Air Quality Assessment

Land South of Bryn Lane, Wrexham

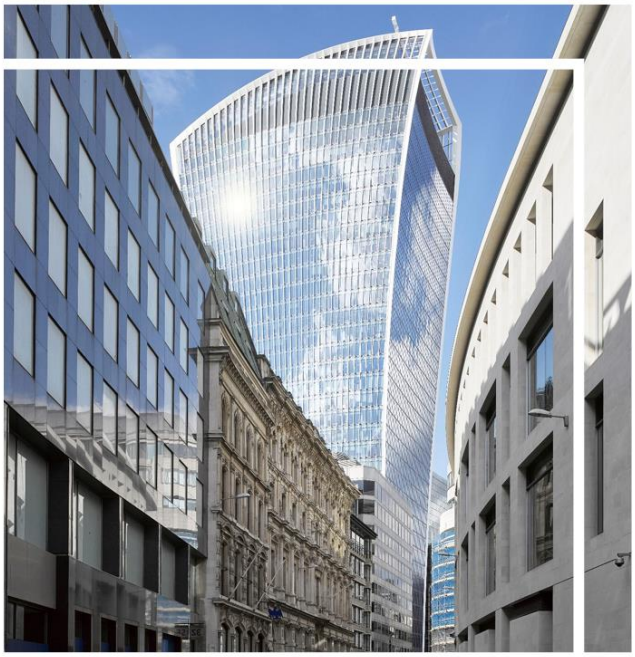
Mauna Kea Limited, a fully owned subsidiary of Net World Sports

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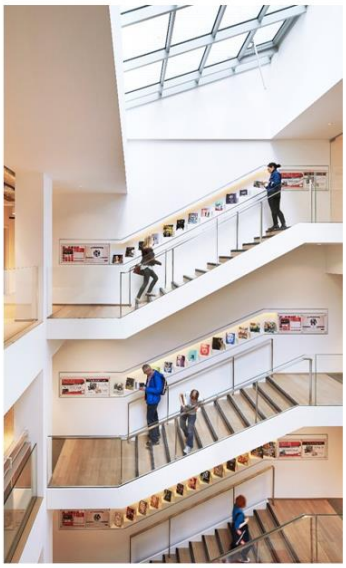
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Executive Summary

Hilson Moran has been instructed by Mauna Kea Limited, a fully owned subsidiary of Net World Sports to undertake an Air Quality Assessment (AQA) for the Proposed Development at Land South of Bryn Lane, Wrexham.

This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational stages of the Proposed Development. The assessment has been undertaken in line with the relevant policy and guidance, and where necessary outlines the required mitigation measures to minimise impacts.

A qualitative assessment of construction phase impacts was carried out. There is a low risk of dust soiling during demolition. During earthworks, construction and trackout activities the risk of dust soiling is medium. There is a negligible risk to human health during demolition. During earthworks, construction and trackout activities the risk to human health is low. Through good site practice, the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases will be minimised. The residual effect of the construction phase on air quality is therefore not significant.

A quantitative road traffic assessment has been undertaken using ADMS-Urban. The conclusions of the detailed dispersion modelling indicate:

- The impact on annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all existing receptors modelled is negligible;
- All proposed receptors have predicted annual mean NO_2 concentrations well below the AQS;
- All modelled receptors (existing and proposed) are predicted to have 1-hour mean NO_2 concentrations well below the AQS objective;
- The annual mean concentrations of PM_{10} and $PM_{2.5}$ are below the AQS objective for all modelled receptors and within the objective for daily mean PM_{10}. The impacts are classified as negligible; and,
- All modelled receptors (existing and proposed) are predicted to have 24-hour mean PM_{10} concentrations well below the relevant AQS objective.

Several key embedded mitigation measures incorporated into the proposals encompass an 'air quality positive' design approach. These include sustainable transport measures such as cycle parking, electric vehicle (EV) charging provisions and all-electric systems for the provision of heating and hot water. The retention of the tree boarder along Bryn Lane will also provide a natural vegetation buffer, reducing the ingress of traffic-polluted air towards the Proposed Development.

Based on the findings of the assessment site specific mitigation to protect existing receptors and future users of the Proposed Development from poor air quality is not required.

The residual effect is not significant.

Overall, with the recommended mitigation measures (construction phase only) in place the proposals would be compliant with legislation and policy.

1. Introduction

Hilson Moran has been instructed by Mauna Kea Limited, a fully owned subsidiary of Net World Sports to undertake an Air Quality Assessment (AQA) for the proposed development of Land South of Bryn Lane, Wrexham, hereafter referred to as the 'Proposed Development' or 'Application Site'. The Application Site is located in Wrexham County Borough Council (WCBC), as identified in **Figure 1-1**.

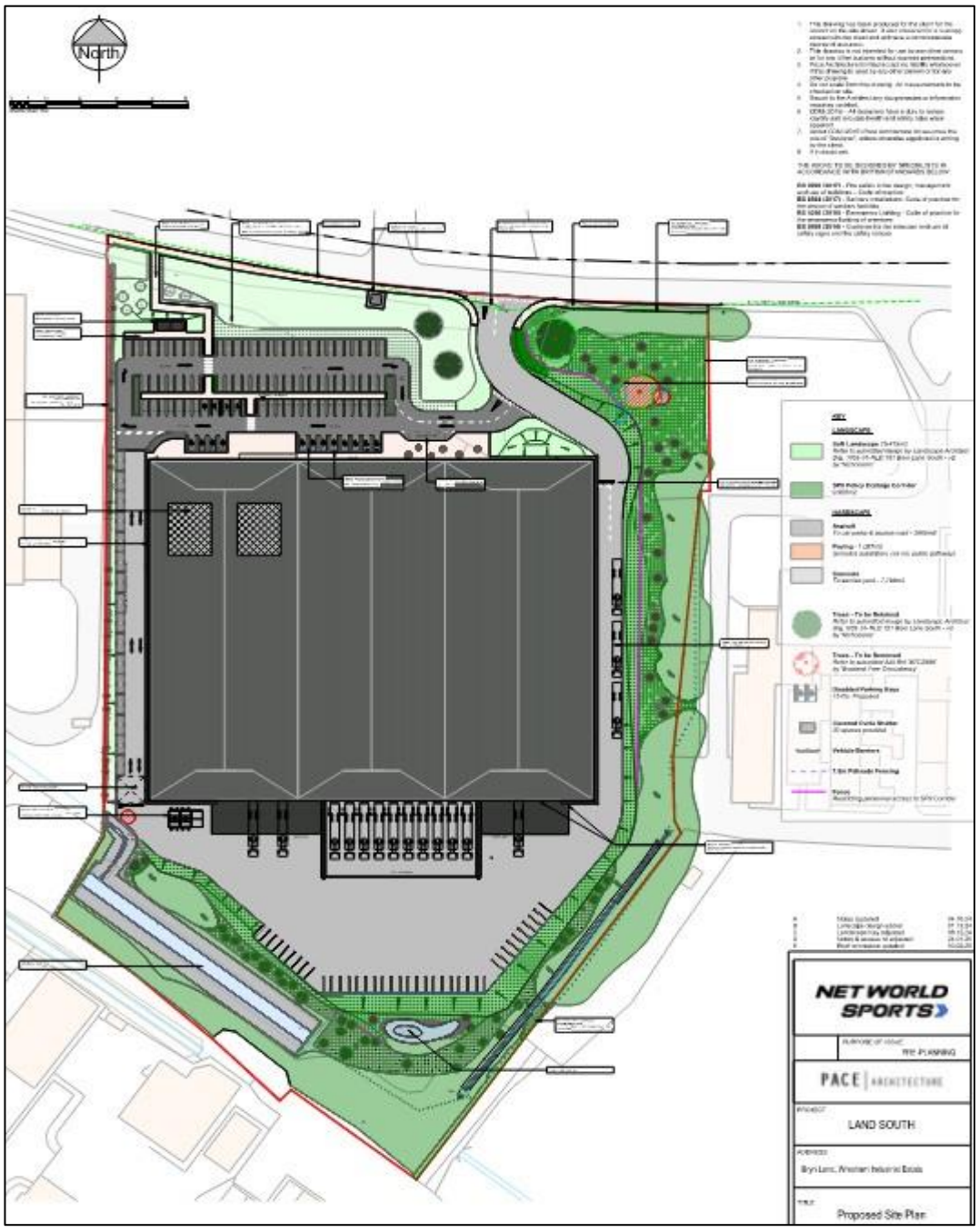


Figure 1-1 Site Layout (Source: Pace Architecture, Drawing No. 2042.P.004 (E), dated February 2024).

The Application Site falls within the Wrexham Industrial Estate and is bounded by Bryn Lane to the north and a range of employment uses to the east, west, and south. Adjacent uses include warehouses used for leisure, distribution, manufacturing, and storage alongside the Kellogg's Factory which occupies a substantial footprint to the south-east of the Application Site.

The Application Site was historically used for manufacturing purposes and has since become grassland, which was previously grazed, alongside vegetation and trees. Other features on site include an area of slopping masonry forming a drain in the south-western corner, a disused concrete bunker in the north-eastern corner, and redundant fencing.

1.1. Proposed Development

The proposals comprise of the following:

- *14,564 sq. m (GIA) of employment floorspace (Use Classes B2 and B8) alongside ancillary office floorspace (Use Class B1a);*
- *146 car parking spaces (including 15 disabled car parking spaces);*
- *30 cycle parking spaces within an external cycle store;*
- *New landscaping;*
- *Retention of a Strategic Ecological Network around the southern and eastern perimeter of the Site; and,*
- *Improved access off Bryn Lane and new internal circulation roads.*

1.2. Potential Impacts

This report presents the findings of the AQA for both the operational and construction phases. During the construction phase, activities on the Application Site could give rise to dust, which, if transported beyond the site boundary, could have an adverse effect on local air quality and cause a statutory 'nuisance'. During the operational phase, emissions from road traffic has the potential to affect local pollution levels at existing and proposed receptors. For both phases, the impacts are identified and the mitigation measures that should be implemented to minimise the impact are described.

The AQA considers the potential impact on existing and future users of the Proposed Development.

A glossary of terms is provided in **Appendix A**.

1.3. Limitations

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2. Legislation, Policy & Guidance

2.1. Legislation

A summary of relevant air quality legislation is provided below.

2.1.1. Air Quality Strategy for England, Scotland, Wales and Northern Ireland

The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland[1], most recently updated in 2023. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that the European Union and International agreements are met in the UK.

The AQS covers the following air pollutants: ammonia (NH_3), benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), oxides of nitrogen (NO_X) (including nitrogen dioxide (NO_2)), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

The AQS sets standards and objectives for the listed pollutants for the protection of human health, vegetation and ecosystems. The standards are based on recommendations by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) based on current understanding and scientific knowledge about the effects of air pollution on health and the environment. The air quality objectives are policy based targets set by the UK Government that are often expressed as maximum concentrations not to be exceeded either without exception or with a limited number of exceedances within a specified timescale.

For the pollutants considered in this assessment, there are both a long-term (e.g., annual mean) and short-term (e.g., one hour mean) standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period (no more than 18 exceedances of 200 µg/m^3 per year), whereas for PM_{10} it is a 24-hour averaging period (no more than 35 exceedances of 50 µg/m^3 per year). The variation in time period reflects the varying impacts on health of differing exposures to pollutants.

Defra recently issued interim planning guidance[2] which established two new targets for $PM_{2.5}$. These targets are recognised throughout this report:

- A maximum annual mean concentration target of 10 µg/m^3 to be achieved by 2040; and,
- A population exposure reduction target of 35% compared to 2018 to be achieved by 2040.

2.1.2. Air Quality Regulations

The air quality objectives in the AQS are statutory in Wales within the Air Quality (Wales) Regulations 2000[3] and the Air Quality (Wales) (Amendment) Regulations 2002[4] for the purpose of Local Air Quality Management (LAQM).

The Regulations require likely exceedances of the AQS objectives to be assessed in relation to:

'…the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…'

The Air Quality Standards (Amendment) Regulations 2016[5] transpose the European Union Ambient Air Quality Directive (2008/50/EC) into law in Wales, with the Air Quality (Amendment of Domestic Regulations) (EU Exit) Regulations 2019 ensuring continuation of the transposition of the Directive. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as NO_2, PM_{10} and $PM_{2.5}$. The limit values for NO_2 and PM_{10} are the same concentration levels as the relevant AQS objectives and the limit value for $PM_{2.5}$ is a concentration of 20 $\mu g/m^3$. The relevant air quality objectives are presented in Table 2.1.

Table 2.1 Air Quality Objectives for Relevant Pollutants

Pollutant	Concentration	Measured as
NO_2	200 $\mu g/m^3$	1-hour mean, not to be exceeded more than 18 times a year (99.79 %ile)
	40 $\mu g/m^3$	Annual mean
PM_{10}	50 $\mu g/m^3$	24-hour mean, not to be exceeded more than 35 times a year (90.41 %ile)
	40 $\mu g/m^3$	Annual mean
$PM_{2.5}$	20 $\mu g/m^3$	Annual mean

2.1.3. Environment (Air Quality and Soundscapes) (Wales) Act 2024

The Environment (Air Quality and Soundscapes) (Wales) Act 2024[6] sets out the provision for improving air quality in Wales; for a national strategy for assessing and managing soundscapes in Wales; and for connected purposes. The act sets out the air quality targets, the effects of air pollution and guidance on how local authorities should review, monitor, and report local air quality. Local authorities are to periodically review and assess the quality of air within their administrative area. Where the objectives are not likely to be achieved, an authority is required to designate an AQMA. For each designated AQMA the local authority is required to produce an Air Quality Action Plan (AQAP) that works to ensure compliance with the objectives by implementing a number of air quality improvements measures.

2.1.4. WHO Guidelines

Table 2.2 states the World Health Organisation (WHO) Air Quality Guidelines for NO_2, PM_{10} and $PM_{2.5}$. Whilst these guidelines are not targeted in the UK there is a push meet the guidelines and be more stringent with air quality control.

Table 2.2 WHO Air Quality Guidelines

Pollutant	Concentration	Measured as
NO_2	25 µg/m^3	24-hour mean, not to be exceeded more than 3-4 times a year (99.79 %ile)
	200 µg/m^3	1 hour mean, not to be exceeded more than 3-4 times a year (99.79 %ile)
	10 µg/m^3	Annual mean
PM_{10}	45 µg/m^3	24-hour mean, not to be exceeded more than 35 times a year (90.41 %ile) for UK, not to exceeded more than 3 to 4 times a year (99th %ile) under WHO
	15 µg/m^3	Annual mean
$PM_{2.5}$	15 µg/m^3	24-hour mean, not to exceeded more than 3 to 4 times a year (99th %ile)
	5 µg/m^3	Annual mean

2.2. Planning Policy

A summary of the national and local planning policy relevant to air quality and the Proposed Development is detailed below.

2.2.1. National

2.2.1.1. Planning Policy Wales

Planning Policy Wales (PPW)[7] sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs), Welsh Government Circulars, and policy clarification letters, which together with PPW provide the national planning policy framework for Wales. PPW, the TANs, MTANs and policy clarification letters comprise national planning policy.

The primary objective of PPW is to ensure that the planning system contributes towards the delivery of sustainable development and improves the social, economic, environmental, and cultural well-being of Wales, as required by the Planning (Wales) Act 2015, the Well-being of Future Generations (Wales) Act 2015 and other key legislation and resultant duties such as the Socio-economic Duty. A well-functioning planning system is fundamental for sustainable development and achieving sustainable places.

PPW promotes action at all levels of the planning process which is conducive to maximising its contribution to the well-being of Wales and its communities. It encourages a wider, sustainable, and problem-solving outlook which focuses on integrating and addressing multiple issues rather than on an approach which is fragmented, un-coordinated and deals with issues in isolation. It provides an opportunity to remove any actual or perceived problems in current approaches and stimulate and support innovative and creative ideas as well as high standards of evidence and assessment to underpin the preparation of development plans and strategies and individual proposals.

Monitoring and learning from development outcomes to drive sustainable improvements in planning practice is also important.

Section 6.7 of the PPW sets out how air quality should be considered in the context of planning and the development of sustainable places.

2.2.2. Local

2.2.2.1. Wrexham Local Development Plan (LDP)

Local planning policy is provided in Wrexham's Local Development Plan (LDP)[8], adopted in 2023, this replaces the UDP. The LDP serves as a long-term land use and development strategy, focused on achieving sustainable development by:

- Guiding development for housing, employment, retail and other uses;
- Setting out policies that will be used to decide planning applications; and,
- Safeguarding areas of land requiring protection or enhancement.

The main planning policy relating to air quality is provided by Policy DM1 on 'Development Management Considerations', which states that development proposals must '*safeguard the environment from the adverse effects of pollution of water, land, noise, light or air, or land instability, arising from development*.'

The sources and impacts of air pollution and climate change are interconnected. Policy SP18 on 'Climate Change', states:

'To mitigate against the effects of climate change and adapt to its impacts, development proposals will need to demonstrate that they have taken into account the following:

i. Reducing carbon emissions;

ii. Protecting and increasing carbon sinks;

iii. Adapting to the implications of climate change at both a strategic and detailed design level;

iv. Promoting energy efficiency and increasing the supply of renewable energy;

v. Maintaining ecological resilience;

vi. Avoiding areas susceptible to flood risk in the first instance in accordance with the sequential approach set out in national guidance. Highly vulnerable development, as defined in TAN15: Development and Flood Risk, should not be located within zone C2;

vii. Preventing development that increases flood risk; and

viii. Assesses the potential effects of climate change when preparing a Flood Consequence Assessment for the site.'

2.2.2.2. Wrexham Unitary Development Plan (UDP)

The Unitary Development Plan (UDP)[9], adopted in 2005, set out the intentions for development in the administrative area of WCBC between 1996-2011.

Strategic Policy PS2, states '*Development must not materially detrimentally affect countryside, landscape/townscape character, open space, or the quality of the natural environment.*'

The main planning policy relating to air quality was provided by Policy GDP1 (part f), which states that all new development should:

"Ensure the safety and amenity of the public and safeguard the environment from the adverse effects of pollution of water, land or air, hazards from industry and quarrying, and associated noise, odour or vibration arising from development".

2.3. Guidance

A summary of the publications referred to in undertaking the air quality assessment is provided below.

2.3.1. Local Air Quality Management Review and Assessment Technical Guidance

The Department for Environment, Food and Rural Affairs (Defra) has published technical guidance for use by local authorities. This technical guidance, identified as LAQM.TG(22)[10], is for used by local authorities for their review and assessment work and has been applied where appropriate to this assessment.

2.3.2. Land-Use Planning and Development Control: Planning for Air Quality

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) have published guidance[11], which offers advice as to when an air quality assessment may or may not be required. The guidance document details what should be included within an assessment, how to determine the significance of impacts and the likely mitigation measures required to minimise the impacts.

2.3.3. Guidance on the Assessment of Dust from Demolition and Construction

This document[12], published by the IAQM, provides guidance on how to assess the impact of construction activities on air quality associated with new developments. The methodology prescribed within the document allows the impacts to be categorised based on risk (with reference to dust and PM_{10} on sensitive human and ecological receptors) and, where applicable, identify mitigation measures associated to the risk classification determined.

3. Assessment Methodology

3.1. Scope of Assessment

The scope of the assessment has been determined in the following way:

- Consultation with the Environmental Health Officer (EHO) at WCBC Council to agree the scope of the assessment and the methodology to be applied;
- Review of the North Wales Combined Authority (including WCBC) latest review and assessment reports[13] and the air quality data for the area surrounding the Application Site, including WCBC and Defra;
- Desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality, and a review of the Proposed Development to establish the location of new sensitive receptors; and,
- Review of the traffic data provided by Cora IHT (the Applications Transport Consultant).

The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:

- Dust and particulate matter generated by on-site activities during the construction phase;
- Increases in pollutant concentrations as a result of exhaust emissions arising from construction traffic and plant; and
- Increases in pollutant concentrations as a result of exhaust emissions arising from traffic generated by the Proposed Development once operational.

It is understood that the proposals do not include for any proposed Combined Heat and Power (CHP) Units, gas-fired boilers, or diesel generators for the purposes of providing heating and cooling (where necessary) and hot water. At this stage, it is understood that the proposals will include for an all-electric approach consisting of Air Source Heat Pumps (ASHP) and Photovoltaics (PV). As such a detailed assessment of any onsite combustion plant has been scoped out.

3.2. Construction Phase

Assessment of the risk of impact associated with the generation of dust during the construction phase of the Proposed Development and determination of subsequent mitigation measures necessary has been undertaken following IAQM guidelines.

The assessment is based on a series of steps: screening the requirement for a detailed assessment, classification of the likely magnitude of dust emissions; characterisation of the area of influence and establishment of its sensitivity to dust; and establishment of the overall risk of impact. The risk of impact from dust emissions from the Proposed Development considers effects on human health, nuisance as a result of dust soiling and ecological receptors from four main activities: demolition; earthworks; construction; and trackout. The potential for dust emissions from each activity should be considered, unless any of them are not relevant to the Proposed Development.

3.2.1. Identification of Receptors

The guidelines identify appropriate screening criteria for the identification of potential receptors, based on a conservative approach and in consideration of the exponential decline in both airborne concentrations and the rate of deposition with distance. A detailed assessment of the impact of dust from construction sites will be required where:

- A 'human receptor' is located within 350m of the boundary of the Site or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the Site entrance;
- An 'ecological receptor' is located within 50m of the boundary of the Site or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the Site entrance.

Tables 3.2, 3.3, 3.4 and 3.5 provide the criteria to define receptor sensitive to dust soiling and fugitive PM_{10} emissions associated with construction activities.

Receptor sensitivity ranges from low (indicative examples include public footpaths, playing fields and parks), to medium (offices and shops) to high sensitivity (residential dwellings, hospitals, schools, and care homes).

Sensitive ecological receptors are defined as a site with features determined to be sensitive to NO_x, NO_2, PM_{10} or $PM_{2.5}$, either directly or indirectly. No ecological receptors are within 50m of the Proposed Development and/or 200m of the likely construction route, therefore ecological construction phase impacts are scoped out of this assessment.

3.2.2. Establishing Risk

The magnitude of dust emissions for each activity is classified as small, medium or large depending upon the scale of the works proposed, materials involved, and level of activity required. The IAQM guidelines provide examples of how the magnitude of emission can be defined, which are identified in Table 3.1. The Proposed Development is unlikely to satisfy all criteria within the examples, therefore professional judgement and site-specific information are used to identify appropriate emission magnitude.

Table 3.1 ***Dust Emission Magnitude*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Activity	Small	Medium	Large
Demolition	• Total building volume <12,000m³ • Construction material with low potential for dust release (e.g., metal cladding or timber) • Demolition activities <6m above ground level • Demolition during wetter months	• Total building volume 12,000 – 75,000m³ • Potentially dusty construction material • Demolition activities 6-12m above ground level	• Total building volume >75,000m³ • Potentially dusty construction material (e.g., concrete) • On-site crushing and screening • Demolition activities >12m above ground level

Activity	Small	Medium	Large
Earthworks	• Total site area <18,000m^2 • Soil type with large grain size (e.g. sand) • <5 heavy earth moving vehicles active at any one time • Formation of bunds <4m in height	• Total site area 18,500 – 110,000m^2 • Moderately dusty soil type (e.g. silt) • 5 – 10 heavy earth moving vehicles active at any one time • Formation of bunds 3 – 6m in height	• Total site area >110,000m^2 • Potentially dusty soil type (e.g. clay) • >10 heavy earth moving vehicles at any one time • Formation of bunds >6m in height
Construction	• Total building volume <12,000m^3 • Construction material with low potential for dust (e.g. metal cladding or timber)	• Total building volume 12,000 – 75,000m^3 • Potentially dusty construction material (e.g. concrete) • On-site concrete batching	• Total building volume >75,000m^3 • On-site concrete batching, sandblasting.
Trackout	• <20 HDV (>3.5t) outward movements* in any one day# • Surface material with low potential for dust release • Unpaved road length <50m	• 20 – 50 HDV (>3.5t) outward movements* in any one day# • Moderately dusty surface material (e.g. high clay content) • Unpaved road length 50 – 100m	• >50 HDV (>3.5t) outward movements* in any one day# • Potentially dusty surface material (e.g. high clay content) • Unpaved road length >100m

* A vehicle movement is a one way journey, i.e. from A to B, and excludes the return journey.

HDV movements during a construction project vary over its lifetime, and the number of movements is the maximum not the average.

Consideration is given to the likely sensitivity of the area to the impacts of dust, establishing a sensitivity of low, medium, or high for dust soiling, human health and ecological receptors. The sensitivity of the area considers a number of factors, including the specific sensitivities of receptors in the area, the proximity and number of those receptors, local baseline conditions such as background concentrations and site-specific factors.

The first step in identifying the sensitivity of the area is to establish the sensitivity of the receptor, based on the presence or level of activity associated with the area influenced by the Proposed Development. Professional judgement and site-specific information are used to assign an appropriate level of receptor sensitivity using the principles outlined in Table 3.2. Following this, the sensitivity of the area can be established from Tables 3.3 to 3.5 based on the sensitivity of the receptor, number of receptors (in the case of human health and dust soiling) and the distance from source.

Table 3.2 ***Receptor Sensitivity Definitions*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Activity	Low	Medium	High
Dust Soiling	• Enjoyment of amenity would not reasonably be expected; • There is property that would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; • Transient exposure, where people or property is only expected to be present for limited periods of time as part of the normal pattern of use; • Indicative examples including playing fields, farmland, footpaths, short-term car parks and roads.	• Users would expect to enjoy a reasonable level of amenity, but not reasonably at same level as in their home; • The appearance, aesthetics or value of property could be diminished by soiling; • Indicative examples include parks and places of work.	• Users can reasonably expect enjoyment of a high level of amenity; • The appearance, aesthetics or value of property would be diminished by soiling, and continuous or regularly extended periods of presence expected during normal pattern of land use; • Indicative examples include dwellings, museum and other culturally important collections, medium and long-term car parks and car showrooms.
Human Health	• Locations where human exposure is transient; • Indicative examples include public footpaths, playing fields, parks and shopping streets.	• Locations where the people exposed are workers#, and exposure is over a time period relevant to the air quality objective for PM_{10}*; • Indicative examples include office and shop workers, but not those occupationally exposed to dust.	• Locations where members of the public are exposed over a period of time relevant to the air quality objective for PM_{10}*; • Indicative examples include residential properties, hospitals, schools and residential care homes.
Ecological	• Locations with a location designation where the features may be affected by dust deposition, *e.g.* Local Nature Reserve.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown; • Locations with a national designation where the features may be affected by dust deposition, e.g. Site of Special Scientific Interest.	• Locations with an international or national designation and the designated features may be affected by dust soiling, e.g. Special Area of Conservation with acid heathland; • Location where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data List for Great Britain.
* In the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day, following Defra guidance.			

Activity	Low	Medium	High
# Workers are considered to be less sensitive than the general public as a whole because the most sensitive to the effects of air pollution, such as young children, are not normally workers.			

Table 3.3 ***Sensitivity of the Area to Dust Soiling Effects on People and Property*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Receptor Sensitivity	Number of Receptors	Distance from Source			
		<20m	*<50m*	*<100m*	*<250m*
High	>100	High	High	Low	Low
	10 – 100	High	Medium	Low	Low
	1 – 10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 3.4 ***Sensitivity of the Area to Human Health Impacts*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source			
			<20m	*<50m*	*<100m*	*<250m*
High	>32 µg/m^3	>100	High	High	High	Medium
		10 – 100	High	High	Medium	Low
		1 – 10	High	Medium	Low	Low
	28 – 32 µg/m^3	>100	High	High	Medium	Low
		10 – 100	High	Medium	Low	Low
		1 – 10	High	Medium	Low	Low
	24 - 28 µg/m^3	>100	High	Medium	Low	Low
		10 – 100	High	Medium	Low	Low
		1 – 10	Medium	Low	Low	Low
	<24 µg/m^3	>100	Medium	Low	Low	Low
		10 – 100	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low
Medium	>32 µg/m^3	>10	High	Medium	Low	Low
		1 – 10	Medium	Low	Low	Low
	28 - 32 µg/m^3	>10	Medium	Low	Low	Low

Receptor Sensitivity	Annual Mean PM_{10} Concentration	Number of Receptors	Distance from Source			
			<20m	*<50m*	*<100m*	*<250m*
		1 – 10	Low	Low	Low	Low
	24 - 28 µg/m^3	>10	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low
	<24 µg/m^3	>10	Low	Low	Low	Low
		1 – 10	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low

Table 3.5 ***Sensitivity of the Area to Ecological Impacts*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Receptor Sensitivity	Distance from Source	
	<20m	*<50m*
High	High	Medium
Medium	Medium	Low
Low	Low	Low

3.2.3. Establishing Significance

The risk of dust related impacts from the Proposed Development is established from the sensitivity of the area and the likely dust emission magnitude. The risk should be established, on the worst-case area sensitivity and in the absence of mitigation, for each of the construction related activities (demolition, earthworks, construction and trackout) following the matrix in Table 3.6.

Table 3.6 ***Risk of Dust Impacts from Each Activity*** *(Source: IAQM Guidance, v2.2 Updated January 2024)*

Sensitivity of Area	Activity	Dust Emission Magnitude		
		Large	Medium	Small
High	Demolition	High Risk	Medium Risk	Medium Risk
	Earthworks	High Risk	Medium Risk	Low Risk
	Construction	High Risk	Medium Risk	Low Risk
	Trackout	High Risk	Medium Risk	Low Risk
Medium	Demolition	High Risk	Medium Risk	Low Risk
	Earthworks	Medium Risk	Medium Risk	Low Risk
	Construction	Medium Risk	Medium Risk	Low Risk

Sensitivity of Area	Activity	Dust Emission Magnitude		
		Large	Medium	Small
	Trackout	Medium Risk	Low Risk	Negligible
Low	Demolition	Medium Risk	Low Risk	Negligible
	Earthworks	Low Risk	Low Risk	Negligible
	Construction	Low Risk	Low Risk	Negligible
	Trackout	Low Risk	Low Risk	Negligible

The IAQM guidelines identify a range of mitigation measures intended to reduce the emission and effects of dust from construction sites and identify their likely applicability to a development based on the level of impact risk attributed. Consideration is given to these in the development of mitigation measures, with the significance of the residual effect based on professional judgement.

3.3. Operational Phase

3.3.1. Road Traffic Emissions

Road traffic is the main source of local pollution with respect to NO_2, PM_{10} and $PM_{2.5}$. Following consultation with the Transport Consultant (Markides Associates), it has been confirmed that emissions from the development-generated road traffic exceeds the thresholds detailed in the IAQM & EPUK Air Quality Guidance (+/- 500 Annual Average Daily Traffic (AADT) for LGV outside an AQMA and or +/-100 AADT for LGV's in or adjacent to an AQMA; See Table 3.7).

Table 3-7 below sets out the road traffic attributable to the Proposed Development.

Table 3-7 Daily Trip Generation (as Annual Average Daily Traffic (AADT) Flows)

Trips to the Site (AADT)	
Link	**Development Generated Road Traffic (LGV)**
B5130 (North)	7
B5130 (South)	7
Ridley Wood Road	15
Bryn Lane (East)	133
Site Access (Land South of Bryn Lane)	791
Bryn Lane	643
Ash Road North	0
Abenbury Way	0

Trips to the Site (AADT)	
Link	**Development Generated Road Traffic (LGV)**
Industrial Estate Road	643
A534 Wrexham Road	41
Sandy Lane	0
A534	573
Borras Hall Lane	30
A5156	492
A534 Holt Road	81
Borras Park Road	15

To consider the impact on NO_2, PM_{10} and $PM_{2.5}$ concentrations at the specified receptor locations a detailed assessment has been undertaken using the air dispersion model ADMS-Urban, Version 5 (release date 31st January 2022). This model uses detailed road traffic information, surface roughness, and local meteorological information to predict the impact on pollutant concentrations at specific receptor points. Table 3-8 summarises the air quality modelling parameters for road traffic.

Table 3-8 ADMS Roads Modelling Parameters

Parameter	Local Area	Met. Measurement Site
Latitude	53	53
Surface Roughness	0.5	0.5
Monin-Obukhov Length (m)	30	30

The ADMS model uses meteorological data including wind speed and direction to determine the how pollution is transported and diluted with distance from the source. For this assessment, meteorological data for Harwarden 2023 has been selected due to its proximity (<15km) to the Application Site. The Windrose for Harwarden is provided in **Appendix B**.

3.3.2. Model Scenarios

A summary of the traffic data used in the air quality assessment is presented in **Appendix C** and illustrated in Figure 3-1.

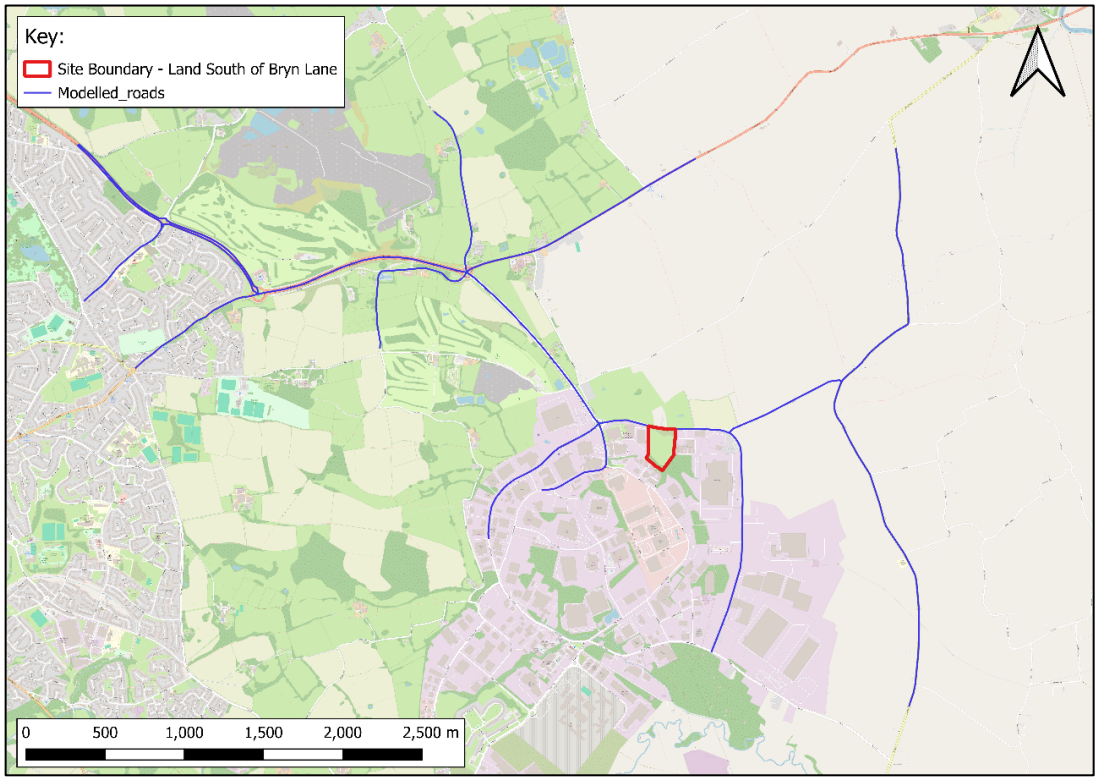


Figure 3-1 ***Modelled Road Network*** *(Contains Ordnance Survey Data © Crown copyright database right 2024)*

Appendix C includes details regarding Annual Average Daily Traffic (AADT) flows, percentage of Heavy Goods Vehicles (HGV) and vehicle speeds (km/hr). For the assessment traffic data has been obtained for the following three scenarios:

- **Scenario 1:** 2023 Baseline;
- **Scenario 2:** 2028 Baseline + Committed Developments; and,
- **Scenario 3:** 2028 Baseline + Committed Developments + Proposed Development.

3.3.3. Vehicle Emission Factors

Vehicle emission factors for input into ADMS-Roads have been calculated using the Emission Factor Toolkit (EFT) version 12.1 (published August 2024), available on the Defra website[14]. The EFT allows for the calculation of emission factors arising from road traffic for all years between 2018 and 2030. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in fleet composition, such that vehicle emissions are assumed to reduce over time. There is good evidence from real-world testing of EURO 6 (VI) compliant vehicles of substantial improvements in vehicle emissions compared to earlier EURO categories, in particular with respect to NO_X emissions.

Defra's EFT calculator has been used to calculate the emission factors for PM_{10} and $PM_{2.5}$.

Emission factors for 2023 have been used for the baseline and model verification scenario and emission factors for 2028 have been used for all future scenarios.

3.3.4. Selection of Background Concentrations

The background concentrations of those pollutants included within the Air Quality Standard (AQS) and used within the air quality assessment have been mapped at a grid resolution of 1 x 1 km for the whole of the UK and are available on Defra's website[15].

Estimated background concentrations are available for all years between 2018 and 2030 and the maps assume that background concentrations will reduce (*i.e.,* improve) over time. This assumption is based upon improvements in emissions from various sources. In line with the findings (usually based on monitoring data) of local authorities, measured concentrations have not reduced as expected over time.

For the purposes of the assessment, background concentrations from 2023 have been used in the baseline and verification scenario and background concentrations from 2028 have been utilised in the future scenarios. The background concentrations and relevant receptors used in the assessment are presented in **Appendix D.**

3.3.5. Model Verification

The ADMS-Urban dispersion model has been validated by the software developer and is considered to be fit for purpose, however local model validation, i.e., in the vicinity of the Proposed Development, has not been undertaken. Therefore, to validate the model and to determine how well the model is performing at a local level, comparing the modelling results with local monitoring data is undertaken. The verification process aims to minimise model uncertainty and error by adjusting the modelled results by a factor to offer greater confidence in the final results. This is undertaken in accordance with the methodology specified in Chapter 7, Section 4, of LAQM.TG(22).

Details of the verification factor calculations are presented in **Appendix E** and illustrated on Figure D.1. An adjustment factor of 1.3 was obtained during the verification process, which indicated that the model was under-predicting. As the model was under-predicting, this factor was applied to adjust the modelled road-NO_X outputs.

No local monitoring data was available for $PM_{2.5}$ and PM_{10}, therefore the adjustment factor calculated for NO_X has been applied to both the modelled PM_{10} and $PM_{2.5}$ concentrations prior to adding to the appropriate background concentration. This approach is in accordance with LAQM.TG(22).

3.3.5.1. Point Source Emissions

Following consultation with Hilson Moran (project Energy / M&E engineers), it is understood that the provision of heating and hot water will be from an all-electric approach.

At this stage, there is no onsite combustion plant, in the form of Combined Heat and Power (CHP) Units, boilers or generators proposed – as such a detailed assessment of these sources has been scoped out.

3.4. Significance Criteria

3.4.1. Existing Receptors

The EPUK and IAQM provide guidance for establishing the significance of air quality impacts arising as a result of the proposed development. The impact on individual receptors is dependent upon the long-term average pollutant concentrations at the receptor in the assessment year and the percentage change relative to the Air Quality Assessment Level (AQAL). The assessment of significance within this chapter is based on these criteria, as identified in Table 3.9.

Table 3.9 Impact Descriptors

Long-term Average Concentration at Receptor in Assessment Year	Percentage Change in Concentrations to AQAL*			
	1	2-5	6-10	>10
75% of less of AQAL	Negligible	Negligible	Slight	Moderate
76 – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95 – 102% of AQAL	Slight	Moderate	Substantial	Substantial
103 – 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
* Where the % change is <0.5% the change is described as 'Negligible' regardless of concentration.				

In addition to predicting the effect of significance at individual existing receptor locations, IAQM guidance states that other influences should be accounted for, such as:

- The existing and future air quality in the absence of the development, notably whether the Air Quality Objectives are likely to be met or the scale of exceedances in the long-term and short-term concentrations;
- The extent of current and future population exposure to the impacts, notably the number of properties and/or people present and the scale of impact (e.g., whether the majority of the local population is subject to substantial or minor impacts);
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts, such as establishing a worst-case scenario for sensitive receptors.
- These factors are considered to determine whether the overall impact of the operational phase is adverse or beneficial.

3.4.2. Proposed Receptors

As the proposed receptor locations are introduced to the site through the proposed development, a change in pollutant concentrations from the baseline cannot be assessed

at these locations. Instead, the modelled results at proposed receptor locations will be compared to the relevant AQOs to determine the potential of any exceedances.

Where a relevant AQO is predicted to be exceeded, the significance of effect is considered 'Substantial' in the absence of mitigation. Where no exceedance is predicted, the effect is considered of 'Negligible' significance and no mitigation is required to precent exposure to elevated pollution concentrations. This criterion is set out in Table 3.10 below.

Table 3.10 Significance Criteria – Proposed Receptors

Significance Criteria for Proposed Receptors Category	Applicable Annual Mean AQO	Significance	Recommendation
Below AQO	40 µg/m^3 (NO_2 and PM_{10}) 20 µg/m^3 ($PM_{2.5}$)	Negligible (Not Significant)	No mitigation required beyond the best practice measures already incorporated into the design
Equal to or greater than AQO	40 µg/m^3 (NO_2 and PM_{10}) 20 µg/m^3 ($PM_{2.5}$)	Substantial (Significant)	Additional mitigation required in addition to the best practice measures already incorporated into the design.

3.5. Sensitive Receptors

Sensitive human receptors are defined as locations that have potential to be impacted by emissions from road traffic emissions. These locations include those sensitive land uses (residential dwellings, hospitals, schools and care homes), in worst-case locations, in the vicinity of highways used by traffic travelling to and from the proposed development.

The locations of nearby designated sites have been considered within this assessment; no designated sites are within 200m of the road network likely to be utilised by traffic generated by the proposed development. Therefore, impacts on these ecological receptors have been scoped out of this assessment.

Defra provides guidance on locations where the air quality objectives should apply and Table 3.11 and professional judgement have been used to select receptors where likely significant exposure to pollutant concentrations may occur.

Table 3.11 Examples of where the Air Quality Objectives apply/do not apply

Averaging Period	Objectives Should Apply	Objectives Should Generally Not Apply
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access.

Averaging Period	Objectives Should Apply	Objectives Should Generally Not Apply
		Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other locations where public exposure is expected to be short-term.
24-Hour Mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.	Kerbside sites (as opposed to locations at the building façade), or any other locations where public exposure is expected to be short-term.
1-Hour Mean	All locations where the annual mean and 24-hour mean objectives apply. Kerbside sites (for example pavements of busy shopping streets). Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably be expected to spend 1 hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-Minute Mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

3.6. Assumptions & Limitations

Professional judgement has been used in the completion of the construction phase dust assessment for the proposed development.

The ADMS-Urban dispersion model has been used in this assessment to assess the current and future baseline pollution concentrations in the vicinity of the Proposed Development. The dispersion models rely on input data, such as traffic data and predicted emissions data, etc., which may have uncertainties associated with them. The models simplify complex environments and does not always accurately reflect local micro-climatic conditions which may ultimately affect the predicted pollutant concentrations.

It is assumed that the information provided by the project Transport Consultant (Cora IHT) for use in the air quality assessment is accurate.

It is assumed that the information provided by the project M&E engineers and the energy consultant (Hilson Moran) to scope out the inclusion of any onsite combustion plant is accurate.

The assumptions made in the assessment are considered reasonable and robust.

4. Baseline Conditions

4.1. Local Air Quality Information

There are no declared Air Quality Management Areas within WCBC or within any of the other local authorities that form part of the North Wales Combined Authority.

4.1.1. Defra Background Concentrations

The UK Air Information Resource (AIR) is operated by Defra and includes computer modelled predictions of background concentrations of air pollutants over the whole of the UK with a grid resolution of 1km^2. The background concentrations for relevant pollutants in the grid square (338500, 350500) in which the Proposed Development is located are presented in Table 4.1.

Table 4.1 Defra Background Concentrations (µg/m^3)

Grid Square	Pollutant	2023	2028
338500, 350500	NO_2	11.2	10.5
	PM_{10}	10.9	10.7
	$PM_{2.5}$	6.8	6.6
*Bold indicates an exceedance of the relevant AQS objective.			

The Defra background concentrations for NO_2, PM_{10} and $PM_{2.5}$ for 2023 are below the relevant AQS objectives (40µg/m^3 for NO_2 and PM_{10}, and 20µg/m^3 for $PM_{2.5}$).

4.1.2. Local Air Quality Monitoring Data

WCBC have a network of air quality monitoring stations, including 3 continuous monitors and 33 passive diffusion tube sites. The latest monitoring report published in 2023[16], presents the latest monitoring results from these locations.

It is acknowledged that monitoring results from the years 2020 and 2021 should be treated with caution due to the impacts the national lockdowns associated with COVID-19 had on traffic levels and air quality.

A summary of the monitoring locations most representative of the proposed development are identified in **Figure 4.1** and Tables 4.2 to 4.7 below.

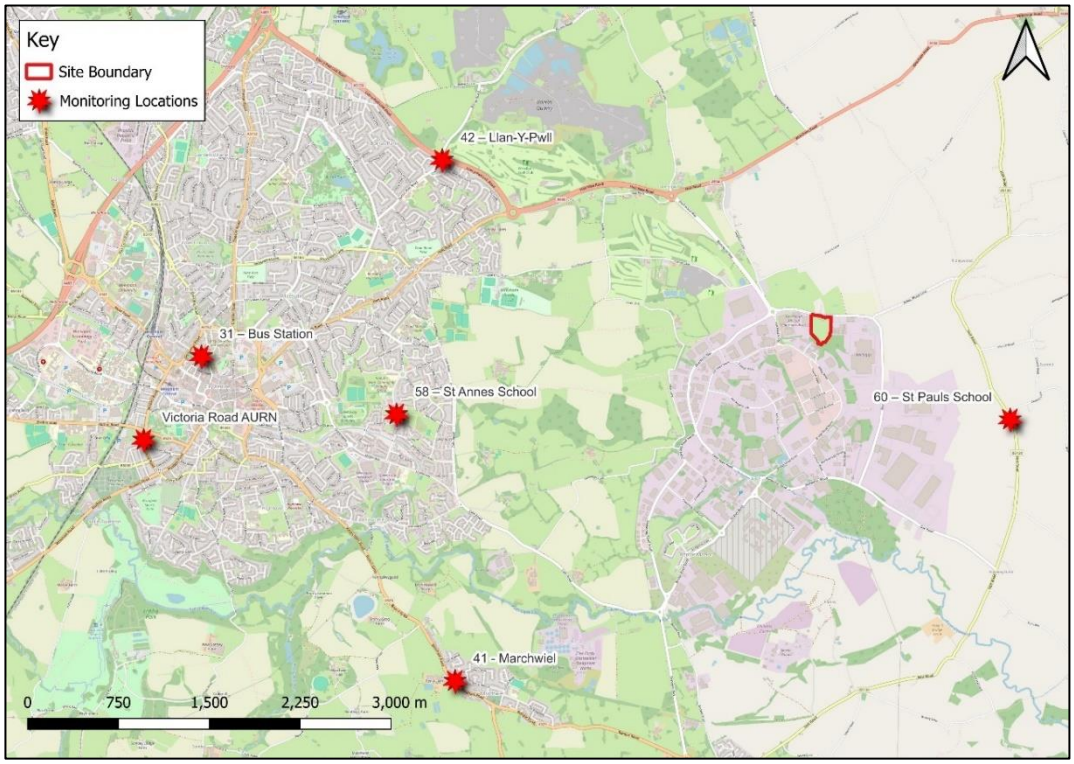


Figure 4.1 Local Air Quality Monitoring Locations (OpenStreetMap 2024)

4.1.2.1. Nitrogen Dioxide

The annual mean NO_2 concentrations and number of exceedances of the 1-hour NO_2 objective at the 3 automatic monitoring sites at are identified in Table 4.2 and 4.3, respectively.

Annual mean NO_2 concentrations at all locations are compliant with the AQS objective between 2018-2022. The monitoring results also indicate no exceedances of the 1-hour NO_2 objective between 2018 and 2022 were recorded.

Table 4.2 WCBC Continuous Monitoring Results – Annual Mean NO_2

Site ID	X, Y	Type	Annual Mean Concentrations (µg/m³)				
			2018	2019	2020*	2021*	2022
Victoria Road AURN	332865, 349909	Roadside	18.2	16	13	14.7	14.2
Wrexham Chirk	329318, 338300	Urban Industrial	-	-	21	18.1	11.6
Wrexham Chirk Community Hospital	329329, 338992	Urban Background	-	-	-	-	13.3
Bold indicates exceedance.							

*Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.

Table 4.3 WCBC Continuous Monitoring Results – 1-Hour Mean NO_2

Site ID	X, Y	Type	Number of Exceedances of the 1-Hour Mean (>200µg/m³)				
			2018	2019	2020*	2021*	2022
Victoria Road AURN	332865, 349909	Roadside	0	0	0	0	0
Wrexham Chirk	329318, 338300	Urban Industrial	-	-	-	0	0
Wrexham Chirk Community Hospital	329329, 338992	Urban Background	-	-	-	-	0

Bold indicates exceedance.

*Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.

The annual mean NO_2 concentrations for the diffusion tube monitoring sites located in closest proximity to the proposed development are presented in Table 4.4.

Annual mean NO_2 concentrations at all monitor locations are compliant with the AQS objective between 2018 and 2022.

Table 4.4 WCBC Diffusion Tube Monitoring Results – Annual Mean NO_2

Site ID	X, Y	Type	Annual Mean Concentrations (µg/m³)				
			2018	2019	2020*	2021*	2022
60 – St Pauls School	340016, 349982	Roadside	-	7.7	6.8	7.4	5.8
59- Cross Lane	337541, 346942	Roadside	-	11.2	8.4	9.7	8.4
41 - Marchwiel	335407, 347890	Roadside	15.4	13.9	10.3	13	12.2
43 - Hightown	333966, 349691	Roadside	19.3	17	14.4	16.5	17.5
58 – St Annes School	334954, 350090	Roadside	-	12.7	10.5	10.7	9.7

Site ID	X, Y	Type	Annual Mean Concentrations (µg/m³)				
			2018	2019	2020*	2021*	2022
42 – Llan-Y-Pwll	335359, 352178	Suburban	23.2	20.6	17.1	19.6	18.3
33 – Smithfield Road	333981, 350171	Roadside	18.5	15.6	19.3	21	17.4
31 – Bus Station	333350, 350590	Roadside	28.6	27.3	20	24	22.6
Bold indicates exceedance. *Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.							

4.1.2.2. Particulate Matter

PM_{10}

The annual mean PM_{10} concentrations for the 3 automatic monitoring sites at are identified in Table 4.5. Annual mean PM_{10} concentrations at all locations are compliant with the AQS objective between 2018-2022. The exceedances of the 24-hour mean (> 50µg/m³) are indicated in Table 4.6. The 24-hour objectives have also been met at all locations between 2018 and 2022.

Table 4.5 WCBC Continuous Monitoring Results – Annual Mean PM_{10}

Site ID	X, Y	Type	Annual Mean Concentrations (µg/m³)				
			2018	2019	2020*	2021*	2022
Victoria Road AURN	332865, 349909	Roadside	-	12	11	11.3	11.7
Wrexham Chirk	329318, 338300	Urban Industrial	-	-	9.3	8.3	11
Wrexham Chirk Community Hospital	329329, 338992	Urban Background	-	-	-	-	10
Bold indicates exceedance. *Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.							

Table 4.6 WCBC Continuous Monitoring Results – Number of Exceedances of PM_{10} 24-Hour Means Mean

Site ID	X, Y	Type	Exceedances of of PM_{10} 24-Hour Means > 50µg/m³ (not to be exceeded more that 35 times a year)				
			2018	2019	2020*	2021*	2022
Victoria Road AURN	332865, 349909	Roadside	-	0	0	1	0
Wrexham Chirk	329318, 338300	Urban Industrial	-	-	0	0	0
Wrexham Chirk Community Hospital	329329, 338992	Urban Background	-	-	-	-	0

Bold indicates exceedance.

*Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.

$PM_{2.5}$

The annual mean $PM_{2.5}$ concentrations for the 3 automatic monitoring sites at are identified in Table 4.7. Annual mean $PM_{2.5}$ concentrations at all locations are compliant with the AQS objective between 2018-2022.

Table 4.7 LPA Continuous Monitoring Results – Annual Mean $PM_{2.5}$

Site ID	X, Y	Type	Annual Mean Concentrations (µg/m³)				
			2018	2019	2020*	2021*	2022
Victoria Road AURN	332865, 349909	Roadside	-	8	7	7	7.1
Wrexham Chirk	329318, 338300	Urban Industrial	-	-	2	3.9	4
Wrexham Chirk Community Hospital	329329, 338992	Urban Background	-	-	-	-	5

Bold indicates exceedance.

*Monitoring data collected in 2020 and 2021 should be treated with caution due to the impact of COVID-19 on air quality monitoring data.

5. Effects Appraisal & Site Suitability

5.1. Construction

5.1.1. Assessment of Potential Dust Emission Magnitude

The likely magnitude of dust emissions from the Proposed Development for the four main activities has been assessed, as identified in Table 5.1.

Table 5.1 Predicted Magnitude of Dust Emissions from Proposed Development

Activity	Magnitude	Justification
Demolition	Small	It is understood that the small concrete bunker in the northeast corner of the Application Site will be demolished. These works will be minimal and the dust emission magnitude from these activities has been classified as Small.
Earthworks	Medium	The Application Site area is approximately 3.72ha, with a potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size). There is potential that the during the earthworks there could be >10 heavy earth moving vehicles active at any one time and the formation of bunds. The dust emission magnitude from these activities has been classified as Medium.
Construction	Large	Total building volume is likely to exceed 75,000 m^3. The materials proposed are likely to be of low dust generating potential (steel, metal and cladding). However, there is potential for some use of concrete within the slab. The dust emission magnitude from these activities has been classified as Large.
Trackout	Large	Specific details regarding the number of trips associated with Trackout has not been made available. Therefore, as a worst case it has been assumed that there are >50HDV movements in any one day. There is potential for the unpaved road length to exceed 100m. The dust emission magnitude from these activities has been classified as Large.

5.1.2. Sensitivity of the Area

A wind rose for Harwarden is provided in **Appendix B** and this indicates that the prevailing wind direction is from the southeast with smaller contributions from the northeast. Therefore, existing receptors that are located to the northwest are most likely to fall within the area of with greatest influence from dust emissions generated by the construction phase.

The majority of dust generated by the construction phase is likely to be deposited in close proximity to the source (see **Figure 5.1**).

Surrounding the Application Site the majority of existing receptors are places of employment, predominantly industrial in nature. These receptors are of medium sensitivity and there are estimated to be between 10-100 within 20m of the Application Boundary. It is acknowledged that there is a residential dwelling located directly opposite the Application Site (Little Acorns, Bryn Lane) – this site is now owned by the Applicant and will be demolished by the time of construction and operation of the Proposed Development. There are no ecological receptors located within 50m of the Application Site, or within 500m of the likely construction traffic route and therefore consideration of these receptors has been scoped out.

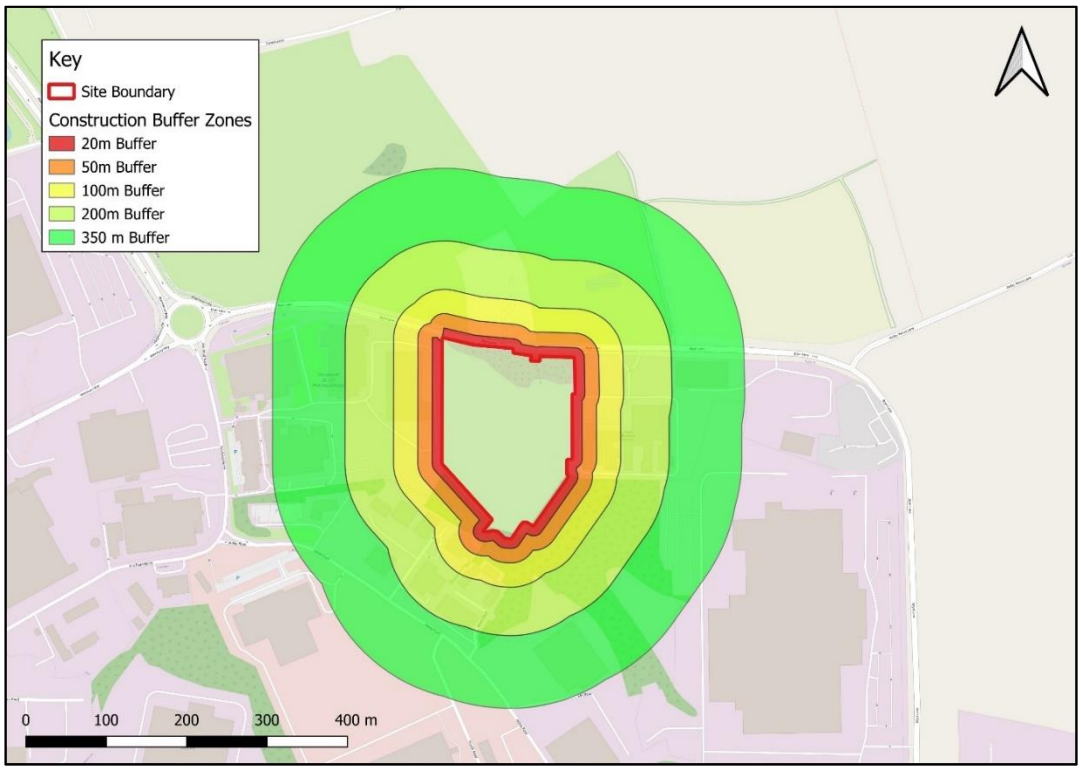


Figure 5.1 Zones of Construction Influence (OpenStreetMap 2024)

The Defra background PM_{10} concentration is 10.3µg/m^3 in 2023 which is well below the annual mean air quality objective.

The sensitivity of the area to each of the previously identified impact types associated with the Proposed Development are identified in Table 5.2.

5.1.3. Receptor Sensitivity

The sensitivity of the area to each of the previously identified impact types associated with the Application Site are identified in Table 5.2.

Table 5.2 Sensitivity of Receptors to Dust Emission Effects

Impact Type	Sensitivity of Surrounding Area

	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low
Ecological	N/A	N/A	N/A	N/A

The sensitivity of the surrounding area for dust soiling is classified as medium and for human health the sensitivity is classified as low.

5.1.4. Risk of Impact

To determine the risk of impacts prior to the implementation of mitigation the dust emission magnitude and the sensitivity of the area have been combined. Table 5.3 below summaries the potential risk of impacts during the construction phase.

Table 5.3 Potential Risk During the Construction Phase

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

The risk of dust soiling impacts from the Proposed Development on existing receptors in the vicinity of the Application Site is low during demolition, and medium during earthworks, construction and trackout activities, without the implementation of mitigation. The risk of human health impacts from the Proposed Development on existing receptors is negligible for during demolition, and low during earthworks, construction and trackout activities, without the implementation of mitigation.

5.1.5. Construction Road Traffic & Non-Road Mobile Machinery

The greatest impact on air quality due to construction traffic and NRMM is likely to be along roads in the vicinity of the Application Site. It is likely that construction traffic will enter the Application Site via Bryn Lane. It is likely that the volume of construction traffic will be low compared to the existing traffic flows.

Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, the impacts are therefore considered to be slight adverse without the implementation of mitigation.

5.2. Operational Phase

5.2.1. Impact Assessment

A detailed assessment of the operational phase impacts has been undertaken using ADMS Urban. The pollutants considered are NO_2, PM_{10} and $PM_{2.5}$ – a summary of the results is presented below, and a full breakdown of results can be found in **Appendix F**.

5.2.1.1. Annual Mean NO_2 concentrations

The objective for annual mean NO_2 concentrations is 40 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean NO_2 concentrations at all existing receptor locations were compliant with the AQS Objective.

The highest predicted concentration with the Proposed Development operational is 13.0µg/m^3 at existing receptor E8. The greatest predicted change in annual mean NO_2 brought about by development generated road traffic is 0.5 µg/m^3 at existing receptor locations E17. According to the EPUK/IAQM guidance, the impacts on annual mean NO_2 concentrations at all existing receptors were negligible.

With the Proposed Development operational, annual mean NO_2 concentrations at modelled proposed receptor locations below the AQS objective. The highest concentration is 10.8 µg/m^3 at ground floor level at receptor location P1 and P2. On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean NO_2 concentrations is not required.

5.2.1.2. Hourly Mean NO_2 Concentrations

To determine compliance with the 1-hour mean objective for NO_2, detailed modelling has been undertaken to compare total concentrations against the relevant AQS objective – 200 µg/m^3.

With the Proposed Development operational, short-term NO_2 concentrations at all existing receptors are predicted to be below AQS objective. The highest predicted concentration with the Proposed Development operational is 32.3 µg/m^3 at existing receptor E8. The impacts of the Development on hourly mean NO_2 concentrations are negligible, therefore mitigation is not required.

All new Proposed receptors would experience concentrations below the short-term AQS objective, with the highest predicted concentration being 33.7 µg/m^3 at E8. On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean NO_2 concentrations is not required.

5.2.1.3. Annual Mean PM_{10}

The objective for annual mean PM_{10} concentrations is 40 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean PM_{10} concentrations at all existing receptors are below the AQS Objective.

The highest predicted concentration with the Proposed Development operational is 11.6 µg/m^3 at existing receptor location E8. There highest change in annual mean PM_{10}

brought about by development generated road traffic at any existing receptor was 0.2 at E19. According to the EPUK/IAQM guidance, the impacts on annual mean PM_{10} concentrations at existing receptors are negligible.

With the Proposed Development operational, annual mean PM_{10} concentrations at all modelled proposed receptors were below the AQS objective - the highest concentration is 10.8 µg/m^3 ground floor level at receptor location P1, P2 and P4. On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean PM_{10} concentrations is not required.

5.2.1.4. Daily Mean PM_{10}

The AQS objective for daily mean PM_{10} concentrations is 50 µg/m^3, to be exceeded no more than 35 times a year.

The assessment demonstrates that all existing receptors fall within the daily mean PM_{10} objective with a maximum of 4 days of exceedance predicted 'without' and 'with' the Proposed Development operational. Furthermore, there are no differences between the 'without' and 'with' development scenarios. As a result, the impacts on daily mean PM_{10} concentrations are negligible.

For daily mean PM_{10}, it is predicted that all new receptors would be well within the AQS objective, again with a maximum of 2 days predicted exceedances of the limit at a number of receptors.

5.2.1.5. Annual Mean $PM_{2.5}$ Concentrations

The objective for annual mean $PM_{2.5}$ concentrations is 20 µg/m^3.

'Without' and 'with' the Proposed Development operational, the annual mean $PM_{2.5}$ concentrations at all existing receptors are below the AQS Objective.

The highest predicted concentration with the Proposed Development operational is 7.6 µg/m^3 at existing receptor E19 and E20.

The greatest predicted change in annual mean $PM_{2.5}$ brought about by development generated road traffic is 0.1 µg/m^3 at several existing receptor locations (E8, E13, E15, E16, E17, E19 and E20). According to the EPUK/IAQM guidance, the impacts on annual mean $PM_{2.5}$ concentrations at existing receptors are negligible.

With the Proposed Development operational, annual mean $PM_{2.5}$ concentrations at all modelled proposed receptors were below the AQS objective - the highest concentration is 6.6 µg/m^3 at ground floor level at all proposed receptor locations (P1, P2, P3 and P4). On this basis, mitigation to protect future users of the Proposed Development from elevated annual mean $PM_{2.5}$ concentrations is not required.

6. Mitigation

6.1. Construction Phase

The IAQM guidelines provide an indication of the mitigation measures that would be appropriate for inclusion within the Proposed Development, based on the level of risk of dust related impacts identified for each of the activities. Consequently, the following mitigation measures should be incorporated into the Proposed Development and delivered through the implementation of a Construction Environment Management Plan (CEMP).

Mitigation measures that are generic to each of the activities, and therefore should be implemented for the duration of the construction related works where applicable are identified in Table 6.1, whilst activity specific mitigation measures are identified in Table 6.2.

Table 6.1 Mitigation to be implemented during the Construction Phase

Development Element	Mitigation Measure
Communication	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.
Planning	Develop and implement a Dust Management Plan (DMP) as part of a Construction Environmental Management Plan (CEMP). The appointed contractor will be responsible for the DMP and CEMP, which should be reported to the developer. Additionally, the DMP and CEMP must be approved by the Local Authority.. The level of detail will depend on the risk, and should include as a minimum the measures recommended in this table.
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 emissions, either on- or off- site, and the action taken to resolve the situation in the log book.
Monitoring	Undertake daily on-site and off-site 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 100m of the site boundary, with cleaning provided if necessary. Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked. Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to

Development Element	Mitigation Measure
	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 at 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 run-off 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.
Operating Vehicle/ Vehicle Movements	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. Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking and car-sharing).
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, *e.g.* suitable local exhaust ventilation systems. Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate. Use enclosed chutes and conveyors and covered skips. Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fin 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 6.2 Activity Specific Mitigation Measures to be implemented during the Construction Phase

Development Element	Mitigation Measure
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. Only remove the cover in small areas during work and not all at once.
Construction	Avoid scabbling (roughening of concrete surfaces) if possible. Ensure sand and other aggregates are stored in bunds in areas that 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.

Development Element	Mitigation Measure
	For small supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use. Avoid dry sweeping of large areas. Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. Record all inspections of access roads and any subsequent action in a site log book. Access gates to be located at least 10m from receptors where possible.

6.1.1. Residual Effects

The residual effects of dust and PM_{10} generated by construction activities following the application of the mitigation measures described above and good site practice is not significant.

The residual effects of emissions to air from construction vehicles and NRMM on local air quality is not significant following the implementation of the recommended mitigation measures.

6.2. Operational Phase

As summarised above, air quality in the vicinity of the Application Site, based on current monitoring data, is compliant with the relevant AQS objectives for NO_2, PM_{10} and $PM_{2.5}$.

There are also several key embedded mitigation measures incorporated into the proposals that encompass an 'air quality positive' design approach. These include sustainable transport measures such as cycle parking, electric vehicle (EV) charging provisions and all-electric systems for the provision of heating and hot water. The retention of the tree boarder along Bryn Lane will also provide a natural vegetation buffer, reducing the ingress of traffic-polluted air towards the Proposed Development.

In the future, we would expect further reductions as cleaner vehicles come onto the network. Therefore, site specific mitigation is not required.

However, this does not deter from best practice design, and therefore the following recommendations are made:

- Where possible locate air intake along facades that face away from roads;
- Locate air intakes at height; and,
- Be mindful of the location of air intakes at roof level – where roof level intakes are necessary it is important to consider existing flues (energy plant/kitchen extracts) associated with any neighbouring buildings and any exhausts (kitchen or ventilation) associated with the Proposed Development itself. This will reduce the likelihood of recirculating 'dirty' air. Where possible air intakes should be located approximately 20m from any exhausts (See Part F of the Building Regulations).

6.2.1. Residual Effects

The overall residual effect for the operational phase is not significant.

7. Conclusion

This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational stages of the Proposed Development. The assessment has been undertaken in line with the relevant policy and guidance, and where necessary outlines the required mitigation measures to minimise impacts.

A qualitative assessment of construction phase impacts was carried out. There is a low risk of dust soiling during demolition. During earthworks, construction and trackout activities the risk of dust soiling is medium. There is a negligible risk to human health during demolition. During earthworks, construction and trackout activities the risk to human health is low. Through good site practice, the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases will be minimised. The residual effect of the construction phase on air quality is therefore not significant.

A quantitative road traffic assessment has been undertaken using ADMS-Urban. The conclusions of the detailed dispersion modelling indicate:

- The impact on annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at all existing receptors modelled is negligible;
- All proposed receptors have predicted annual mean NO_2 concentrations well below the AQS;
- All modelled receptors (existing and proposed) are predicted to have 1-hour mean NO_2 concentrations well below the AQS objective;
- The annual mean concentrations of PM_{10} and $PM_{2.5}$ are below the AQS objective for all modelled receptors and within the objective for daily mean PM_{10}. The impacts are classified as negligible; and,
- All modelled receptors (existing and proposed) are predicted to have 24-hour mean PM_{10} concentrations well below the relevant AQS objective.

Several key embedded mitigation measures incorporated into the proposals encompass an 'air quality positive' design approach. These include sustainable transport measures such as cycle parking, electric vehicle (EV) charging provisions and all-electric systems for the provision of heating and hot water. The retention of the tree boarder along Bryn Lane will also provide a natural vegetation buffer, reducing the ingress of traffic-polluted air towards the Proposed Development.

Based upon the above findings it is concluded that site specific mitigation to protect existing and future users of the Proposed Development from poor air quality is not required.

The residual effect is not significant.

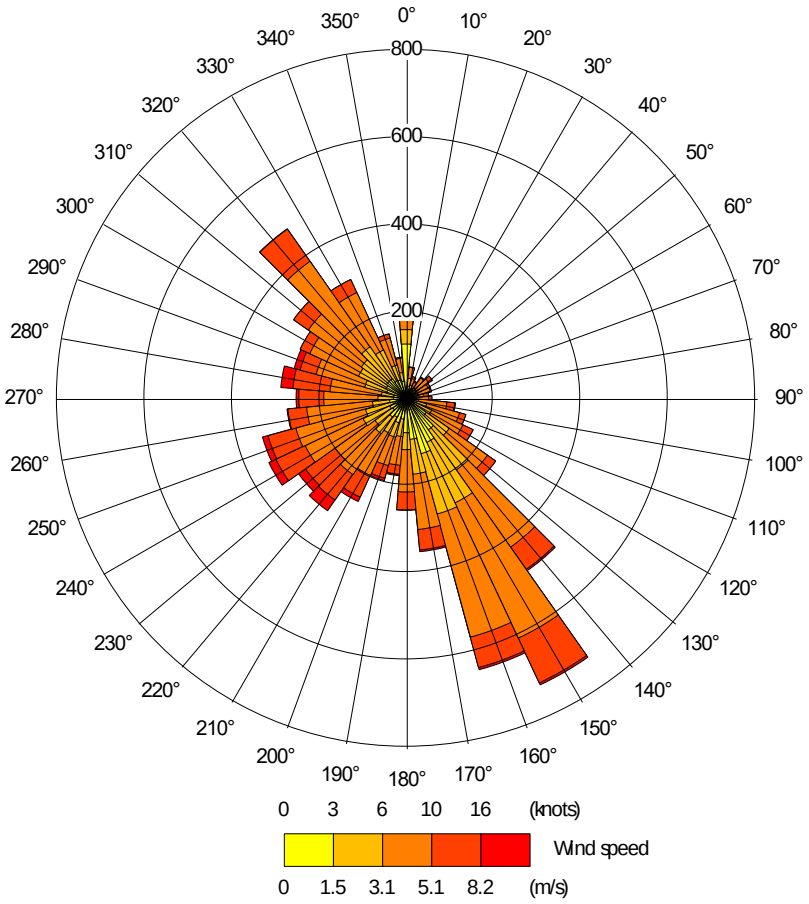
Overall, with the recommended mitigation measure (construction phase only) in place the proposals would be compliant with legislation and policy.

Appendix A – Glossary

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Air Quality Objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air Quality Standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective)
Ambient Air	Outdoor air in the troposphere, excluding workplace air.
Annual Mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area
Conservative	Tending to over-predict the impact rather than under-predict.
Data Capture	The percentage of all the possible measurements for a given period that were validly measured.
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport.
Dust	Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials.
Exceedance	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle
LAQM	Local Air Quality Management
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres (µm)
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres (µm)
Trackout	The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network. This arises when heavy duty vehicles (HDVs) leave the construction/ demolition site with dusty materials, which may then spill

Term	Definition
	onto the road, and/or when HDV's transfer dust and dirt onto the road having travelled over muddy ground on site.

Appendix B – 2023 Harwarden Windrose



Appendix C – Traffic Data

Link	ID	Speed (kmph)	Width	2023 Baseline			2028 WO Development			2028 W Development		
				AADT	HGV %	HGV AADT	AADT	HGV %	HGV AADT	AADT	HGV %	HGV AADT
Ridley Wood Lane	1	10	10	2212	2.20	49	2328	1.80	42	2343	1.80	42
Ridley Wood Lane	2	40	5.7	2212	2.20	49	2328	1.80	42	2343	1.80	42
Ridley Wood Lane	3	10	12	2212	2.20	49	2328	1.80	42	2343	1.80	42
B5130 (North)	4	40	5.7	3099	1.30	40	3197	1.30	42	3204	1.30	42
B1530 (South)	5	40	5.7	1775	2.30	41	1830	1.80	33	1838	2.20	40
Bryn Lane (East)	6	40	6.5	5311	10.20	542	5478	10.20	559	5611	10.00	561
Bryn Lane (East)	7	10	17.5	5311	10.20	542	5478	10.20	559	5611	10.00	561
Bry Lane	8	40	6.3	5427	10.90	592	5597	10.90	610	7162	9.70	695
Bry Lane	9	10	11	5427	10.90	592	5597	10.90	610	7162	9.70	695
Ash Road North	10	10	12.5	11105	7.20	800	11453	7.20	825	13272	6.70	889
Ash Road North	11	40	7	11105	7.20	800	11453	7.20	825	13272	6.70	889
Abenbury Way	12	10	13.5	8771	12.80	1123	9046	12.80	1158	9046	12.80	1158
Abenbury Way	13	40	7.5	8771	12.80	1123	9046	12.80	1158	9046	12.80	1158
Industrial Estate Road	14	10	15	23244	8.30	1929	23895	9.30	2222	28685	8.70	2496
Industrial Estate Road	15	60	15	23244	8.30	1929	23895	9.30	2222	28685	8.70	2496
Industrial Estate Road	16	10	15	23244	8.30	1929	23895	9.30	2222	28685	8.70	2496
A534 Wrexham Road	17	10	12	11400	5.50	627	11758	5.50	647	12178	5.50	670
A534 Wrexham Road	18	60	7.3	11400	5.50	627	11758	5.50	647	12178	5.50	670

Link	ID	Speed (kmph)	Width	2023 Baseline			2028 WO Development			2028 W Development		
				AADT	HGV %	HGV AADT	AADT	HGV %	HGV AADT	AADT	HGV %	HGV AADT
Borras Hall Lane	19	10	10	2238	0.40	9	2308	0.40	9	2455	8.00	196
Borras Hall Lane	20	60	7	2238	0.40	9	2308	0.40	9	2455	8.00	196
Sandy Lane	21	10	12	489	3.90	19	504	3.90	20	504	3.90	20
Sandy Lane	22	60	6.7	489	3.90	19	504	3.90	20	504	3.90	20
A534	23	10	15.5	27565	8.50	2343	28444	8.00	2276	33289	8.00	2663
A534	24	60	15	27565	8.50	2343	28444	8.00	2276	33289	8.00	2663
A534	25	10	16	27565	8.50	2343	28444	8.00	2276	33289	8.00	2663
A534 Holt Road	26	10	14	13677	2.70	369	14106	2.70	381	17310	2.20	381
A534 Holt Road	27	30	7.5	13677	2.70	369	14106	2.70	381	17310	2.20	381
A534 Holt Road	28	10	12.5	13677	2.70	369	14106	2.70	381	17310	2.20	381
A534 Holt Road	29	30	7	13677	2.70	369	14106	2.70	381	17310	2.20	381
A5156	30	10	8.7	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	31	60	7.3	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	32	10	10	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	33	60	7.3	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	34	10	10.5	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	35	60	7.5	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	36	10	10	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
A5156	37	60	7.6	14149	7.90	1118	14594	7.90	1153	16957	7.90	1340
Borras Park Road	38	10	6.7	3251	0.70	23	3353	0.70	23	3360	0.70	24
Borras Park Road	39	10	6.2	3251	0.70	23	3353	0.70	23	3360	0.70	24
Borras Park Road	40	20	6.2	6501	0.70	46	6705	0.70	47	6720	0.70	47

Appendix D – Modelled Receptors and Background Conditions

Receptor ID	X	Y	2023			2028		
			NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	NO_2 (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
E1	339993	350023	5.46	10.40	6.37	4.92	10.13	6.14
E2	339728	350667	7.35	10.66	6.86	6.31	10.38	6.64
E1	339622	351123	6.78	10.28	6.42	6.19	10.02	6.19
E4	339990	352162	6.78	10.28	6.42	6.19	10.02	6.19
E4	338805	349540	6.51	9.94	6.26	5.91	9.68	6.04
E6	338892	350798	6.06	10.26	6.30	5.42	9.99	6.08
E7	338477	350885	9.65	11.09	6.72	8.99	10.84	6.50
E8	338078	350832	11.18	10.91	6.76	10.45	10.66	6.53
E9	337949	350554	11.18	10.91	6.76	10.45	10.66	6.53
E10	337639	350628	11.18	10.91	6.76	10.45	10.66	6.53
E11	337997	351074	11.11	11.03	6.87	10.35	10.77	6.64
E12	337270	351994	11.11	11.03	6.87	10.35	10.77	6.64
E13	337213	352708	6.91	10.45	6.48	6.19	10.18	6.26
E14	337865	352056	6.91	10.45	6.48	6.19	10.18	6.26
E15	336776	351880	6.15	10.50	6.41	5.47	10.22	6.19
E16	335793	351912	6.15	10.50	6.41	5.47	10.22	6.19
E17	335370	352170	6.77	11.08	6.75	5.97	10.81	6.53
E18	334965	352477	7.58	11.42	7.31	6.56	11.14	7.09
E19	335782	351722	7.35	10.66	6.86	6.31	10.38	6.64
E20	335618	351637	7.85	10.90	7.22	6.68	10.62	7.00
E21	335338	351408	7.58	11.42	7.31	6.56	11.14	7.09
E22	335259	352129	7.58	11.42	7.31	6.56	11.14	7.09
E23	335195	352019	7.58	11.42	7.31	6.56	11.14	7.09
E24	334899	351775	7.35	10.66	6.86	6.31	10.38	6.64
P1	338394	350808	7.35	10.66	6.86	6.31	10.38	6.64
P2	338519	350807	7.76	10.80	7.32	6.74	10.52	7.10
P3	338517	350706	11.18	10.91	6.76	10.45	10.66	6.53
P4	338392	350708	11.18	10.91	6.76	10.45	10.66	6.53

Appendix E - Model Verification

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations. Discrepancies occur due to model uncertainties, such as:

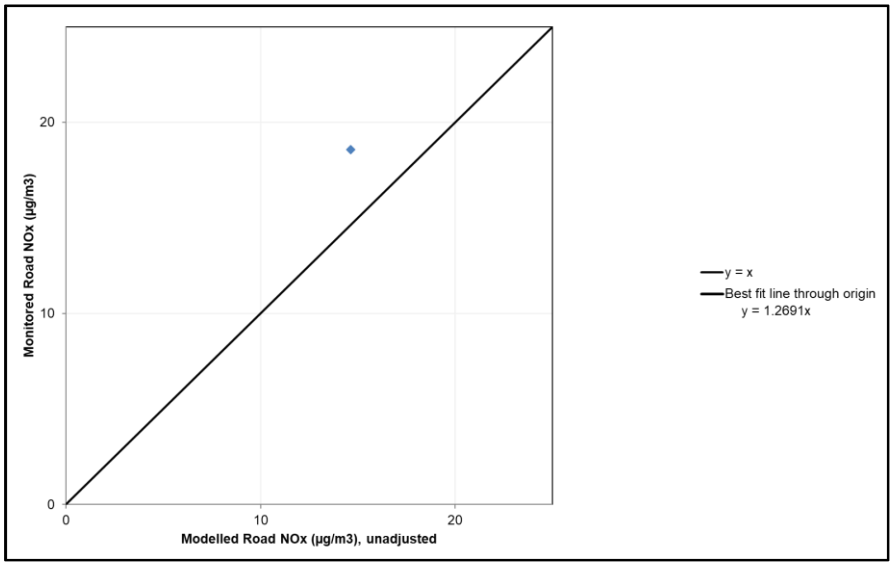
- Estimates of background pollutant concentrations;
- Meteorological data uncertainties;
- Traffic data uncertainties;
- Model input parameters; and
- Overall limitations of the dispersion model

NO_2 is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. Therefore model verification for nitrogen oxides (NO_X = NO + NO_2) the primary pollutant is appropriate. This has been undertaken in accordance Chapter 7 of LAQM.TG(22). The model has been run to predict the 2023 annual mean road-NO_X contribution at the monitoring locations given below. The model outputs of road-NO_X for each location have been compared with the 2023 'measured' road-NO_X, which was determined utilising the NO_X from NO_2 calculator and the NO_2 concentration data from WBCC monitoring.

Details of the data used in the verification process is in the table and figure below.

ID	2023 Monitored Total NO_2 (µg/m^3)	Background NO_2 (µg/m^3)	2023 Monitored Road Contribution NO_X (µg/m^3)	2023 Modelled Road Contribution NO_X (µg/m^3)	Ratio of monitored NO_X road contribution/modelled road contribution NO_X
42	17.40	7.35	18.58	14.64	1.26

A model adjustment factor of 1.3 was calculated indicating that the modelling was under-predicating.



For PM_{10} and $PM_{2.5}$ there are no relevant local monitoring data against which the model could be verified. Consequently, the verification factors determined above for adjusting the road-NO_X contribution has been applied to the predicted road-PM_{10} and road-$PM_{2.5}$ contributions, consistent with guidance set out in LAQM.TG(22).

Appendix F – Modelled Results

Annual Mean NO_2

Receptor ID	Without Development	With Development	Change	Impact/Exceed
E1	6.50	6.50	0.00	Negligible
E2	6.40	6.40	0.00	Negligible
E1	6.20	6.20	0.00	Negligible
E4	5.70	5.70	0.00	Negligible
E4	10.20	10.20	0.00	Negligible
E6	10.90	11.00	0.10	Negligible
E7	11.00	11.20	0.20	Negligible
E8	12.70	13.00	0.30	Negligible
E9	11.20	11.40	0.20	Negligible
E10	11.20	11.20	0.00	Negligible
E11	7.90	8.20	0.30	Negligible
E12	7.40	7.60	0.20	Negligible
E13	5.80	5.90	0.10	Negligible
E14	6.60	6.60	0.00	Negligible
E15	6.70	6.80	0.10	Negligible
E16	8.40	8.70	0.30	Negligible
E17	9.50	10.00	0.50	Negligible
E18	7.80	8.00	0.20	Negligible
E19	8.20	8.50	0.30	Negligible
E20	8.40	8.70	0.30	Negligible
E21	7.60	7.80	0.20	Negligible
E22	7.00	7.10	0.10	Negligible
E23	7.00	7.00	0.00	Negligible
E24	8.00	8.00	0.00	Negligible
P1	-	10.80	-	Compliant
P2	-	10.80	-	Compliant
P3	-	10.70	-	Compliant
P4	-	10.70	-	Compliant

Hourly Mean NO_2 Results

Receptor ID	Without Development	With Development	Impact/Exceed
E1	13.7	13.8	Compliant
E2	13.8	13.9	Compliant
E1	13.7	13.8	Compliant
E4	12.5	12.6	Compliant
E4	23.0	23.1	Compliant
E6	22.9	23.4	Compliant
E7	23.0	23.4	Compliant
E8	32.3	33.7	Compliant
E9	25.3	25.9	Compliant
E10	23.6	23.6	Compliant
E11	18.4	19.3	Compliant
E12	16.4	16.9	Compliant
E13	12.3	12.5	Compliant
E14	16.7	17.1	Compliant
E15	15.0	15.5	Compliant
E16	22.3	23.7	Compliant
E17	29.7	32.1	Compliant
E18	21.0	22.2	Compliant
E19	21.2	22.7	Compliant
E20	19.8	21.0	Compliant
E21	17.9	18.9	Compliant
E22	17.0	17.6	Compliant
E23	16.2	16.5	Compliant
E24	18.8	19.0	Compliant
P1	-	23.6	Compliant
P2	-	23.5	Compliant
P3	-	23.0	Compliant
P4	-	23.2	Compliant

Annual Mean PM_{10}

Receptor ID	Without Development	With Development	Change	Impact/Exceed
E1	10.1	10.2	0.1	Negligible
E2	10.1	10.1	0.0	Negligible
E1	9.8	9.8	0.0	Negligible
E4	10.1	10.1	0.0	Negligible
E4	11.4	11.4	0.0	Negligible
E6	10.9	10.9	0.0	Negligible
E7	10.9	11.0	0.1	Negligible
E8	11.5	11.6	0.1	Negligible
E9	11.2	11.2	0.0	Negligible
E10	11.2	11.2	0.0	Negligible
E11	10.7	10.8	0.1	Negligible
E12	10.5	10.6	0.1	Negligible
E13	10.3	10.3	0.0	Negligible
E14	10.5	10.5	0.0	Negligible
E15	11.0	11.0	0.0	Negligible
E16	11.7	11.8	0.1	Negligible
E17	11.4	11.6	0.2	Negligible
E18	10.9	11.0	0.1	Negligible
E19	11.9	12.1	0.2	Negligible
E20	11.9	12.0	0.1	Negligible
E21	11.7	11.8	0.1	Negligible
E22	10.7	10.7	0.0	Negligible
E23	10.7	10.7	0.0	Negligible
E24	11.1	11.1	0.0	Negligible
P1	-	10.8	-	Compliant
P2	-	10.8	-	Compliant
P3	-	10.7	-	Compliant
P4	-	10.8	-	Compliant

Daily Mean PM_{10}

Receptor ID	Without Development	With Development	Change	Impact/Exceed
E1	3	3	0	Negligible
E2	3	3	0	Negligible
E1	4	4	0	Negligible
E4	3	3	0	Negligible
E4	2	2	0	Negligible
E6	2	2	0	Negligible
E7	2	2	0	Negligible
E8	2	2	0	Negligible
E9	2	2	0	Negligible
E10	2	2	0	Negligible
E11	3	2	0	Negligible
E12	3	3	0	Negligible
E13	3	3	0	Negligible
E14	3	3	0	Negligible
E15	2	2	0	Negligible
E16	1	1	0	Negligible
E17	2	2	0	Negligible
E18	2	2	0	Negligible
E19	1	1	0	Negligible
E20	1	1	0	Negligible
E21	1	1	0	Negligible
E22	3	3	0	Negligible
E23	3	3	0	Negligible
E24	2	2	0	Negligible
P1	-	2	-	Compliant
P2	-	2	-	Compliant
P3	-	2	-	Compliant
P4	-	2	-	Compliant

Annual Mean $PM_{2.5}$

Receptor ID	Without Development	With Development	Change	Impact/Exceed
E1	6.3	6.3	0.0	Negligible
E2	6.2	6.2	0.0	Negligible
E1	6.1	6.1	0.0	Negligible
E4	6.2	6.2	0.0	Negligible
E4	6.8	6.8	0.0	Negligible
E6	6.7	6.7	0.0	Negligible
E7	6.7	6.7	0.0	Negligible
E8	7.0	7.1	0.1	Negligible
E9	6.9	6.9	0.0	Negligible
E10	6.9	6.9	0.0	Negligible
E11	6.6	6.6	0.0	Negligible
E12	6.5	6.5	0.0	Negligible
E13	6.2	6.3	0.1	Negligible
E14	6.4	6.4	0.0	Negligible
E15	6.6	6.7	0.1	Negligible
E16	7.4	7.5	0.1	Negligible
E17	7.2	7.3	0.1	Negligible
E18	7.2	7.2	0.0	Negligible
E19	7.5	7.6	0.1	Negligible
E20	7.5	7.6	0.1	Negligible
E21	7.4	7.4	0.0	Negligible
E22	6.8	6.8	0.0	Negligible
E23	6.8	6.8	0.0	Negligible
E24	7.4	7.4	0.0	Negligible
P1	-	6.6	-	Compliant
P2	-	6.6	-	Compliant
P3	-	6.6	-	Compliant
P4	-	6.6	-	Compliant

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