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Noise | Vibration | Air Quality

Air Quality Assessment

Land North of Arborfield Road, Shinfield

Air Quality Assessment

Project: LAND NORTH OF ARBORFIELD ROAD, SHINFIELD

Report reference: RP01-23676-R1

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1. EXECUTIVE SUMMARY

- 1.1 Cass Allen has been instructed by Bellway Homes (Thames Valley) Limited to assess the potential air quality effects associated with a proposed residential development located north of Arborfield Road in Shinfield, Wokingham.
- 1.2 The site is not located within an existing Air Quality Management Area (AQMA). However, it is situated 730m southeast (at the closest point) of Wokingham Borough Council's (WBC) M4 AQMA, declared due to exceedances of both the annual and 1-hour mean Air Quality Objectives (AQOs) for nitrogen dioxide (NO₂).
- 1.3 Emissions of construction phase dust and particulate matter (PM₁₀) were assessed in accordance with Institute of Air Quality Management (IAQM) guidance. A High Risk and Low Risk of dust soiling and PM₁₀ health effects has been identified, respectively, in the absence of mitigation. Suitable best practice mitigation measures for the relevant activities' risk levels have been recommended and no significant residual air quality impacts are expected.
- 1.4 A detailed atmospheric dispersion model was utilised to predict NO₂ and particulate matter (PM₁₀ and PM_{2.5}) concentrations at relevant sensitive receptor locations within the study area during the operation of the development.
- 1.5 The results indicate that pollutant concentrations at proposed sensitive receptors will be below the relevant AQOs during the operational phase, with no requirement for additional mitigation. Furthermore, no significant impacts on local air quality as a result of development-generated traffic are anticipated. Accordingly, the overall effect of the development is considered not significant regarding air quality.
- 1.6 In summary, it is our view that the site is suitable for the development in terms of air quality and that there are no air quality constraints with respect to planning consent.

2. INTRODUCTION

- 2.1 Cass Allen has been instructed by Bellway Homes (Thames Valley) Limited to assess the potential air quality effects associated with a proposed residential development located north of Arborfield Road in Shinfield, Wokingham.
- 2.2 This proposal is located immediately adjacent to the 'Land to the south of Cutbush Lane' development of 249 dwellings (Local Authority reference: 181499), which was granted planning permission in 2020. The Air Quality Assessment submitted with that application (Mayer Brown, 2018) concluded that *'the proposed development does not raise any significant or other residual adverse impacts on the health and/or quality of life for existing or proposed sensitive receptors as a result of any anticipated changes to air quality.'* As such, air quality is not expected to be a major concern in this location.
- 2.3 The assessment of the site presented herein has been carried out in accordance with relevant local and national planning guidance.
- 2.4 The aims of the assessment are to consider potential impacts on local air quality, resulting from:
- Dust and particulate matter emissions generated by construction phase activities;
 - Exhaust emissions from construction plant and traffic;
 - The exposure of new sensitive receptors (i.e. anything that may be sensitive to changes in air quality) to elevated pollutant concentrations; and
 - Emissions from traffic generated by the operation of the development.
- 2.5 Subsequently, where required, appropriate measures will be identified to minimise the impacts.
- 2.6 This report contains technical terminology; a glossary of terms can be found at www.cassallen.co.uk/glossary.

3. PROJECT DESCRIPTION AND SITE CONTEXT

- 3.1 This assessment has been prepared to inform the full planning application for the erection of new dwellings, open space, landscaping, supporting infrastructure and associated works. A new through road is also proposed as part of the development, which will connect Arborfield Road to Cutbush Lane.
- 3.2 As shown in Figure 1, the site is currently an agricultural field located to the east of Shinfield. It is surrounded to the north, west and south by residential properties which have the potential to be affected by emissions associated with development-generated traffic. The A327 Eastern Relief Road and B3349 Arborfield Road run adjacent to the eastern and southern boundaries, respectively, and have the potential to contribute to pollutant concentrations at the site.
- 3.3 The site is situated 730m southeast (at the closest point) of WBC's M4 AQMA, declared due to exceedances of both the annual and 1-hour mean AQOs for NO₂.

Figure 1 Site Location and Surrounding Area



4. PLANNING POLICY

Air Quality Legislation

- 4.1 The wider air quality legislation which underpins national, regional and local planning policy, is summarised in Appendix 1.
- 4.2 Within the UK Air Quality Strategy (2007), standards and objectives are set for nine key air pollutants to protect health, vegetation and ecosystems. These were revised in the Air Quality Standards Regulations 2010 to include a reduced target for PM_{2.5}. The national AQOs for the pollutants most associated with vehicle emissions, and therefore applicable to this assessment, are detailed in Table 1.

Table 1 UK National Air Quality Objectives

Pollutant	Objective	Averaging Period
Nitrogen Dioxide (NO ₂)	40µg/m ³	Annual mean
	200µg/m ³ not to be exceeded more than 18 times per year	1-hour mean
Particulate Matter (PM ₁₀)	40µg/m ³	Annual mean
	50µg/m ³ not to be exceeded more than 35 times per year	24-hour mean
Particulate Matter (PM _{2.5})	20µg/m ³	Annual mean

- 4.3 The above AQOs are typically applied where there is 'relevant exposure', i.e. where members of the public are likely to be present for the relevant averaging periods, or regularly exposed, and not in workplaces. Accordingly, the long term (annual mean) AQOs are only strictly applicable to the residential uses within the development.

National Policy

- 4.4 Outline guidance for the assessment of air quality affecting new developments is given in the National Planning Policy Framework (NPPF) (2023). Relevant sections in this case are highlighted below:

109. ...Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.

180. Planning policies and decisions should contribute to and enhance the natural and local environment by: ... preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of ... air or noise pollution.

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

192. Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.

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

Local Policy

- 4.5 The WBC Core Strategy (January 2010) informs planning decisions in the borough and includes the following policy relevant to air quality:

CP1 – Sustainable development

Planning permission will be granted for development proposals that:

- 1) Maintain or enhance the high quality of the environment;*
- 2) Minimise the emission of pollutants into the wider environment;...*
- 8) Avoid areas where pollution ... may impact upon the amenity of future occupiers*

- 4.6 To address the requirements of the national and local policies, the following key air quality matters have been considered:

- Construction phase fugitive emissions of dust and particulate matter at nearby existing receptors;
- Construction phase plant and vehicle emissions at existing receptors;
- Vehicle emissions exposing proposed receptors to elevated pollutant concentrations; and
- Emissions from traffic generated by the operation of the development at existing receptors.

5. ASSESSMENT METHODOLOGY

- 5.1 The scope and methodology for this assessment has been determined with regard to Defra Local Air Quality Technical Guidance, August 2022 (TG22), and EPUK & IAQM 'Land Use Planning & Development Control: Planning for Air Quality'(LUPDC), January 2017. Reference has also been made to other relevant technical guidance, where applicable.
- 5.2 Additionally, consultation was undertaken with the EHO at WBC (response via email, dated 25 April 2024), to inform the methodology and local assessment requirements.

Construction Phase Assessment

- 5.3 The assessment of potential air quality impacts during the construction phase has focussed on the generation and dispersion of dust and PM₁₀, following the IAQM Guidance on the Assessment of Dust from Demolition and Construction (January 2024) methodology, summarised as follows:
- **Step 1** – screen the need for an assessment: impacts to sensitive human and ecological receptors should be considered where they are located within 250m or 50m of the site boundary, respectively (as shown on Figure 2). These receptors should also be considered if they are within 50m of a route used by construction vehicles up to 250m from the site entrance.
 - **Step 2A** – estimate the dust emission magnitude for each of the main construction activities – demolition, earthworks, general construction, and trackout.
 - **Step 2B** – determine the sensitivity of the receiving environment, through consideration of factors such as meteorological conditions, the number of nearby receptors, their proximity and their sensitivity. Other factors to consider are detailed in Box 9 of the guidance. A wind rose for nearby Farnborough meteorological station is included in Appendix 2.
 - **Step 2C** – define the risk of impacts.
 - **Step 3** – identify site-specific mitigation requirements (in addition to basic project controls).
- 5.4 In addition, exhaust emissions from construction vehicles and plant may impact local air quality. The potential for significant effects resulting from these emissions has also been considered with reference to screening and significance criteria in the LUPDC guidance.

Operational Phase Assessment

- 5.5 The LUPDC guidance indicates that a change in the following is potentially significant, and likely to require further assessment:
- Light Duty Vehicle (LDV) flows of 500 Annual Average Daily Traffic (AADT); and/or
 - Heavy Duty Vehicle (HDV) flows of 100 AADT.
 - This also applies to a change in LDV flows of 100 AADT and/or HDV flows of 25 AADT or more on routes through or close to an AQMA.

- 5.6 The project's Transport Consultant (Abley Letchford Partnership Ltd) has indicated that the development is expected to generate >500 AADT along Shepherd Road and Arborfield Road (west of site access) and thus, existing receptors along these roads may be exposed to elevated pollutant concentrations.
- 5.7 Furthermore, the development also has the potential to expose future residents to elevated pollutant concentrations along the eastern and southern site boundaries and the internal site road. Although it should be noted that by constructing this through road, traffic along other roads in the vicinity is expected to reduce as a result during the operational phase.
- 5.8 Concentrations of NO₂, PM₁₀ and PM_{2.5} have been considered in the operational phase assessment as road traffic is a major source of these pollutants and their concentrations are often close to, or in exceedance of, the relevant AQOs in urban locations. Cambridge Environmental Research Consultants' (CERC) ADMS-Roads (version 5.0.1.3) atmospheric dispersion model has been used to predict pollutant concentrations at the existing receptor (R) and proposed receptor (PR) locations detailed in Table 2 and illustrated on Figure 2.

Table 2 Modelled Receptor Locations

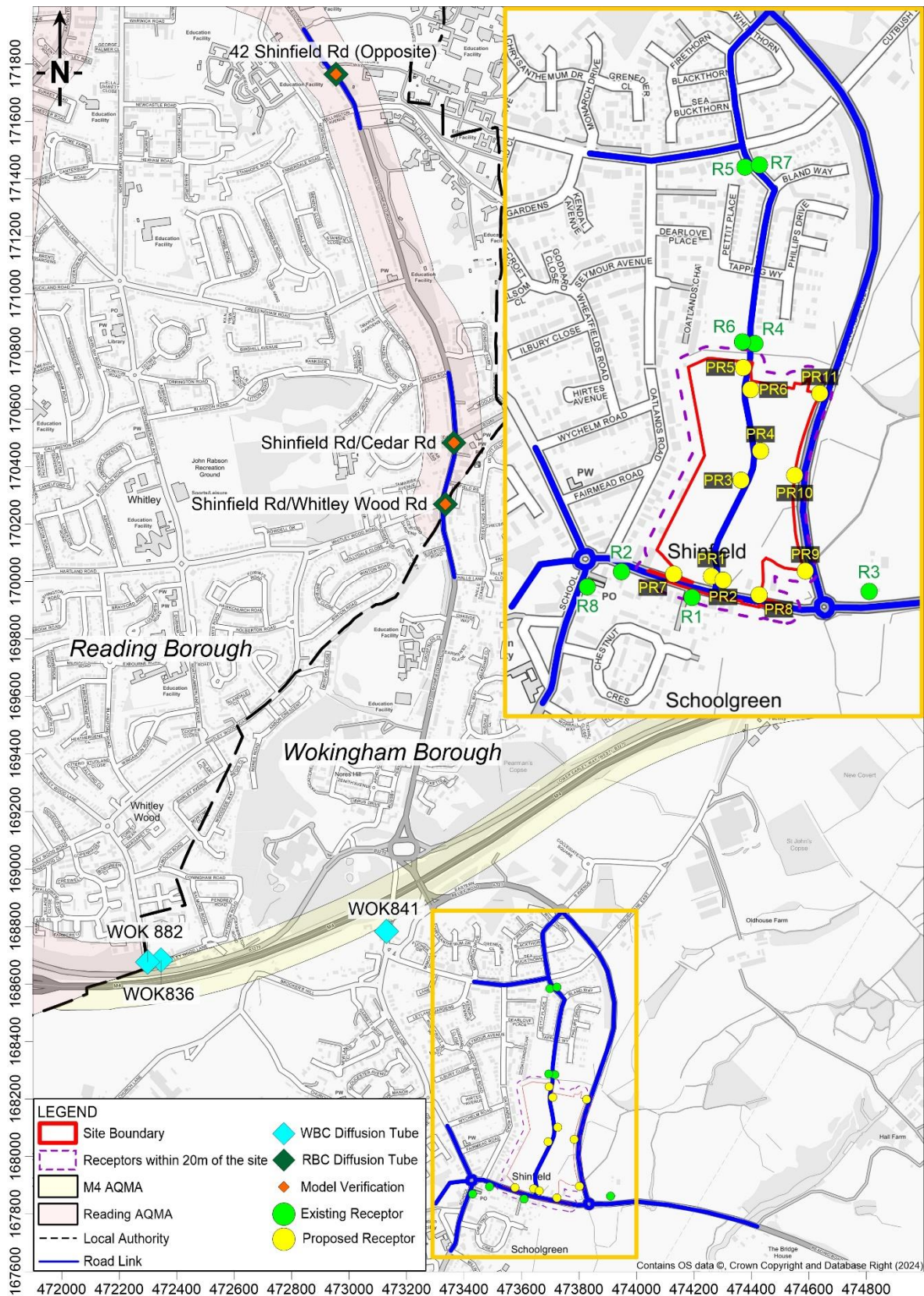
ID	Description	Grid Reference (OSGB)	Approx. Breathing Height (m)
PR1	Shepherd Road south	473642.0, 167888.5	1.5
PR2		473661.3, 167881.5	
PR3	Shepherd Road middle	473692.1, 168051.6	
PR4		473725.1, 168101.7	
PR5	Shepherd Road north	473695.6, 168243.7	
PR6		473708.2, 168206.5	
PR7	Southwestern site boundary	473577.1, 167892.0	
PR8	Southeastern site boundary	473722.7, 167856.4	
PR9	Eastern boundary south	473801.8, 167897.3	
PR10	Eastern boundary middle	473783.5, 168060.0	
PR11	Eastern boundary north	473826.3, 168199.5	
R1	12 Arborfield Road	473608.4, 167852.4	
R2	6 Vickers Close, Arborfield Road	473488.2, 167895.9	
R3	Magpie and Parrot, A327	473910.3, 167862.6	
R4	6 Jerome Row	473715.5, 168284.8	
R5	4 Shepherd Road	473699.0, 168585.0	
R6	5 Jerome Row	473694.6, 168287.5	
R7	5 Shepherd Road	473723.2, 168588.8	
R8	15 School Green	473430.0, 167870.3	

- 5.9 A review of the Multi-Agency Geographic Information for the Countryside (MAGIC) website did not identify any statutory designated ecological sites in the vicinity, and therefore these have been excluded.
- 5.10 To assess the local air quality effects of the development, the following scenarios have been modelled:
- 2022 - Model Verification;
 - 2027 - Assumed Opening Year, Without Development; and
 - 2027 - Assumed Opening Year, With Development.
- 5.11 The study area, including modelled road links and receptors, is shown in Figure 2 below.
- 5.12 Details of the traffic data used in the model are included in Appendix 3, and other model inputs such as emission factors, verification and adjustment, in Appendix 4.

Significance Criteria

- 5.13 Significance criteria applicable to the assessment of vehicle emissions impacts have been taken from the LUPDC guidance. Where the 'without' and 'with' development pollutant concentrations are predicted at an individual receptor, the guidance recommends expressing the magnitude of incremental change as a proportion of the Air Quality Assessment Level (normally the applicable AQO).
- 5.14 The LUPDC significance criteria applicable to the assessment of impacts at existing receptors are included in Appendix 5. It should be noted that, in line with the LUPDC guidance:
- The criteria should not be applied rigidly; in some instances, it may be appropriate to amend them on the basis of professional judgement... the objective is to identify situations where there is a possibility of a significant effect on local air quality.*
- 5.15 For proposed receptors, predicted pollutant concentrations have been compared to the relevant AQOs to determine the potential for exceedance, and therefore, the suitability of the site for the proposed use.

Figure 2 Study Area



6. BASELINE CONDITIONS

- 6.1 Air quality conditions in the vicinity of the site have been reviewed to provide a baseline for consideration. The data included in the tables below were obtained from WBC, neighbouring Reading Borough Council (RBC), and Defra. Monitoring locations are indicated on Figure 2.

Table 3 Monitored Concentrations Across Study Area – NO₂ (µg/m³)

ID	Location	Type	Distance to site (km)	Annual Mean				
				2019	2020	2021	2022	2023
Wokingham Borough Council								
WOK836	349 Old Whitley Wood Lane	Roadside	1.33	27.0	19.3	18.7	21.5	18.9
WOK841	Lane End Villas	Kerbside	0.72	33.3	20.7	23.0	24.4	20.6
WOK882	Sign Whitley Wood Lane	Roadside	1.37	32.6	20.7	23.8	24.9	23.9
Reading Borough Council								
Shinfield Road/Whitley Wood Road		Roadside	2.03	26.2	20.1	24.3	22.2	-
Shinfield Road/Cedar Road		Roadside	2.24	34.1	23.8	30.7	28.7	-
42 Shinfield Road (Opposite)		Kerbside	3.57	-	-	-	20.0	-

Note: Data obtained from WBC 2024 Air Quality Annual Status Report (ASR) (2024) and RBC 2023 Air Quality ASR (2023). Results from 2020 and 2021 are likely to be atypical due to COVID-19 travel restrictions

- 6.2 As indicated in Table 3 above, NO₂ concentrations in the vicinity of the site were below the relevant AQOs during the five most recent monitoring years, with data available. Furthermore, all monitoring results (except 42 Shinfield Road) display a downward trend from 2019 to 2022/23, indicating that local air quality is improving over time.

Table 4 Mapped Background Annual Mean Concentrations Across Study Area (µg/m³)

2022 (Verification Year)				2027 (Assessment Year)			
NO _x	NO ₂	PM ₁₀	PM _{2.5}	NO _x	NO ₂	PM ₁₀	PM _{2.5}
13.5 - 21.8	10.2 - 15.9	13.7 - 16.7	9.1 - 10.8	11.5 - 18.1	8.8 - 13.3	13.2 - 16.2	8.7 - 10.4

Note: Data obtained from <https://uk-air.defra.gov.uk/data/laqm-background-home>

- 6.3 WBC and RBC do not undertake monitoring of PM₁₀ or PM_{2.5} in the vicinity of the site, however Defra-predicted background concentrations for 2022 and 2027 (Table 4) are well below (defined by the IAQM as less than 75% of) the relevant AQOs for all pollutants.

7. CONSTRUCTION PHASE ASSESSMENT

- 7.1 The IAQM methodology has been used to assess the potential impact of dust and PM₁₀ arising from onsite activities. As indicated within the guidance, the use of professional judgment is necessary, due to the diverse range of projects that are subject to dust impact assessment, meaning that it is not possible to be prescriptive as to how to assess the impacts.
- 7.2 As sensitive receptors were identified within the relevant IAQM screening distances, the assessment progressed to Step 2, which has been summarised in the tables below.

Table 5 Step 2A – Dust Emission Magnitude for Construction Activities

Activity	Magnitude	Explanation
Demolition	Small	Removal of small outbuilding in southeastern corner, <12,000 m ³ to be demolished
Earthworks	Medium	Total site area 18,000m ² - 110,000m ² , 5-10 heavy earth moving vehicles at one time
Construction	Large	Total building volume to be constructed >75,000m ³
Trackout	Large	>100m unpaved road length

Table 6 Step 2B – Sensitivity of the Area

Potential Impact	Details	Construction Activity			
		Demolition	Earthworks	Construction	Trackout
Dust Soiling	10 - 100 high sensitivity receptors within 20m of site.	High	High	High	High
Human Health (PM ₁₀)	10 - 100 high sensitivity receptors within 20m of site; low background PM ₁₀ concentration.	Low	Low	Low	Low
Ecological (Dust Smothering)	No designated sites within the relevant screening distances.	N/A	N/A	N/A	N/A

Table 7 Step 2C – Summary of Impact Risks to Define Site-Specific Mitigation

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

- 7.3 It should be noted that the prevailing winds (as shown in Appendix 2) are south-westerly and thus, locations downwind of the site, to the northeast, are more at risk of construction dust impacts. Nonetheless, as an overall worst case, the development is considered High Risk for dust soiling effects and Low Risk for PM₁₀ health effects, in the absence of mitigation. Following implementation of the recommended mitigation measures for the relevant activities' risk levels in Appendix 6, it is anticipated that the residual effect of the construction phase will be not significant.
- 7.4 With regard to construction traffic, the construction phase flows are not expected to exceed the criteria detailed in paragraph 5.5 and therefore, significant residual effects are not anticipated.

8. OPERATIONAL PHASE ASSESSMENT – SITE SUITABILITY

- 8.1 To consider the suitability of the site for the proposed use, the potential for future residents of the development to be exposed to exceedances of the relevant AQOs has been assessed. Modelled predicted pollutant concentrations at proposed receptor locations are detailed in Table 8. Proposed and existing receptor locations are shown on Figure 2.

Table 8 Predicted Pollutant Concentrations at the Development in 2027

Receptor	Annual Mean Concentration ($\mu\text{g}/\text{m}^3$)					
	NO ₂	% of AQO (40 $\mu\text{g}/\text{m}^3$)	PM ₁₀	% of AQO (40 $\mu\text{g}/\text{m}^3$)	PM _{2.5}	% of AQO (20 $\mu\text{g}/\text{m}^3$)
PR1	11.9	29.8	14.4	36.1	9.4	46.9
PR2	12.3	30.8	14.6	36.4	9.4	47.2
PR3	12.7	31.8	15.6	39.0	10.2	50.8
PR4	13.0	32.6	15.7	39.3	10.2	51.1
PR5	12.3	30.7	15.4	38.6	10.1	50.4
PR6	12.8	32.0	15.6	39.1	10.2	50.9
PR7	12.9	32.2	15.0	37.4	9.7	48.3
PR8	12.8	31.9	14.8	37.1	9.6	47.9
PR9	14.3	35.7	14.8	36.9	9.6	47.8
PR10	14.1	35.2	16.1	40.3	10.5	52.3
PR11	15.2	37.9	16.6	41.6	10.7	53.7

Note: Results are reported to the nearest 0.1 $\mu\text{g}/\text{m}^3$. Any apparent discrepancies are due to rounding.

- 8.2 The data in Table 8 show that all pollutant concentrations were predicted to be below (defined by the IAQM as less than 75% of) the relevant annual mean AQOs at all proposed receptor locations. The highest predicted NO₂, PM₁₀ and PM_{2.5} concentrations were 15.2 $\mu\text{g}/\text{m}^3$, 16.6 $\mu\text{g}/\text{m}^3$, and 10.7 $\mu\text{g}/\text{m}^3$, respectively, all at receptor PR11, despite its worst-case location adjacent to the Eastern Relief Road. Predicted pollutant concentrations at PR1-6, which are located at proposed dwellings adjacent to the internal site road, were below 51% of each applicable AQO.
- 8.3 As the annual mean NO₂ concentrations were all below 60 $\mu\text{g}/\text{m}^3$, a breach of the hourly mean AQO for NO₂ is unlikely (as indicated in TG22). Equally, exceedances of the 24-hour mean AQO for PM₁₀ are not anticipated, as concentrations of PM₁₀ are all below 32 $\mu\text{g}/\text{m}^3$.
- 8.4 Accordingly, it is not anticipated that future residents would be exposed to exceedances of the relevant AQOs and, therefore, the site is considered suitable for the proposed use, with no requirement for additional mitigation.

9. OPERATIONAL PHASE ASSESSMENT – AIR QUALITY IMPACTS

- 9.1 To assess the potential air quality impacts resulting from development-generated vehicle emissions at existing receptor locations, dispersion modelling has been undertaken to quantify pollutant concentrations in both 'without development' and 'with development' scenarios. A summary of the worst-case impacts is provided in Table 9, with full model results detailed in Appendix 7.

Table 9 Worst-Case Predicted Operational Impacts at Existing Receptors in 2027

Pollutant	Receptor	Annual Mean Concentration (µg/m³)			Impact Descriptor
		Without	With	Change	
Highest Absolute Concentrations					
NO₂	R3	17.7	17.7	<0.1	Negligible
PM₁₀	R4	15.2	15.7	0.4	Negligible
PM₂.₅	R4	10.0	10.2	0.2	Negligible
Maximum Predicted Changes					
NO₂	R4	11.7	12.8	1.2	Negligible
PM₁₀	R4	15.2	15.7	0.4	Negligible
PM₂.₅	R4	10.0	10.2	0.2	Negligible

Note: Results are reported to the nearest 0.1 $\mu\text{g}/\text{m}^3$. Any apparent discrepancies are due to rounding.

- 9.2 No existing receptors are expected to experience pollutant concentrations in excess of the relevant annual mean AQOs. Furthermore, the impact at all receptor locations is considered 'Negligible' in accordance with the LUPDC criteria.
- 9.3 As such, based on the extent of predicted population exposure to NO₂, PM₁₀ and PM_{2.5} impacts, the overall air quality effect of the proposed development is considered to be not significant.

10. CONCLUSIONS

- 10.1 Cass Allen was instructed by Bellway Homes (Thames Valley) Limited to assess the potential air quality effects associated with a proposed residential development located north of Arborfield Road in Shinfield, Wokingham.
- 10.2 Emissions of construction phase dust and PM₁₀ were assessed in accordance with IAQM guidance. A High Risk and Low Risk of dust soiling and PM₁₀ health effects has been identified, respectively, in the absence of mitigation. Suitable best practice mitigation measures for the relevant activities' risk levels have been recommended and no significant residual air quality impacts are expected.
- 10.3 A detailed atmospheric dispersion model was utilised to predict NO₂, PM₁₀ and PM_{2.5} concentrations at relevant sensitive receptor locations within the study area during operational phase. This followed Defra TG22 and EPUK & IAQM LUPDC guidance.
- 10.4 The results indicate that pollutant concentrations at proposed sensitive receptors are expected to be below the relevant AQOs during the operational phase. Furthermore, no significant impacts on local air quality as a result of development-generated traffic are anticipated. Based on the extent of predicted population exposure to NO₂, PM₁₀ and PM_{2.5} impacts, the overall effect of the development is considered to be 'not significant', with regard to air quality, with no requirement for additional mitigation.
- 10.5 In summary, it is our view that the site is suitable for the development in terms of air quality and that there are no air quality constraints with respect to planning consent.

Appendix 1 Air Quality Legislation

Defra and the Devolved Administrations (2007) - The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2):

The Air Quality Strategy provides a framework for reducing air pollution in the UK, with the aim of meeting the requirements of European Union (EU) legislation. This has been brought into UK law via the EU (Withdrawal) Act 2018 (as amended) and is referred to as 'retained EU law'.

The air quality standards set within the Air Quality Strategy are recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO), based on current scientific knowledge regarding the effects of each pollutant on health and the environment.

The AQOs are medium-term policy-based targets set by the government, taking into account economic efficiency, practicability, feasibility and timescales. Whilst some of the AQOs correspond with the EPAQS / WHO limits, others have a margin of tolerance, by specifying a number of permitted exceedances of the standard over a given period.

Many of the AQOs in the Air Quality Strategy have been made statutory in England via The Air Quality (England) Regulations, 2000, The Air Quality (England) Amendment Regulations, 2002 and The Air Quality Standards (Amendment) Regulations, 2016 – Statutory Instrument 2016 No. 1184.

Environmental Protection Act (1990):

Section 79 of the Environmental Protection Act 1990 defines statutory nuisance relevant to dust and particles as:

'Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance'; and

'Any accumulation or deposit which is prejudicial to health or a nuisance'.

Furthermore, Section 80 states that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the Local Authority may abate the nuisance and recover expenses. However, there are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist and nuisance is a subjective concept, its perception being highly dependent upon the existing conditions and the change which has occurred.

Environment Act (2021):

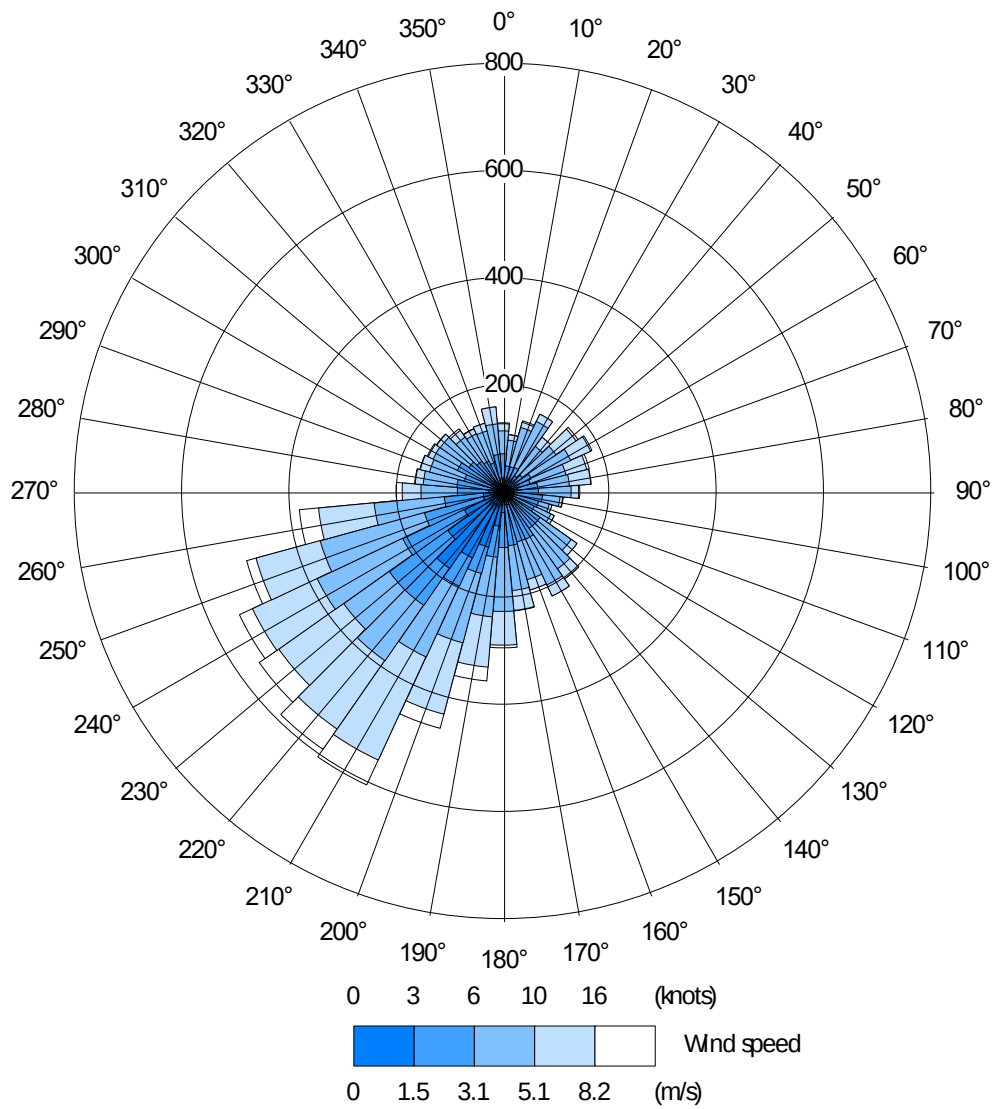
The Act mandates that local authorities review and document local air quality within their jurisdiction by way of staged appraisals and respond accordingly, with the aim of meeting the AQOs defined in the Regulations. There is a requirement for local authorities to identify relevant sources of emissions that are likely to be responsible for any failure to achieve the AQOs, or to identify relevant sources within neighbouring authorities' areas. Where the objective(s) are not likely to be achieved within the relevant period(s), the authority is required to designate an AQMA. For each AQMA the Local Authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality, in order to work towards achieving air quality standards in the future.

Defra (2019) Clean Air Strategy:

The UK Government's Clean Air Strategy sets out the comprehensive actions required to improve air quality, required from all parts of government and society.

The primary focus of previous iterations of the Clean Air Strategy has been NO₂, and its principal source – road traffic. The 2019 Strategy broadens the focus into other areas, including actions on clean growth and pollutant emissions from other sources such as industry, agriculture, and domestic wood-burning stoves.

Appendix 2 Wind Rose for Farnborough (2022)



Appendix 3 Traffic Data

Traffic data for the dispersion model were obtained from the project's Transport Consultant and supplemented by additional data from Department for Transport (DfT) Traffic Counts. Where necessary, traffic data were converted to the appropriate assessment years using a robust factor derived from Defra Trip End Model Presentation Program (TEMPro) program (version 8.0).

2022 Model Verification

ID	Description	Road Type	Speed (km/h)	AADT	%HDV
1	A327 Shinfield Road, north of Halls Lane, south of Egerton Road	Urban (not London)	30	8,409	2.77
2	A327 Shinfield Road, north of Egerton Road, south of Whitley Wood Road junction	Urban (not London)	5	8,409	2.77
3	A327 Shinfield Road, Whitley Wood Road Junction	Urban (not London)	5	8,409	2.77
4	A327 Shinfield Road, north of Whitley Wood Road Junction, south of Shinfield Rise	Urban (not London)	5	12,093	3.66
5	A327 Shinfield Road, north of Shinfield Rise, south of Shell petrol station	Urban (not London)	15	12,093	3.66
6	A327 Shinfield Road, north of Shell petrol station, south of Elm Road/Cedar Road junction	Urban (not London)	5	12,093	3.66
7	A327 Shinfield Road, Elm Road/Cedar Road junction	Urban (not London)	5	12,964	2.18
8	A327 Shinfield Road, north of Elm Road/Cedar Road junction, south of 20/30mph sign	Urban (not London)	5	12,964	2.18
9	A327 Shinfield Road, north of 20/30mph sign, south of Beech Road	Urban (not London)	30	12,964	2.18
10	A327 Shinfield Road, north of Leighton Park School, south of Pepper Lane/Wellington Avenue junction	Urban (not London)	5	12,964	2.18
11	A327 Shinfield Road, north of Pepper Lane/Wellington Avenue junction, south of Wellington Avenue Bus Stop	Urban (not London)	5	12,964	2.18
12	A327 Shinfield Road, north of Wellington Avenue Bus Stop, south of UoR Shinfield Road entrance	Urban (not London)	30	12,964	2.18

2027 Without Development

ID	Description	Road Type	Speed (km/h)	AADT	%HDV
13	Arborfield Road, east of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, west of Esso Petrol Station	Urban (not London)	5	11,686	0.23
14	Arborfield Road, east of Esso Petrol Station, west of internal site road	Urban (not London)	45	11,686	0.23
15	Arborfield Road, east of internal site road, west of Parrot Farmhouse	Urban (not London)	45	11,686	0.23
16	Arborfield Road, east of Parrot Farmhouse, west of Eastern Relief Road	Urban (not London)	5	11,686	0.23
17	Eastern Relief Road/Arborfield Road/A327 roundabout	Urban (not London)	5	17,041	2.73
18	A327, east of Eastern Relief Road/Arborfield Road/A327 roundabout, west of Lamppost 515	Urban (not London)	5	28,897	2.68

ID	Description	Road Type	Speed (km/h)	AADT	%HDV
19	A327, east of Lamppost 515, west of UoR Hall Farm entrance	Urban (not London)	45	28,897	2.68
20	Eastern Relief Road, north of Eastern Relief Road/Arborfield Road/A327 roundabout, south of 50mph sign	Urban (not London)	5	23,050	3.32
21	Eastern Relief Road, north of 50mph sign, south of Cutbush Lane (East) sign	Urban (not London)	65	23,050	3.32
22	Eastern Relief Road, north of Cutbush Lane (East) sign, south of 40mph sign	Urban (not London)	65	23,050	3.32
23	Eastern Relief Road, north of 40mph sign, south of Hawthorne/South Avenue	Urban (not London)	5	23,050	3.32
24	Internal Site Road, north of Arborfield Road	Urban (not London)	-	-	-
25	Internal Site Road	Urban (not London)	-	-	-
26	Shepherd Road, north of internal site road, south of 3 Shepherd Rd	Urban (not London)	20	1,412	0.00
27	Shepherd Road, north of 3 Shepherd Rd, south of Cutbush Lane	Urban (not London)	5	1,412	0.00
28	Hawthorn, north of Shepherd Road, south of 3 Hawthorn	Urban (not London)	5	3,865	0.82
29	Hawthorn, north of 3 Hawthorn, south of Whitethorn	Urban (not London)	15	3,865	0.82
30	Hawthorn, east of Whitethorn, west of Eastern Relief Road/Hawthorne/ South Avenue roundabout	Urban (not London)	5	3,865	0.82
31	Cutbush Lane, west of Shepherd Road, east of 71 Cutbush Lane	Urban (not London)	5	3,956	0.00
32	Cutbush Lane, west of 71 Cutbush Lane, east of Monarch Drive	Urban (not London)	25	3,956	0.00
33	B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout	Urban (not London)	5	12,326	0.16
34	Beke Avenue, west of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, east of corner	Urban (not London)	5	3,175	0.59
35	Beke Avenue, west of corner	Urban (not London)	10	3,175	0.59
36	B3349 Hyde End Road, south of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, north of 30mph sign	Urban (not London)	5	16,731	0.15
37	B3349 Hyde End Road, south of 30mph sign, north of Millworth Lane	Urban (not London)	30	16,731	0.15
38	Hollow Lane, north of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, south of pedestrian crossing island	Urban (not London)	5	15,666	0.20
39	Hollow Lane, north of pedestrian crossing island, south of Wychem Road	Urban (not London)	30	15,666	0.20

2027 With Development

ID	Description	Road Type	Speed (km/h)	AADT	%HDV
13	Arborfield Road, east of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, west of Esso Petrol Station	Urban (not London)	5	12,446	0.23
14	Arborfield Road, east of Esso Petrol Station, west of internal site road	Urban (not London)	45	12,446	0.23

ID	Description	Road Type	Speed (km/h)	AADT	%HDV
15	Arborfield Road, east of internal site road, west of Parrot Farmhouse	Urban (not London)	45	11,049	0.23
16	Arborfield Road, east of Parrot Farmhouse, west of Eastern Relief Road	Urban (not London)	5	11,049	0.23
17	Eastern Relief Road/Arborfield Road/A327 roundabout	Urban (not London)	5	16,987	2.70
18	A327, east of Eastern Relief Road/Arborfield Road/A327 roundabout, west of Lamppost 515	Urban (not London)	5	29,277	2.68
19	A327, east of Lamppost 515, west of UoR Hall Farm entrance	Urban (not London)	45	29,277	2.68
20	Eastern Relief Road, north of Eastern Relief Road/Arborfield Road/A327 roundabout, south of 50mph sign	Urban (not London)	5	21,643	3.32
21	Eastern Relief Road, north of 50mph sign, south of Cutbush Lane (East) sign	Urban (not London)	65	21,643	3.32
22	Eastern Relief Road, north of Cutbush Lane (East) sign, south of 40mph sign	Urban (not London)	65	21,643	3.32
23	Eastern Relief Road, north of 40mph sign, south of Hawthorne/South Avenue	Urban (not London)	5	21,643	3.32
24	Internal Site Road, north of Arborfield Road	Urban (not London)	5	2,697	0.00
25	Internal Site Road	Urban (not London)	20	2,697	0.00
26	Shepherd Road, north of internal site road, south of 3 Shepherd Rd	Urban (not London)	20	2,583	0.50
27	Shepherd Road, north of 3 Shepherd Rd, south of Cutbush Lane	Urban (not London)	5	2,583	0.50
28	Hawthorn, north of Shepherd Road, south of 3 Hawthorn	Urban (not London)	5	3,095	0.82
29	Hawthorn, north of 3 Hawthorn, south of Whitethorn	Urban (not London)	15	3,095	0.82
30	Hawthorn, east of Whitethorn, west of Eastern Relief Road/Hawthorne/ South Avenue roundabout	Urban (not London)	5	3,095	0.82
31	Cutbush Lane, west of Shepherd Road, east of 71 Cutbush Lane	Urban (not London)	5	3,485	0.00
32	Cutbush Lane, west of 71 Cutbush Lane, east of Monarch Drive	Urban (not London)	25	3,485	0.00
33	B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout	Urban (not London)	5	12,595	0.16
34	Beke Avenue, west of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, east of corner	Urban (not London)	5	3,218	0.59
35	Beke Avenue, west of corner	Urban (not London)	10	3,218	0.59
36	B3349 Hyde End Road, south of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, north of 30mph sign	Urban (not London)	5	17,085	0.15
37	B3349 Hyde End Road, south of 30mph sign, north of Millworth Lane	Urban (not London)	30	17,085	0.15
38	Hollow Lane, north of B3349/Hollow Lane/Arborfield Road/Beke Avenue roundabout, south of pedestrian crossing island	Urban (not London)	5	15,801	0.20
39	Hollow Lane, north of pedestrian crossing island, south of Wychem Road	Urban (not London)	30	15,801	0.20

Appendix 4 Dispersion Model Details

Model Details and Input Parameters

Parameter	Value
Emissions Factors	Defra Emissions Factors Toolkit v12.1 using the traffic data in Appendix 3
Emissions Year	2022 for verification, 2027 for future scenarios
Background Concentrations	Sources from Defra maps – 2022 for verification, 2027 for future scenarios
Surface Roughness	Site – 0.5m; Meteorological Station – 0.2m
Monin-Obukhov Length	Site – 10m; Meteorological Station – 10m
Meteorological Data	Farnborough (2022)
Road-contribution Adjustment Factor	1.13 – see Model Verification, below
NO _x to NO ₂ conversion	Defra NO _x to NO ₂ Calculator v8.1 and Defra mapped background concentrations

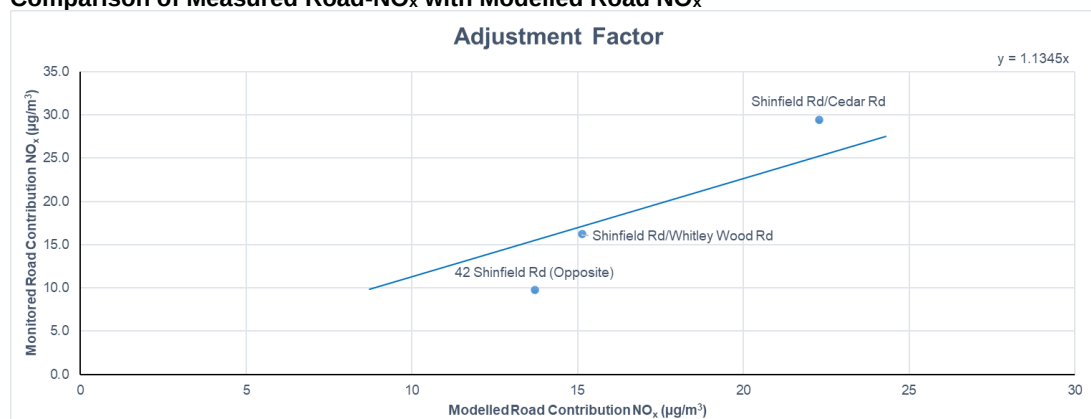
Model Verification

The model has been verified using the TG22 methodology. The model has been used to predict 2022 annual mean road-NO_x contributions at roadside and kerbside monitoring locations within the study area. The modelled road-NO_x concentrations have been compared with the 'measured' road-NO_x utilising the Defra NO_x to NO₂ Calculator.

Model Verification (all concentrations in µg/m³)

Monitor ID	Monitored NO ₂	Background NO ₂	Monitored Road NO _x	Modelled Road NO _x	Ratio
Shinfield Road/Whitley Wood Road	22.2	13.7	16.3	15.1	1.074
Shinfield Road/Cedar Road	28.7	13.7	29.5	22.3	1.322
42 Shinfield Road (Opposite)	20.0	14.8	9.8	13.7	0.713

Comparison of Measured Road-NO_x with Modelled Road NO_x



Calculation of Model Uncertainty

To assess model uncertainty, the Root Mean Square Error (RMSE) of the above data was calculated to provide an estimate of the average error of the model. The overall weighted RMSE value calculated following model verification was 2.08µg/m³, which is within the acceptable range specified in TG22.

Appendix 5 Operational Phase Significance Criteria

Long Term Average Concentration at Receptors in Assessment Year	% Change in Concentration Relative to Air Quality Objective (AQO)			
	1	2 – 5	6 – 10	>10
75% or less of AQO	Negligible	Negligible	Slight	Moderate
76 - 94% of AQO	Negligible	Slight	Moderate	Moderate
95 - 102% of AQO	Slight	Moderate	Moderate	Substantial
103 - 109% of AQO	Moderate	Moderate	Substantial	Substantial
110% or more of AQO	Moderate	Substantial	Substantial	Substantial

Notes:

- The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. less than 0.5%, will be described as Negligible.
- The Table is only designed to be used with annual mean concentrations.
- Descriptors for individual receptors only; the overall significance is determined using professional judgement. For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
- When defining the concentration as a percentage of the AQO, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme' concentration for an increase.
- The total concentration categories reflect the degree of potential harm by reference to the AQO value. At exposure less than 75% of this value, i.e. 'well below', the degree of harm is likely to be small. As the exposure approaches and exceeds the AQO, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQO.
- It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQO. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQO, rather than being exactly equal to it.
- When defining the concentration as a percentage of the AQO, 'without scheme' concentration should be used where there is a decrease in pollutant concentration and the 'with scheme;' concentration where there is an increase. Where concentrations increase, the impact is described as adverse, and where it decreases as beneficial.
- LUPDC states that an assessment must reach a conclusion on the likely significance of the predicted effect. It should be noted that this is a binary judgement of either it is significant, or it is not significant.

Appendix 6 Recommended Construction Phase Mitigation

Highly Recommended Mitigation Measures for High-Risk Sites (indicative and subject to change)

General Communication

- Prior to work commencing on each phase of development, the developer will inform the local community on works due to commence and a point of contact provided for construction-related queries.
- 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, where applicable.
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this Appendix. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, real-time PM₁₀ continuous monitoring and/or visual inspections.

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 complaints log available to the Local Authority on request.
- Record any exceptional incidents that cause dust and/or air emissions, either on or off-site should be recorded, and the action taken to resolve the situation, in the logbook.
- Hold regular liaison meetings with other major / high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and windowsills within 100m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM₁₀ continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it 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 the site layout so that machinery and dust causing activities are located away from receptors, as far as is practicable.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on-site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on-site. If they are being reused on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicle operators 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.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- 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 is available on the site for effective dust/PM suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes/conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on-site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition (Medium Risk)

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

Measures Specific to Construction (High Risk)

- Avoid scabbling (roughening of concrete surfaces), if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case make sure that that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.

Measures Specific to Trackout (High Risk)

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

Appendix 7 Dispersion Model Results

Annual Mean NO₂ Impacts

Receptor	Without (µg/m ³)	With (µg/m ³)	With % of AQO	Change (µg/m ³)	Change (% AQO)	Impact
R1	10.3	10.4	25.9	0.1	0.2	Negligible
R2	11.8	11.9	29.8	0.1	0.3	Negligible
R3	17.7	17.7	44.2	0.0	0.1	Negligible
R4	11.7	12.8	32.1	1.2	2.9	Negligible
R5	11.7	11.9	29.7	0.2	0.4	Negligible
R6	11.6	12.0	30.1	0.4	1.0	Negligible
R7	12.1	12.5	31.3	0.5	1.2	Negligible
R8	14.1	14.2	35.5	0.1	0.3	Negligible

Note: Results are reported to the nearest 0.1µg/m³. Any apparent discrepancies are due to rounding.

Annual Mean PM₁₀ Impacts

Receptor	Without (µg/m ³)	With (µg/m ³)	With % of AQO	Change (µg/m ³)	Change (% AQO)	Impact
R1	13.8	13.8	34.6	0.0	0.1	Negligible
R2	14.3	14.3	35.7	0.0	0.1	Negligible
R3	15.5	15.5	38.9	0.0	0.0	Negligible
R4	15.2	15.7	39.1	0.4	1.1	Negligible
R5	15.2	15.3	38.2	0.1	0.1	Negligible
R6	15.2	15.3	38.4	0.1	0.4	Negligible
R7	15.3	15.5	38.8	0.2	0.4	Negligible
R8	15.2	15.2	38.1	0.0	0.1	Negligible

Note: Results are reported to the nearest 0.1µg/m³. Any apparent discrepancies are due to rounding.

Annual Mean PM_{2.5} Impacts

Receptor	Without (µg/m ³)	With (µg/m ³)	With % of AQO	Change (µg/m ³)	Change (% AQO)	Impact
R1	9.0	9.1	45.3	0.0	0.1	Negligible
R2	9.3	9.3	46.5	0.0	0.1	Negligible
R3	9.9	10.0	49.8	0.0	0.0	Negligible
R4	10.0	10.2	51.0	0.2	1.1	Negligible
R5	10.0	10.0	50.0	0.0	0.1	Negligible
R6	10.0	10.0	50.2	0.1	0.4	Negligible
R7	10.0	10.1	50.6	0.1	0.4	Negligible
R8	9.8	9.8	48.9	0.0	0.1	Negligible

Note: Results are reported to the nearest 0.1µg/m³. Any apparent discrepancies are due to rounding.



Architectural & Environmental Consultants

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