



Air Quality Mitigation Strategy

Cheadle North Strategic Development

Persimmon Homes (North West) Limited

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Contents

1.0	Introduction	2
1.1	Background	2
2.0	Legislation, Guidance, and Policy	3
3.0	Assessment	5
3.1	Damage Cost Analysis	5
4.0	Road Vehicle Source Apportionment	7
5.0	Mitigation Strategy	9
6.0	Conclusion	11
7.0	Abbreviations.....	12

Tables and Figures

Table 1: Sensitive Receptor Locations For Source Apportionment	4
Table 2: Leek Road Fleet Breakdown.....	4
Table 3: Summary of Calculation Inputs	5
Table 4: Development Road Vehicle Exhaust Emissions.....	5
Table 5: 2017 IGBC Damage Cost Factors	6
Table 6: Air Quality Damage Cost	6
Table 7: Air Quality Damage Costs - 5 Year Period	6
Table 8: Source Apportionment for all Road Transport Type on Leek Road	7
Figure 1: Road Vehicle Fleet Proportions (%)	8
Figure 2: NOx Emission by Fleet.....	8
Table 9: Fixed Mitigation Strategy	10
Table 10: Summary of Mitigation Strategy	10

1.0 Introduction

1.1 Background

1.1.1 Enzygo Limited was commissioned by Persimmon Homes (North West) to finalise an air quality mitigation strategy prepared by to discharge Condition 14 of a the hybrid planning application (SMD/2018/0180) on land east of Froghall Road and north of Ayr Road/Cheltenham Avenue, Cheadle.

1.1.2 The hybrid planning application is seeking:

1. Full permission for 125 dwellings and access to proposed primary school, and;
2. Outline permission for up to 135 dwellings and primary school with all matters reserved.

1.1.3 An air quality mitigation strategy was submitted to Staffordshire Moorlands District Council (SMDC) in July 2021 as part of a decision notice associated with the planning application. Following a review by the Environmental Health Officer at SMDC the report was deemed acceptable, however given its status as a draft document the mitigation strategy was incomplete.

1.1.4 This version of the report intends to produce a fixed mitigation strategy with associated objectives and costings, and will detail the appropriate level of mitigation required to offset associated impacts detailed in the original Air Quality Assessment (ref: AQ105750r2). The assessment also restates commentary on source contributions responsible for predicted exceedances, as required by Condition 14.

1.1.5 Details of the assessment methodology, assessment inputs, results and conclusions are detailed within this report.

1.2 Site Location and Context

1.2.1 The Proposed Development is located at Land to the East of Froghall Road and North of Ayr Road and Cheltenham Avenue, Cheadle, Staffordshire and at approximate National Grid Reference (NGR): 401505, 344460.

1.2.2 The site is in a well-established residential area and will occupy an area of approximately 6.7ha bounded to the south and east by residential use adjacent to the A521 and Ness Grove. To the north and east of the site lies open countryside. There are no Air Quality Management Areas (AQMA) within proximity to the site.

2.0 Legislation, Guidance, and Policy

2.1.1 The following guidance and policy will be considered during the preparation of the Air Quality Assessment:

- Local Air Quality Management Technical Guidance 2016¹;
- Air Quality Damage Cost Guidance²; and
- Air Quality Appraisal: Damage cost Guidance³.

2.2 Defra Damage Cost

2.2.1 In accordance DEFRA Damage Cost approach the purpose of the emissions mitigation assessment is to assess the local emissions from a development and to determine the appropriate level of mitigation required to help reduce the potential effect on health and/or the local environment. The value calculated therefore provides a basis for defining the financial commitment required for the offsetting development impacts.

2.2.2 The DEFRA guidance² outlines a simple approach which is detailed below:

- Identify the additional trip rates (as trips/annum) generated by the proposed development (this information will normally be provided in the Transport Assessment);
- Assume an average distance travelled of 10 km/trip;
- Calculate the additional emissions of oxides of nitrogen (NO_x) and particulate matter with an aerodynamic diameter of less than 10µm (PM_{2.5}) (kg/annum), based on emissions factors in the Emissions Factor Toolkit (Version 10.1)⁴, and an assumption of an average speed of 50 km/h;
- Calculate emissions using the Emissions Factor Toolkit over a 5-year time frame;
- Use the latest 2021 DEFRA Damage Cost approach³ to provide a valuation of the excess emissions, using the currently applicable values for each pollutant; and
- Sum the NO_x and PM_{2.5} costs.

2.2.3 It should be noted that the damage costs are adjusted to account for inflation using the Gross Domestic Product (GDP) deflator, as well as an uplift to damage costs by 2% cumulatively per annum from 2017. This reflects the assumption that willingness to pay for health outcomes will rise in line with real per capita GDP growth.

2.2.4 The application of specific damage cost valuations within the air quality mitigation strategy was agreed with the Environmental Health department at SMDC prior to undertaking the assessment.

¹ Local Air Quality Management Technical Guidance 2016 LAQM.(TG16), DEFRA, April 2021.

² Air Quality Damage Cost Guidance, Department for Environment, Food and Rural Affairs, January 2019

³ <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance>

⁴ <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>

2.3 Road Vehicle Source Apportionment

2.3.1 Pollutant concentrations at any given location consists of contributions from numerous emission sources, including the background component. In the case of AQ105750r2 this relates primarily to road vehicle exhaust contribution from the adjacent road network. Source apportionment helps establish a detailed understanding of the contributing factors leading to air quality objective exceedances. This form of analysis aids developers and local authorities to understand the mechanism behind exceedances with the assessment area and helps focus mitigation strategies to offset the prevailing emission sources.

2.3.2 Source apportionment was undertaken to determine the contribution of different road vehicle sources at 3 receptors along Leek Road (R4, 24 and R25). These receptors represent exceedances of the annual mean NO₂ during the Phase 1 2022 opening year scenario. A summary of the receptors is detailed within Table 1.

Table 1: Sensitive Receptor Locations For Source Apportionment

Receptor Locations		NGR (m)		Predicted Annual Mean NO ₂ Concentration µg/m ³
		X	Y	
R4	16 Leek Road	400969	343563	41.61
R24	12 Leek Road	400968	343550	43.80
R25	22 Windy Arbour	400969	343575	40.93

2.3.3 The road vehicle exhaust contributions from the vehicle fleet were assessed in isolation to determine the prevailing factor in regard to receptor exceedances. In the absence of fleet proportion breakdown provided by the transport Consultant, a review of traffic data for Leek Road was obtained from the Department for Transport database.

2.3.4 Table 2 details the road vehicle flow data.

Table 2: Leek Road Fleet Breakdown

Vehicle Type	AADT	Percentage Of Total AADT
Cars	13,977	78.8
Light Goods Vehicle	2,273	12.8
Heavy Duty Vehicles	736	4.1
Bus	305	1.7
Motorcycle	64	0.4
Development Cars	390	2.2

2.3.5 Analysis of fleet emission breakdown is provided in Section 4.0.

3.0 Assessment

3.1 Damage Cost Analysis

- 3.1.1 The Damage Cost calculation was undertaken at the request of SMBC to inform the level of mitigation required to offset development impacts and provide evidence that proposed measures are proportionate to the calculated damage costs.
- 3.1.2 The Emissions Mitigation Assessment provides analysis from 2022 and 2030, the predicted phase completion years, and includes a five-year period of operation in accordance with the DEFRA² guidance.
- 3.1.3 For the calculation, traffic data for the Proposed Development was obtained from the previous Air Quality Assessment (AQ105750r2). Standard vehicle speeds and trip lengths are those provided by the DEFRA guidance² as summarised in Table 3.

Table 3: Summary of Calculation Inputs

Phase	Annual Average Daily Traffic (AADT)	HDV%	Vehicle Speed (km/h)	Average Trip Length (km)
Phase 1 (2022)	563	0	50	10
Phase 2 (2031)	852	0	50	10

- 3.1.4 The inputs detailed in Table 3 were entered into the Emissions Factor Toolkit (v10.1), the most up to date toolkit during the preparation of the July 2021 assessment, to obtain annual vehicle emissions of NO_x and PM₁₀ (tonnes/annum).
- 3.1.5 Emission Factor Toolkit (version 10.1) predictions are limited to 2030, and as such prediction beyond 2030 for Phase 2 are likely to result in over predictions as it is considered for emission factors to decrease overtime.
- 3.1.6 Table 4 details the calculation road vehicle exhaust emissions

Table 4: Development Road Vehicle Exhaust Emissions

Phase 1 (2022)			Phase 2 (2031)		
Year	NO _x Emissions (tonnes/annum)	PM ₁₀ Emissions (tonnes/annum)	Year	NO _x Emissions (tonnes/annum)	PM ₁₀ Emissions (tonnes/annum)
2022	0.467	0.065	2030	0.310	0.097
2023	0.424	0.065	2031	0.310	0.097
2024	0.384	0.065	2032	0.310	0.097
2025	0.347	0.064	2033	0.310	0.097
2026	0.312	0.064	2034	0.310	0.097

- 3.1.7 The DEFRA guidance provides various damage cost factors dependent on emission sources as well as geographical locations. As agreed with the Environmental Health department at SMDC "Road Transport Urban (Medium)" central damage factors were deemed suitable for the Proposed Development.
- 3.1.8 The IGBC damage cost factors for "Road Transport Urban (Medium)" are detailed in Table 5. These are given as 2017 figures.

Table 5: 2017 IGBC Damage Cost Factors

Pollutant	Central Damage Cost (£/t)
NO _x	7,614
PM ₁₀	66,797

3.1.9 In accordance with the DEFRA guidance the above 2017 based damage costs were rebased to 2021 to take account of inflation using Gross Domestic Product (GDP) deflator and also uplifted by 2% cumulatively per annum from 2017 to the phase completions years and over the five-year period. The uplift is to reflect the willingness to pay for health outcomes which are expected to rise each year in line with capita GDP growth.

3.1.10 It should be noted that damage costs are provided for PM_{2.5} and as such, a conversion factor of 0.644 was applied to provide damage costs for PM₁₀.

3.1.11 Air Quality Damage Costs per Year are summarised in Table 6.

Table 6: Air Quality Damage Cost

Phase 1 (2022)			Phase 2 (2031)		
Year	Road NO _x (£/tonne)	Road PM _{2.5} (£/tonne)	Year	Road NO _x (£/tonne)	Road PM _{2.5} (£/tonne)
2022	4,238.67	3,350.16	2030	3,366.86	5,923.91
2023	3,795.93	3,280.38	2031	3,318.06	5,838.05
2024	3,387.37	3,217.19	2032	3,269.97	5,753.44
2025	3,011.77	3,159.15	2033	3,222.58	5,670.06
2026	2,671.20	3,105.09	2034	3,175.88	5,587.89
TOTAL	17,104.93	16,112.00	TOTAL	16,353.35	28,773.38

3.1.12 The values in Table 6 are applied to the emissions given in Table 4 and summed for each pollutant. The final damage costs are summarised in Table 7.

Table 7: Air Quality Damage Costs - 5 Year Period

Pollutant	Phase 1 (2022) Development Damage Costs	Phase 2 (2031) Development Damage Costs
NO _x	£17,105	£16,353
PM _{2.5}	£16,112	£28,773
Total	£33,217	£45,127

3.1.13 As outlined in Table 7, the total damage cost for the Proposed Development was calculated at **£33,217** for Phase 1 and **£45,127** for Phase 2. This cost should be used as an indicator to the level of emissions offsetting measures required as part of the Proposed Development scheme. These may include on site and/or off-site measures.

3.1.14 The fixed air quality mitigation strategy is provided in Section 5.0

4.0 Road Vehicle Source Apportionment

Air Quality modelling undertaken in October 2019 (AQ105750r2) indicated exceedances of the annual mean Air Quality Objective for NO₂ at 3 receptor locations R4, R24 and R25. Source apportionment for NO_x emissions was therefore requested by SMDC at locations identified in Table 1.

4.1 Road Vehicle Breakdown

4.1.1 Source apportionment was carried out for 2022 future year emissions along Leek Road. The information provided by the transport consultant detailed an AADT of 17,745, with 6% HGV. Emission sources were separated into road sources by each vehicle type using fleet information provided by the Department for Transport database.

4.1.2 A breakdown of the vehicle types and NO_x emission contributions from each source along Leek Road is shown in Table 8.

Table 8: Source Apportionment for all Road Transport Type on Leek Road

Source Type	24-hour AADT	NO _x Emissions (g/km/s)	Percentage
Car	13,977	0.045	45.1
Light Goods Vehicle	2,273	0.025	24.6
Heavy Duty Vehicles	736	0.017	17.3
Bus	305	0.012	11.6
Motorcycle	64	0.001	0.1
Development Cars	390	0.001	1.3
Total	17,745	0.09974	100

4.1.3 Car use is the prevailing contributor of NO_x emission at the affected receptor location adjacent to Leek Road, representing 44% of the overall total modelled NO_x emissions. It is also pertinent to provide discussions on the emission associated with HDV and Bus contributions. Whilst these vehicles form 6% of the Leek Road fleet, they contribute 28.6% of NO_x emissions, highlighting their significant emission contributions in comparison to their relatively low traffic proportions.

4.1.4 Emissions from car sources generated from the Proposed Development represent 1.3% of emissions along Leek Road, respectively, and are not considered a major contributor to exceedances at R4, R24 or R25.

4.1.5 Following this analysis, it is recommended that measures that focus on HDV and Bus emissions along Leek Road would best reduce impacts at R4, R24 and R25. Such measures fall outside the scope of the development. It is considered that strategies to reduce private car trips, guided by government policy, the draft SMDC Air Quality Action Plan, and sustainable travel plan produced for the Proposed Development, will reduce the contribution of existing and proposed car movements.

4.1.6 Figure 1 (below) demonstrates the contribution of each vehicle fleet regarding the total traffic flow along Leek Road for the 2022 Opening Year Scenario. Figure 2 (below) shows the contribution of the NO_x emissions generated for each vehicle fleet.

Figure 1: Road Vehicle Fleet Proportions (%)

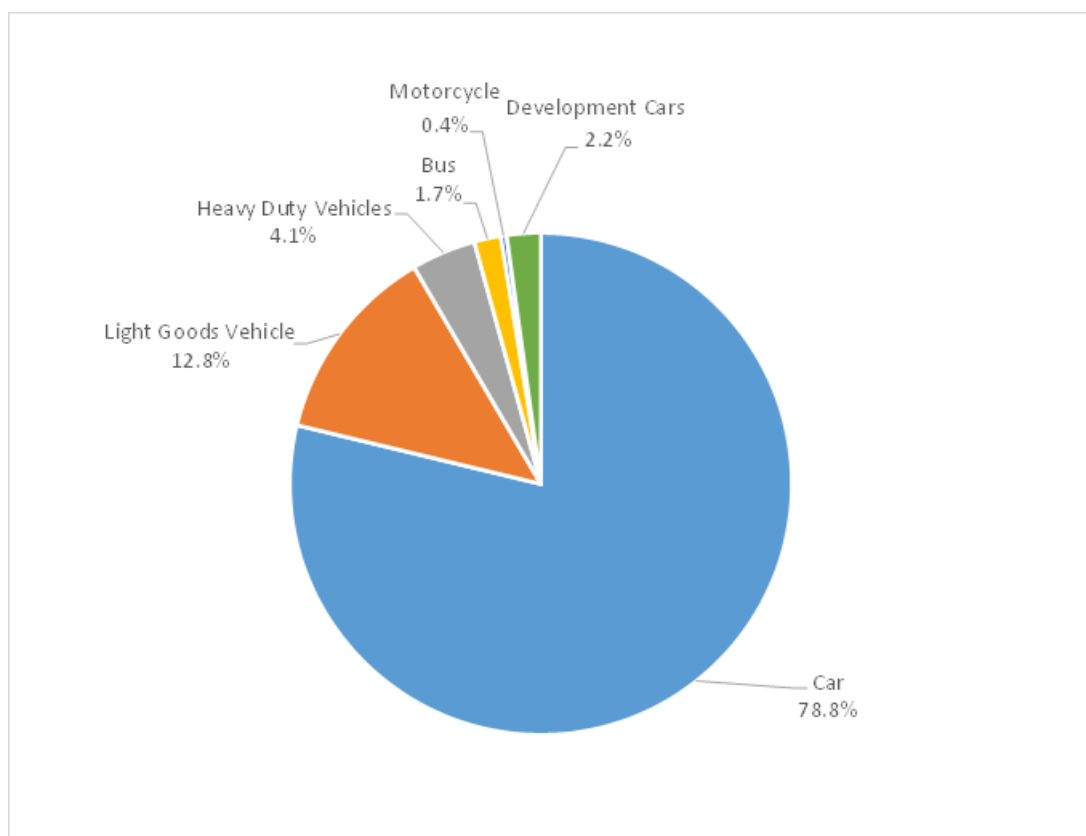
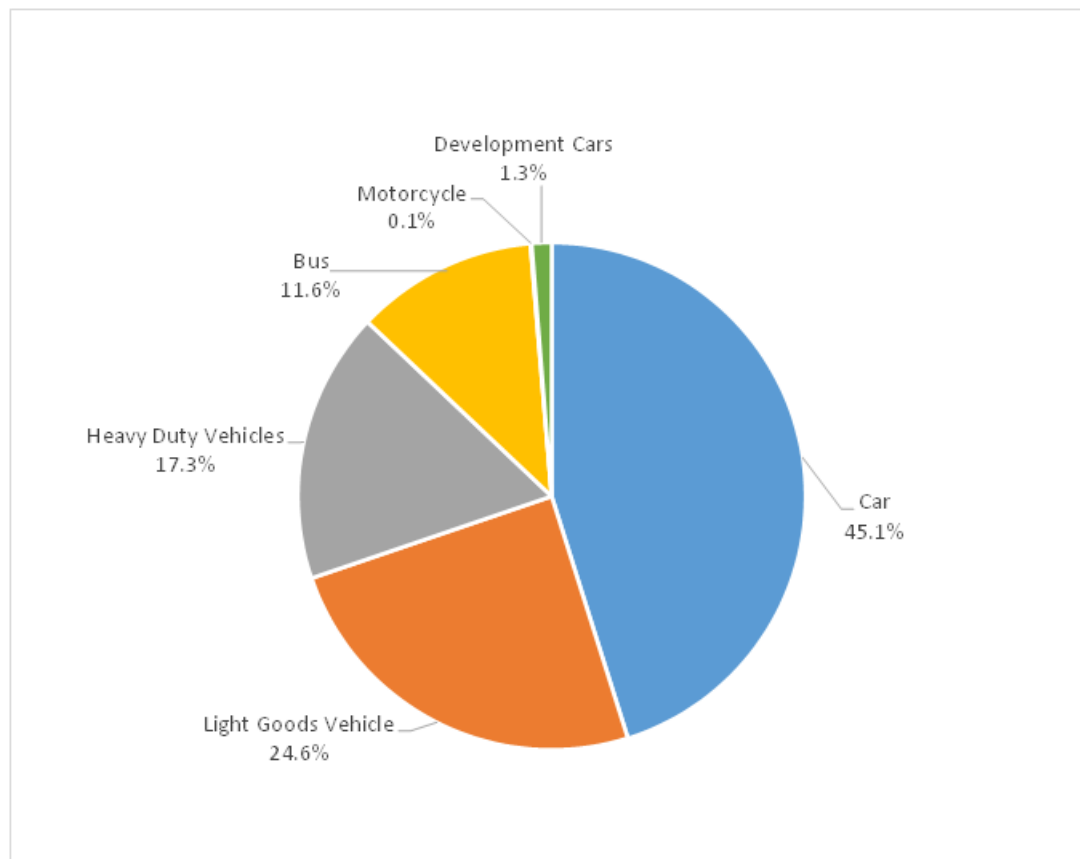


Figure 2: NO_x Emission by Fleet



5.0 Mitigation Strategy

The mitigation measures presented in the following sections are considered sufficient under the guidance in terms of capital expenditure, but more importantly potential offsetting capabilities. The measures are aimed to enhance the sustainability of the Proposed Development and provide a high level of future proofing in preparation for future fleet emission targets. The measures will also help mitigate the potential air quality impacts associated with the Proposed Development through emissions reduction technologies and development design, i.e. electric vehicle charging infrastructure, secure cycle storage, sustainable access and travel.

Following discussions with Persimmon Homes, feasible mitigation options have been considered within the scheme design and are detailed in the following sections. These include:

- Electric Vehicle Charging Points;
- Secure Cycle Storage;
- Travel Plan Implementation (including appointment of a travel plan coordinator); and

The following sections details the objective and indicative costings of selected mitigation measures. Additional narrative on each measure is also provided to justify the inclusion with the air quality mitigation strategy.

5.1 Electric Vehicle Charging Infrastructure

5.1.1 Investments will include the necessary infrastructure to provide 154 points across the two development phases. The electric vehicle charging specification are as follows:

- The Proposed Development will install EV-1Q 7 PRO 7.3kW charging points, the specifications of the chargers are provided in Appendix A.

5.2 Travel Plan and Coordination

5.2.1 The proposed travel plan is aimed to encourage sustainable transport methods and inform residents of sustainable opportunities in order to minimise impacts to air quality.

5.2.2 The travel plan will where applicable, set out measures to encourage a 'modal shift' to sustainable means of transport (electric vehicle, public, cycling and walking) via potential incentives, improved links to public transport, infrastructure, and layout improvement to promote safe and friendly environments. The implementation of which will not only encourage sustainable movement within the area but also increase the connectivity with external transport routes.

5.3 Secure Cycle Storage

5.3.1 The Proposed Development will provide a level of cycle parking allocations across the two phases, including 135 spaces within dedicate sheds. Secure locations are provided to plots where the installation of electric vehicle charging points is not possible.

5.3.2 The implementation of this measure will not only promote cycle usage for new residents, by providing secure locations for residents to store their bicycles, but will also directly minimise private vehicle trips from the development.

5.4 Fixed Mitigation Plan

5.4.1 Table 9 presents the indicative costings of potential mitigation measures which are deemed suitable for the proposed development. The findings below show mitigation measures that are committed in the development.

Table 9: Fixed Mitigation Strategy

Mitigation Measure	Description	Quantity		Costing per Unit	Total Costing (£)	
		Ph1	Ph2		Ph1	Ph2
Electric Vehicle Charging Points	Installation of EV-1Q 7 PRO 7.3kW charging points	76	135	£450.00	£34,200	£60,750
Sustainable Transport Assessment	Travel Plan and Travel Information pack to be prepared, implemented, and monitored	1		£3,250.00	£1,625	£1,625
Secure Cycle Storage	Provision of secure cycle parking for each plot, within dedicated shed	0	135	£450.00	£0	£60,750
TOTAL					£35,825	£123,125

5.5 Summary of Mitigation Measures

5.5.1 Table 10 summarises the indicative costings of potential mitigation measures detailed above which are deemed suitable for the Proposed Development. The findings indicated the proposed AQMS measures significantly exceed the costing benchmark.

Table 10: Summary of Mitigation Strategy

Mitigation Measure	Total Costing
Electric Vehicle Charging Points	£94,950
Sustainable Transport Assessment	£3,250
Secure Cycle Storage	£60,750
TOTAL	£158,950.00

5.5.2 As shown in Table 10 the indicative costings above, the mitigation strategy is at least proportional to the DEFRA Damage Cost benchmark and indeed exceeds the suggest financial value of **£35,82** for Phase 1 and **£123,125** for Phase 2.

5.5.3 It is considered that implementation of the above measures would suitably reduce potential air quality impacts associated with the Proposed Development.

6.0 Conclusion

- 6.1.1 Enzygo were commissioned by the Persimmon Homes (North West) Limited to finalise an air quality mitigation strategy in support of a hybrid application on land east of Froghall Road and north of Ayr Road/Cheltenham Avenue, Cheadle.
- 6.1.2 The development has the potential to cause air quality impacts at sensitive locations as a result of road vehicle exhaust emissions associated with traffic generated by the site during operation. An air quality mitigation strategy has therefore been prepared to consider the potential for increased road vehicle exhaust and energy emissions associated with traffic generation from the site, and to identify suitable measures to control and offset anticipated impacts to an acceptable level.
- 6.1.3 Through the undertaking of the DEFRA damage cost analysis It was determined that a combination of mitigation measures as detailed in this report are proportionate to the total estimated damage cost of **£33,217** for Phase 1 and **£45,127** for Phase 2.
- 6.1.4 It is considered that the implementation of the fixed measures detailed in Table 9, equivalent to **£158,950.00**, will reduce potential effects associated with the Proposed Development to an acceptable level, and provide a level of offsetting, not only isolated to the proposed development, but to the wider area.
- 6.1.5 Additionally, results of the source apportionment exercise indicated that the major contributor to NO₂ concentrations at the affected locations were existing car and HDV movements accounting for 44% and 28.6% of the roadside NO₂ emissions along Leek Road respectively. Emissions from the Proposed Development for Phase 1 account for 1.3% of overall NO₂ emissions and are not considered a major contributing factor to the 2022 exceedances at the receptors R4, R24 and R25.
- 6.1.6 Following this analysis, it is recommended the measures focussed on reducing HDV and Bus emissions along Leek Road would best reduce impacts at R4, R24 and R25. It is considered that strategies to reduce private car trips, guided by government policy, and sustainable travel plan produced for the Proposed Development, will reduce the contribution of existing and proposed car movements.
- 6.1.7 Based on the implementation of air quality mitigation strategy detailed within this report, air quality should not be considered a constraint to planning consent and furthermore the Condition 14 of the hybrid planning permission for the Proposed Development (SMD/2021/0456) can be fully discharged.

7.0 Abbreviations

AADT	Annual Average Daily Traffic
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
IGBC	Interdepartmental Group on Costs and Benefits
NGR	National Grid Reference
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NPPG	National Planning Practice Guidance
PM _{2.5}	Particulate matter with an aerodynamic diameter of less than 2.5µm
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
SMDC	Staffordshire Moorland District Council

Appendix A - Electric Vehicle Charging Point Specifications
