as a result of the demolition and construction stage road vehicle exhaust emissions can be classified as not significant.
Midlands Meres and Mosses Ramsar	The proposed development has the potential to cause changes in pollution levels at Midlands Meres and Mosses Ramsar site as a result of road vehicle exhaust emissions associated with the demolition and construction stage. The identified receptor is located within 200m of Vicarage Lane. Predicted trip generation from the proposed development alone on Vicarage Lane was 0 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts as a result of the demolition and construction stage road vehicle exhaust emissions can be classified as not significant.
River Dee and Bala Lake SAC and River Dee SSSI	The proposed development has the potential to cause changes in pollution levels at the River Dee and Bala Lake SAC as a result of road vehicle exhaust emissions associated with the demolition and construction stage. The identified receptor is located within 200m of the A534 Wrexham Road. Predicted trip generation from the proposed development alone on the A534 Wrexham Road was 12 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts as a result of the demolition and construction stage road vehicle exhaust emissions can be classified as not significant.

Table 9.2.3
Predicted Changes in 24-hour AADT Flow on Road Links within 200m of Ecological Receptors during Completed Development Stage

Receptor(s) affected	Description of Impact
Wrexham Industrial Estate LWS	The proposed development has the potential to cause changes in pollution levels at Wrexham Industrial Estate LWS as a result of road vehicle exhaust emissions associated with the completed development stage. The identified receptor is located within 200m of Bryn Lane and Ash Road (North). Predicted trip generation from the proposed development alone on Bryn Lane and Ash Road (North) was 244 AADT. The proposed development is

Receptor(s) affected	Description of Impact
	not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts at a result of the completed development stage road vehicle exhaust emissions can be classified as not significant.
Cefn Park LWS	The proposed development has the potential to cause changes in pollution levels at Cefn Park LWS as a result of road vehicle exhaust emissions associated with the completed development stage. The identified receptor is located within 200m of Sandy Lane. Predicted trip generation from the proposed development alone on Sandy Lane was 783 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts at a result of the completed development stage road vehicle exhaust emissions can be classified as not significant.
Vicarage Moss SSSI	The proposed development has the potential to cause changes in pollution levels at Vicarage Moss SSSI as a result of road vehicle exhaust emissions associated with the completed development stage. The identified receptor is located within 200m of Vicarage Lane. Predicted trip generation from the proposed development alone on Vicarage Lane was 0 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts at a result of the completed development stage road vehicle exhaust emissions can be classified as not significant.
Midlands Meres and Mosses Ramsar	The proposed development has the potential to cause changes in pollution levels at Midlands Meres and Mosses Ramsar site as a result of road vehicle exhaust emissions associated with the completed development stage. The identified receptor is located within 200m of Vicarage Lane. Predicted trip generation from the proposed development alone on Vicarage Lane was 0 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts at a result of the completed development stage road vehicle exhaust emissions can be classified as not significant.
River Dee and Bala Lake SAC and River Dee SSSI	The proposed development has the potential to cause changes in pollution levels at the River Dee SAC as a result of road vehicle exhaust emissions associated with the completed development stage. The identified receptor is located within 200m of the A534 Wrexham Road. Predicted trip generation from the proposed development alone on the A534 Wrexham Road was 98 AADT. The proposed development is not predicted to increase traffic flows in the vicinity of the identified ecological designation by more than 1,000. As such, potential air quality impacts at a result of the completed development stage road vehicle exhaust emissions can be classified as not significant.

Cumulative Development Stage

The potential for in-combination effects with other developments would arise as a result of additional traffic movements on the road networks. As set out in Section 9.2.5, given that the traffic data used to inform the future baseline year has included cumulative developments, a separate inter-development cumulative assessment has not been undertaken. The potential for in-combination impacts from the proposed development and cumulative schemes is therefore presented in the Assessment of Effects section (Section 9.7).

9.2.8. Assessment Criteria

Human Receptors Sensitivity Criteria

Table 9.2.4 sets out the scale of sensitivity that has been applied to human receptors identified and considered within this assessment.

Table 9.2.4
Receptor Sensitivity Criteria

Sensitivity	Pollutant Concentration at Receptor in Assessment Year
Very High	110% or more of AQO/Interim Target

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Sensitivity	Pollutant Concentration at Receptor in Assessment Year
High	103 - 109% of AQO/Interim Target
Medium	95 - 102% of AQO/Interim Target
Low	76 - 94% of AQO/Interim Target
Very Low	75% or less of AQO/Interim Target

Receptor Magnitude of Impact Criteria

Table 9.2.5 sets out the magnitude of impact criteria that has been applied to human receptors identified and considered within this assessment.

Table 9.2.5
Magnitude of Impact Criteria

Magnitude of Impact	Predicted Concentration Change as Proportion of AQO/Interim Target (%)
Negligible	0
Very Small	1
Small	2-5
Medium	6-10
Large	>10

Receptor Scale of Effect Criteria

EXISTING RECEPTORS

The significance of predicted air quality effects associated with road vehicle exhaust emissions was determined in accordance with the IAQM document 'Land-Use Planning & Development Control: Planning for Air Quality' (2). Using this methodology, impacts were defined based on the interaction between the predicted pollutant concentration from scenario 3 for the demolition and construction stage and scenario 5 for the completed development stage and the magnitude of change between scenario 2 and scenario 3, and scenario 2 and scenario 5, respectively, as presented in **Table 9.2.6**.

Table 9.2.6
Significance of Road Vehicle Exhaust Emissions Effect - Existing Receptors

Receptor Sensitivity	Magnitude of Impact			
	Very Small	Small	Medium	Large
Very High	Moderate	Major	Major	Major
High	Moderate	Moderate	Major	Major
Medium	Minor	Moderate	Moderate	Major
Low	Negligible	Minor	Moderate	Moderate
Very Low	Negligible	Negligible	Minor	Moderate

It should be noted that changes of 0%, i.e. less than 0.5%, are described as negligible in accordance with the IAQM guidance

Based on professional judgement, effects of a moderate or major scale are considered significant in EIA terms.

In determining the scale of effect and its significance, consideration has also been given to the duration of the effect, i.e. short term (< 7 years) and medium term (8-12 years) and temporary, or long term (>12 years) and permanent.

The nature of the effect has been described as either adverse or beneficial as follows:

- Beneficial – An advantageous effect to a receptor;
- Adverse – A detrimental effect to a receptor; and,
- Neutral – An effect that is on balance both beneficial and adverse.

In some instances, negligible may be used on its own without a corresponding nature of effect. This is the case when achieving an absolute value or target.

Whether the effect is direct, indirect or secondary has also been considered.

INTRODUCED RECEPTORS

As the proposed receptor locations are introduced to the application site through the development, a change in pollutant concentrations from the baseline cannot be assessed at these locations. Instead, the model results at proposed receptor locations were compared to the relevant AQOs to determine the potential for any exceedences.

Where a relevant AQO is predicted to be exceeded, the significance of effect is considered to be 'Major' in the absence of mitigation. Where no exceedence is predicted, the effect is considered to be of 'Negligible' significance and no mitigation is required. This is set out in **Table 9.2.7**.

Table 9.2.7
Significance of Road Vehicle Exhaust Emissions Effect - Proposed Receptors

Predicted Pollutant Concentration	Significance	Recommendation
Below AQO	Negligible	-
Above AQO	Major	Mitigation required to limit exposure

9.2.9. Human Health

Exposure to high levels of air pollution in ambient air can cause a variety of adverse health outcomes. It increases the risks of respiratory infections such as asthma and worsens any existing respiratory health conditions.

The proposed development during both the demolition and construction stage and the completed development stage can lead to an increase in concentrations of airborne particles (PM₁₀ and PM_{2.5}) and nitrogen dioxide (NO₂) due to exhaust emissions from diesel powered vehicles and equipment used on site (non-road mobile machinery) and vehicles accessing the application site. These emissions can impact human health and have been assessed within this chapter.

Predicted pollutant concentrations have been compared against the relevant health based AQOs for NO₂ and PM₁₀ and Interim Target for PM_{2.5}, as set out in the Air Quality Standards Regulations (2010) (6) and The Environmental Improvement Plan 2023 (7), respectively.

The consideration of effects on human health are therefore integral to the assessments of air quality undertaken within this ES Chapter.

9.2.10. Climate Change

The key Climate Projections for the UK are summarised in Chapter 2 EIA Methodology of this ES Volume. Air quality is influenced by weather and is therefore sensitive to changes in the climate. Therefore, climate change can have direct impacts on local air quality.

For example, atmospheric warming associated with climate change has the potential to increase ground-level ozone. Whereas the impact climate change has on other pollutants, such as particulate matter is less certain. Based on these uncertainties, it is not feasible to incorporate the effects of climate change within this air quality assessment. Nevertheless, climate change impacts are considered unlikely to materially affect the results of the assessments undertaken in this chapter.

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9.2.11. Risk of Major Accidents and / or Disasters

The major accidents and/or disasters identified as relevant to the proposed development are not applicable to the assessment of air quality, and therefore they have not been considered within the assessment.

9.2.12. Relevant Associated Development

Given the nature of the planning application, the full extent of any associated development, such as utilities or junction works outside the application site boundary, are not confirmed at this stage. However, any such works are not expected to be substantial in the context of the proposed development as a whole and are not considered likely to affect the outcome of this assessment. As such, associated development has not been considered further in this chapter.

9.2.13. Assumptions / limitations

In undertaking the air quality assessment of the application site and wider surrounding area, there are a number of limitations and constraints affecting the outputs from this work. The following assumptions have therefore been made in undertaking the assessment:

- The meteorological data used in the assessment is representative of conditions at the application site. Records were obtained based on a review of available observation locations to ensure the most characteristic record station was selected;
- The background concentrations used for the assessment are representative of baseline annual mean pollutant concentrations at the application site and surrounding areas. These values were obtained from the DEFRA background mapping study, an industry standard database produced on behalf of the UK Government. This ensured the most accurate representation of background pollutant concentrations at the application site;
- Road traffic exhaust emissions are predicted to decrease in future years with changes to the UK's vehicle fleet in line with Government legislation. However, similarly to background concentrations, there is current uncertainty over the level of likely decrease. As such, a worst-case assumption that emission factors do not reduce in the future was adopted to ensure robust results; and
- The monitoring data used in the assessment was accurate. Relevant pollutant concentrations were obtained from the 2021 Air Quality Annual Progress Report prepared on behalf of Wrexham CBC in order to ensure an accurate representation of conditions.

Receptor		NGR (m)	
		X	Y
R7	Residential – Borrás Hall Lane	337271.8	351992.3
R8	Residential – Borrás Hall Lane	337234.9	352300.1
R9	Residential – The Links	335829.1	351753.9
R10	Residential – Birkdale Road	335616.1	351634.5
R11	Residential – A534 Holt Road	335369.2	351462.4
R12	Residential – A534 Holt Road	335090.6	351213.0
R13	Residential – A534 Holt Road	334271.3	350826.8
R14	Residential – Bader Court	335541.9	352097.1
R15	Residential – Avondale Grove	335291.4	352189.2
R16	Residential – Bieston Close	334817.2	352650.7
R17	Residential – Ffordd Llywelyn	334295.9	352996.3
R18	Residential – Ffordd Garmonydd	333943.8	353177.1
R19	Residential – Chester Road	333888.0	353182.6
R20	Residential – Plas Acton Close	333716.0	353022.5
R21	Residential – A5152 Chester Road	333799.2	353049.3
R22	Residential – A5152 Chester Road	333773.9	352601.2
R23	Residential – A5152 Chester Road	333723.1	351981.2

9.3. Sensitive Receptors

The existing human receptors that have been identified as sensitive to potential demolition and construction stage and completed development stage road vehicle exhaust emission impacts are set out in **Table 9.3.1** and shown in **Figure 9.3.1**.

Table 9.3.1
Existing Human Receptor Locations

Receptor		NGR (m)	
		X	Y
R1	Residential – Hugmore Lane	338002.3	351068.4
R2	Residential – Holt Road	336994.2	351867.1
R3	Residential – Sandy Lane	336680.4	351832.4
R4	Residential – A534 Wrexham Road	337640.4	351990.1
R5	Residential – A534 Wrexham Road	339000.9	352690.3
R6	Residential – Sandy Lane	337279.0	350758.2

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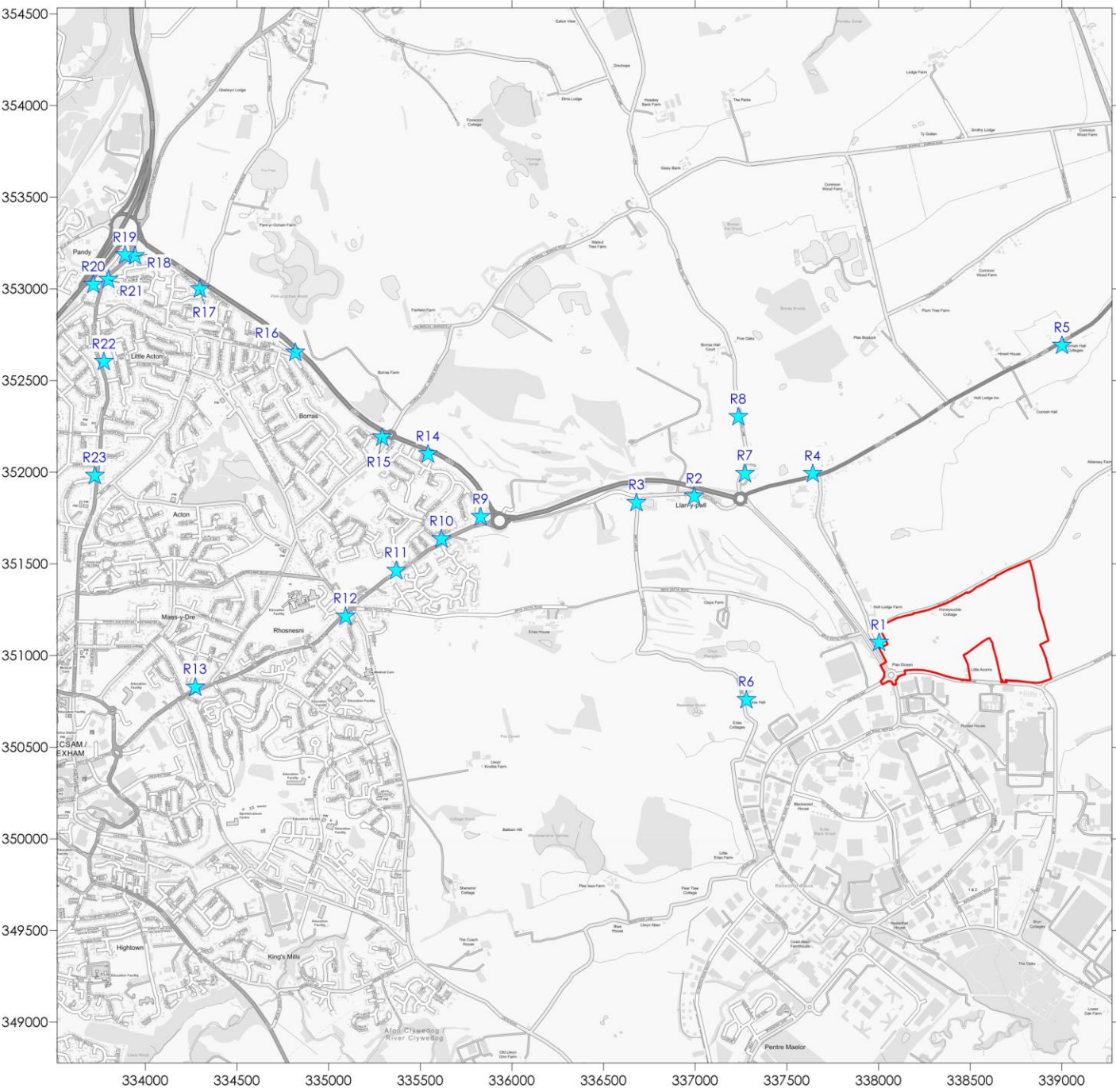


Figure 9.3.1
Existing Human Receptor Locations

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9.4. Baseline Conditions

Table 9.4.1 sets out the diffusion tube monitoring results obtained from the 2021 Air Quality Progress Report (Wood Group UK Limited).

Table 9.4.1
Diffusion Tube Monitoring Results

Site ID	Site Name	Annual Mean NO ₂ Concentration(µg/m³)		
		2018	2019	2020
32	Sycamores	27.2	23.7	18.2
33	Smithfield Road	18.5	15.6	19.3
42	Llan-Y-Pwll	23.2	20.6	17.1
43	Hightown	19.3	17.0	14.4
54	Pandy Lane	-	22.7	15.2
58	St Annes School	-	12.7	10.5
60	St Pauls School	-	7.7	6.8

Table 9.4.2 sets out the existing air quality baseline conditions and future baseline conditions.

Table 9.4.2
Baseline Conditions at Existing Sensitive Receptors

Receptor ID	Description	National Grid Reference	2019 Baseline Annual Mean Concentration (µg/m³)			2030 Future Baseline Annual Mean Concentration (µg/m³)				
			X	Y	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
R1	Residential - Hugmore Lane		338002.3	351068.4	16.16	12.86	8.27	16.51	12.94	8.31
R2	Residential - Holt Road		336994.2	351867.1	15.72	12.73	8.19	16.03	12.79	8.23
R3	Residential - Sandy Lane		336680.4	351832.4	14.41	12.48	8.05	14.59	12.52	8.07
R4	Residential - A534 Wrexham Road		337640.4	351990.1	17.79	13.11	8.41	18.30	13.21	8.47
R5	Residential - A534 Wrexham Road		339000.9	352690.3	15.63	12.70	8.17	15.93	12.75	8.21
R6	Residential - Sandy Lane		337279.0	350758.3	13.27	12.27	7.92	13.34	12.28	7.93
R7	Residential - Borrass Hall Lane		337271.8	351992.3	15.53	12.66	8.15	15.82	12.72	8.18
R8	Residential - Borrass Hall Lane		337234.9	352300.1	13.85	12.36	7.98	13.97	12.39	7.99
R9	Residential - The Links		335829.1	351753.9	16.90	12.88	8.28	17.33	12.96	8.33
R10	Residential - Birkdale Road		335616.1	351634.5	21.04	13.58	8.69	21.86	13.73	8.78
R11	Residential - A534 Holt Road		335369.2	351462.4	18.69	13.25	8.50	19.28	13.36	8.56
R12	Residential - A534 Holt Road		335090.6	351213.0	18.76	13.21	8.48	19.36	13.32	8.54
R13	Residential - A534 Holt Road		334271.3	350826.8	16.56	12.85	8.26	16.95	12.93	8.31
R14	Residential - Bader Court		335541.8	352097.1	18.56	13.28	8.51	19.15	13.40	8.58
R15	Residential - Avondale Grove		335291.4	352189.3	17.51	13.00	8.35	17.99	13.08	8.40
R16	Residential - Bieston Close		334817.2	352650.8	19.17	13.41	8.59	19.81	13.54	8.66
R17	Residential - Ffordd Llywelyn		334295.9	352996.3	16.10	12.80	8.23	16.45	12.86	8.27

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Receptor ID	Description	National Grid Reference	2019 Baseline Annual Mean Concentration (µg/m³)			2030 Future Baseline Annual Mean Concentration (µg/m³)				
			X	Y	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
R18	Residential - Ffordd Garmonydd		333943.8	353177.1	18.10	13.08	8.40	18.58	13.17	8.45
R19	Residential - Chester Road		333888.0	353182.6	18.59	13.19	8.46	19.12	13.29	8.52
R20	Residential - Plas Acton Close		333716.0	353022.5	17.55	13.05	8.38	18.03	13.14	8.43
R21	Residential - A5152 Chester Road		333799.2	353049.3	19.31	13.37	8.57	19.31	13.37	8.57
R22	Residential - A5152 Chester Road		333773.9	352601.3	16.90	12.92	8.30	16.90	12.92	8.30
R23	Residential - A5152 Chester Road		333723.1	351981.3	16.87	12.91	8.30	16.87	12.91	8.30

9.5. Potential Impacts

The impacts considered to have the potential to result in significant effects (prior to inclusion of any embedded mitigation) are reported in **Table 9.5.1**.

Table 9.5.1
Potential significant Impacts

Stage	Description of Potential Impacts	Adverse/beneficial
Demolition and Construction	Changes in pollutant levels at sensitive human receptor locations as a result of vehicle exhaust emissions from construction traffic travelling to and from the application site	Adverse
Completed Development	Changes in pollutant levels at sensitive human receptor locations as a result of vehicle exhaust emissions from traffic travelling to and from the application site	Adverse
Completed Development	Potential exposure of future occupants of the hotel to poor air quality	Adverse

9.6. Embedded Mitigation

The following embedded mitigation has been incorporated into the design of the proposed development.

Table 9.6.1
Potential significant Impacts

Design intervention	Description	Reason for intervention	Further information
Energy Strategy	While the operational energy strategy is still being developed, the use of combustion plant, such as Combined Heat and Power (CHP), has been ruled out. The strategy is expected to rely on Air Source Heat Pumps (ASHPs), while the potential use of other low and zero carbon technologies, such as solar panels, will also be considered as part of the design process. It is possible that backup diesel generators could be required; however, if so, their use is expected to be minimal, mainly associated with annual testing and maintenance with operating hours expected to be below 50 hours per year.	As set out in the Energy and Sustainability Statement, the proposed buildings will target a Design Stage EPC Rating of ‘A’ and will achieve a betterment of the site specific BRUKL Target Emission Rate (TER) in excess of previous Building Regulation requirements. The use of Air Source Heat Pumps (ASHPs) and potentially other low and zero carbon technologies, including solar panels, in preference to combustion plant, would minimize the potential emissions associated with the operational development.	Energy and Sustainability Statement and ES Chapter 4: Proposed Development

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9.7. Assessment of Effects (including Embedded Mitigation)

9.7.1. Demolition and Construction Stage

NO₂ - ANNUAL MEAN

The assessment of the likely annual mean NO₂ effects of the proposed development during the demolition and construction stage (including embedded mitigation) is set out in **Table 9.7.1**.

Table 9.7.1
Demolition and Construction Stage Assessment - NO₂

Receptor(s) affected	Predicted Annual Mean NO ₂ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R1	16.63	17.24	0.61	1.53	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	16.07	16.64	0.57	1.43	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	14.66	15.17	0.51	1.28	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R4	18.33	18.50	0.17	0.43	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	15.98	16.04	0.06	0.15	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R6	13.36	13.72	0.36	0.90	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	15.46	15.94	0.48	1.20	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	13.96	14.06	0.10	0.25	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	17.49	18.11	0.62	1.55	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	22.05	23.57	1.52	3.80	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	19.80	20.52	0.72	1.80	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R12	19.86	20.64	0.78	1.95	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	17.30	17.77	0.47	1.18	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	19.49	19.74	0.25	0.63	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean NO ₂ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R15	17.85	18.46	0.61	1.53	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	20.21	20.44	0.23	0.58	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	16.62	16.77	0.15	0.37	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R18	18.44	18.81	0.37	0.92	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	18.97	19.35	0.38	0.95	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	18.10	18.23	0.13	0.32	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	19.32	19.43	0.11	0.27	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	16.91	16.94	0.03	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R23	16.88	16.90	0.02	0.05	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

As shown in **Table 9.7.1**, annual mean NO₂ concentrations were predicted to be below the AQO of 40µg/m³ at all receptors in both scenarios (i.e. with and without the proposed development). The highest concentration was predicted at R10, with a concentration of 22.05µg/m³ in Scenario 2: 2030 Future Baseline + Cumulative Schemes and 23.57µg/m³ in Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic.

PM₁₀ - ANNUAL MEAN

The assessment of the likely annual mean PM₁₀ effects of the proposed development during the demolition and construction stage (including embedded mitigation) is set out in **Table 9.7.2**.

Table 9.7.2
Demolition and Construction Stage Assessment - PM₁₀

Receptor(s) affected	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R1	12.97	13.09	0.12	0.31	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	12.80	12.92	0.11	0.28	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	12.53	12.64	0.11	0.27	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean PM ₁₀ Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R4	13.22	13.25	0.03	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	12.76	12.77	0.01	0.03	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R6	12.29	12.36	0.08	0.19	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	12.68	12.75	0.07	0.18	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	12.39	12.40	0.02	0.04	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	13.00	13.09	0.09	0.23	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	13.79	14.02	0.23	0.57	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	13.47	13.60	0.13	0.32	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R12	13.42	13.55	0.13	0.33	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	12.99	13.08	0.08	0.21	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	13.47	13.52	0.05	0.13	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R15	13.09	13.17	0.09	0.21	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	13.62	13.67	0.05	0.12	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	12.90	12.92	0.03	0.07	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R18	13.17	13.21	0.04	0.10	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	13.29	13.33	0.04	0.10	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	13.15	13.18	0.02	0.05	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	13.38	13.40	0.02	0.04	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	12.92	12.93	0.00	0.01	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean PM ₁₀ Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R23	12.91	12.92	0.00	0.01	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

As shown in **Table 9.7.2**, annual mean PM₁₀ concentrations were predicted to be below the AQO of 40µg/m³ at all receptors in both scenarios (i.e. with and without the proposed development). The highest concentration was predicted at R10, with a concentration of 13.79µg/m³ in Scenario 2: 2030 Future Baseline + Cumulative Schemes and 14.02µg/m³ in Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic.

PM_{2.5} - ANNUAL MEAN

The assessment of the likely annual mean PM_{2.5} effects of the proposed development during the demolition and construction stage (including embedded mitigation) is set out in **Table 9.7.3**.

Table 9.7.3
Demolition and Construction Stage Assessment - PM_{2.5}

Receptor(s) affected	Predicted Annual Mean PM _{2.5} Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R1	8.33	8.40	0.07	0.60	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	8.23	8.30	0.06	0.54	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	8.08	8.14	0.06	0.52	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R4	8.48	8.50	0.02	0.16	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	8.21	8.22	0.01	0.05	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R6	7.93	7.98	0.04	0.37	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	8.16	8.20	0.04	0.35	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	7.99	8.00	0.01	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	8.35	8.41	0.05	0.45	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	8.82	8.95	0.14	1.13	Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	8.62	8.70	0.08	0.63	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean PM _{2.5} Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic	Change						
R12	8.60	8.67	0.08	0.64	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	8.34	8.39	0.05	0.40	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	8.62	8.65	0.03	0.25	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R15	8.40	8.45	0.05	0.42	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	8.71	8.74	0.03	0.24	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	8.29	8.31	0.02	0.13	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R18	8.45	8.48	0.02	0.20	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	8.52	8.54	0.03	0.21	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	8.44	8.45	0.01	0.11	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	8.57	8.58	0.01	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	8.30	8.31	0.00	0.02	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R23	8.30	8.30	0.00	0.02	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

As shown in **Table 9.7.3**, annual mean PM_{2.5} concentrations were predicted to be below the Interim Target of 12µg/m³ at all receptors in both scenarios (i.e. with and without the proposed development). The highest concentration was predicted at R10, with a concentration of 8.82µg/m³ in Scenario 2: 2030 Future Baseline + Cumulative Schemes and 8.95µg/m³ in Scenario 3: 2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic.

9.7.2. Completed Development Stage

Existing Human Receptors

NO₂ - ANNUAL MEAN

The assessment of the likely annual mean NO₂ effects of the proposed development during the completed development stage (including embedded mitigation) is set out in **Table 9.7.5**. Reference should be made to **Appendix 9.1, ES Volume IV** for model outputs for all scenarios.

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Table 9.7.5
Completed Development Stage Assessment - NO₂

Receptor(s) affected	Predicted Annual Mean NO ₂ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R1	16.63	17.31	0.68	1.70	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	16.07	16.57	0.50	1.25	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	14.66	15.11	0.45	1.13	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R4	18.33	18.51	0.18	0.45	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	15.98	16.04	0.06	0.15	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R6	13.36	13.72	0.36	0.90	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	15.46	15.90	0.44	1.10	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	13.96	14.06	0.10	0.25	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	17.49	18.06	0.57	1.43	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	22.05	23.44	1.39	3.48	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	19.80	20.43	0.63	1.58	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R12	19.86	20.54	0.68	1.70	Very Low	Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	17.30	17.71	0.41	1.03	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	19.49	19.72	0.23	0.58	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R15	17.85	18.44	0.59	1.48	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	20.21	20.43	0.22	0.55	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	16.62	16.80	0.18	0.45	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean NO ₂ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R18	18.44	18.87	0.43	1.08	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	18.97	19.40	0.43	1.08	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	18.10	18.24	0.14	0.35	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	19.32	19.46	0.14	0.35	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	16.91	16.95	0.04	0.10	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R23	16.88	16.91	0.03	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

As shown in **Table 9.7.5**, annual mean NO₂ concentrations were predicted to be below the AQO of 40µg/m³ at all receptors in both scenarios. The highest concentration was predicted at R10, with a concentration of 22.05µg/m³ in Scenario 2: Future Baseline + Cumulative Schemes and 23.44µg/m³ in Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses).

PM₁₀ - ANNUAL MEAN

The assessment of the likely annual mean PM₁₀ effects of the proposed development during the completed development stage (including embedded mitigation) is set out in **Table 9.7.6**.

Table 9.7.6
Completed Development Stage Assessment - PM₁₀

Receptor(s) affected	Predicted Annual Mean PM ₁₀ Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R1	12.97	13.10	0.13	0.33	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	12.80	12.90	0.10	0.24	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	12.53	12.62	0.09	0.23	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R4	13.22	13.25	0.03	0.08	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	12.76	12.77	0.01	0.03	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean PM ₁₀ Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R6	12.29	12.36	0.07	0.18	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	12.68	12.75	0.07	0.17	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	12.39	12.40	0.02	0.04	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	13.00	13.09	0.09	0.22	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	13.79	14.01	0.21	0.54	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	13.47	13.58	0.12	0.29	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R12	13.42	13.54	0.12	0.29	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	12.99	13.07	0.07	0.19	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	13.47	13.51	0.05	0.11	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R15	13.09	13.17	0.08	0.21	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	13.62	13.66	0.05	0.11	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	12.90	12.94	0.04	0.09	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R18	13.17	13.23	0.06	0.16	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	13.29	13.35	0.06	0.15	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	13.15	13.18	0.03	0.07	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	13.38	13.41	0.02	0.06	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	12.92	12.93	0.01	0.02	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R23	12.91	12.92	0.01	0.01	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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As shown in **Table 9.7.6**, annual mean PM₁₀ concentrations were predicted to be below the AQO of 40µg/m³ at all receptors in both scenarios. The highest concentration was predicted at R10, with a concentration of 13.79µg/m³ in Scenario 2: 2030 Future Baseline + Cumulative Schemes and 14.01µg/m³ in Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses).

PM_{2.5} - ANNUAL MEAN

The assessment of the likely annual mean PM_{2.5} effects of the proposed development during the completed development stage (including embedded mitigation) is set out in **Table 9.7.7**.

Table 9.7.7
Completed Development Stage Assessment - PM_{2.5}

Receptor(s) affected	Predicted Annual Mean PM _{2.5} Concentration (µg/m ³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R1	8.33	8.40	0.08	0.65	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R2	8.23	8.29	0.06	0.47	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R3	8.08	8.13	0.05	0.44	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R4	8.48	8.50	0.02	0.16	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R5	8.21	8.22	0.01	0.06	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R6	7.93	7.98	0.04	0.35	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R7	8.16	8.20	0.04	0.33	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R8	7.99	8.00	0.01	0.09	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R9	8.35	8.40	0.05	0.43	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R10	8.82	8.94	0.13	1.06	Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R11	8.62	8.69	0.07	0.56	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R12	8.60	8.67	0.07	0.57	Very Low	Very Small	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R13	8.34	8.39	0.04	0.36	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R14	8.62	8.65	0.03	0.22	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

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Receptor(s) affected	Predicted Annual Mean PM _{2.5} Concentration (µg/m³)			Predicted Change as a Proportion of AQO (%)	Receptor Sensitivity	Magnitude of Change	Scale of Effect and Significance	Additional Mitigation proposed?	Further information
	Scenario 2: 2030 Future Baseline + Cumulative Schemes	Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses)	Change						
R15	8.40	8.45	0.05	0.41	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R16	8.71	8.73	0.03	0.22	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R17	8.29	8.31	0.02	0.18	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R18	8.45	8.49	0.04	0.31	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R19	8.52	8.55	0.04	0.30	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R20	8.44	8.46	0.02	0.13	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R21	8.57	8.59	0.01	0.12	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R22	8.30	8.31	0.01	0.04	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4
R23	8.30	8.30	0.00	0.03	Very Low	Negligible	Negligible (Not significant)	No	Appendix 9.1, Sections 2 - 4

As shown in **Table 9.7.7**, annual mean PM_{2.5} concentrations were predicted to be below the Interim Target of 12µg/m³ at all receptors in both scenarios. The highest concentration was predicted at R10, with a concentration of 8.82µg/m³ in Scenario 2: 2030 Future Baseline + Cumulative Schemes and 8.94µg/m³ in Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses).

Introduced Human Receptors

The maximum number of days with 24-hour mean PM₁₀ concentrations above 50µg/m³ at any point in Zones A1 or A2 was 1 for Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses). This is 29-days below the permitted number of 35-days. As such, effects are predicted to be negligible (not significant).

The maximum annual mean NO₂ concentration at any point in Zones A1 or A2 was 34.67µg/m³ for Scenario 5: 2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses). This is 25.33µg/m³ below the criteria of 60µg/m³ provided by DEFRA to screen out potential exceedences of the 1-hour mean AQO. As such, effects are predicted to be negligible (not significant).

9.8. Additional Mitigation & Enhancement Measures

The assessment indicates that mitigation for road traffic associated with the demolition and construction and completed development stages is not required following the incorporation of the design interventions. Therefore, no additional mitigation is proposed. However, for completeness, best practice construction phase air quality mitigation measures are set out in Chapter 6 *Construction Strategy & CEMP* and Chapter 14 *Summary of mitigation & Residual Effects*.

9.9. Residual Effects

Table 9.9.1 provides a tabulated summary of the outcomes of the air quality assessment of the proposed development.

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Table 9.9.1
Residual Effects

Stage	Receptor (sensitivity)	Description of Residual Effect and Any Additional Mitigation	Residual Effect						
			Magnitude post-mitigation	Scale of Effect and Significance	ADV / BEN	ST / MT/ LT	D/IND	P/T	R/IRR
Key: ADV/BEN= Adverse/Beneficial; ST/MT/LT = Short-term/Medium-term/Long-term; D/IND = Direct/Indirect; P/T = Permanent/Temporary; R/IRR = Reversible/Irreversible									
Demolition and Construction	All Human Receptors (R1 – R23) (Very Low)	2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic (NO ₂) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	ST	D	T	R
Demolition and Construction	All Human Receptors (R1 – R23) (Very Low)	2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic (PM ₁₀) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	ST	D	T	R
Demolition and Construction	All Human Receptors (R1 – R23) (Very Low to Low)	2030 Future Baseline + Cumulative Schemes + Demolition and Construction Traffic (PM _{2.5}) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	ST	D	T	R
Completed Development	All Human Receptors (R1 – R23) (Very Low)	2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses) (NO ₂) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	LT	D	T	R
Completed Development	All Human Receptors (R1 – R23) (Very Low)	2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses) (PM ₁₀) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	LT	D	T	R
Completed Development	All Human Receptors (R1 – R23) (Very Low to Low)	2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses) (PM _{2.5}) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	LT	D	T	R
Completed Development	Proposed Hotel	2030 Future Baseline + Cumulative Schemes + Completed Development (Option 2 – B2/B8 use plus alternative uses) (24-hour PM ₁₀ and 1-hour NO ₂) The residual impact on pollutant concentrations is of negligible significance	Negligible	Negligible (not significant)	ADV	LT	D	T	R

9.10. Air Quality: Inter-Development Cumulative Effects

The assessment of inter-development cumulative effects broadly takes place over two stages, the first of which is screening. The screening exercise undertaken for the cumulative schemes identified in Chapter 2 *EIA Methodology* of this volume of the ES, is included in Section **Error! Reference source not found.**

9.10.1. Screening of Cumulative Schemes

Table 9.10.1
Air Quality Inter-development Cumulative Effects Assessment: Cumulative Scheme Screening

Cumulative scheme	Scheme Description	Potential for cumulative effects?	Considered within assessment?
Land South of Ridleywood Lane and, East Of Bryn Lane, Wrexham Industrial Estate, Wrexham, LL13 9UT P/2020/0167; P/2016/0327; P/2016/0722; P/2011/0891;	Reserved Matters Pursuant to Outline Planning Permission P/2020/0167 (Appearance, Landscaping And Scale) - Erection Of Storage and Distribution Warehouse	Yes – the scheme may result in vehicle exhaust emissions as a result of completed development stage activities. As the scheme became operational in January 2023, there would be no cumulative effects during the demolition and construction stage of the proposed development.	Yes – however, given that the scheme became operational in January 2023, the traffic surveys done in March 2023 already included traffic from this development. The in-combination effects during the completed development stage are therefore captured within Section 9.7.2, Table 9.7.5 to 9.7.7.

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Cumulative scheme	Scheme Description	Potential for cumulative effects?	Considered within assessment?
Unit 6, Pacific Park, Bridge Road North, Wrexham Industrial Estate, Wrexham, LL13 9PN	Erection of 2 new industrial units on land to the north of unit 6 Pacific Park	Yes – During the completed development stage, there is potential for cumulative effects associated with vehicle exhaust emissions. However, traffic associated with the operation of the cumulative scheme has been captured within the future baseline scenario and has therefore been assessed in the Completed Development Stage assessment presented in Section 9.7.2 (Tables 9.7.5 to 9.7.7). In respect of the demolition and construction stage, it is assumed that construction activities relating to the cumulative scheme will apply mitigation and good site practice, alongside a site specific CEMP, and therefore the residual effects of cumulative air quality effects resulting from construction traffic emissions are considered not significant.	Yes – traffic associated with the operation of the cumulative scheme has been captured within the future baseline scenario and has therefore been assessed within the Completed Development Stage assessment presented in Section 9.7.2, Table 9.7.5 to 9.7.7.
Land Off, Ash Road South, Wrexham Industrial Estate, Wrexham, LL13 9UG	Erection of industrial unit comprising two storey office and warehouse accommodation and single storey dust extraction building and associated car parking and storage area	Yes – During the completed development stage, there is potential for cumulative effects associated with vehicle exhaust emissions. However, traffic associated with the operation of the cumulative scheme has been captured within the future baseline scenario and has therefore been assessed in the Completed Development Stage assessment presented in Section 9.7.2 (Tables 9.7.5 to 9.7.7). In respect of the demolition and construction stage, it is assumed that construction activities relating to the cumulative scheme will apply mitigation and good site practice, alongside a site specific CEMP, and therefore the residual effects of cumulative air quality effects resulting from construction traffic emissions are considered not significant.	Yes – traffic associated with the operation of the cumulative scheme has been captured within the future baseline scenario and has therefore been assessed within the Completed Development Stage assessment presented in Section 9.7.2, Table 9.7.5 to 9.7.7.

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