



Appendix 11.3

Detailed Air Quality Assessment Methodology

Air Quality Environmental Impact Assessment

Appendix 11.3 - Detailed Air Quality Assessment Methodology

Redbourn Road, Hemel Hempstead



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1.0 INTRODUCTION

- 1.1.1 Following submission of the Scoping Report, comments were received by the Environmental Health Manager at St Albans City & District Council (SADC). This included the following:

"1. A more detailed air quality assessment methodology report is required to be submitted and agreed in advance with SACDC to ensure clarity of process and the specific assessment methodologies and criteria to be adopted. The report should cover baseline studies, assessment of impact magnitude including dispersion modelling methodology, classification of receptor sensitivity and effect levels and subsequent overall assessment of significance. A matrix representation of each of the effect levels should be derived, along with discussion of other contextual factors that may be considered in assessing the overall significance of effects (e.g. magnitude and number of receptors affected)."

- 1.1.2 This Technical Appendix addresses the above comment and provides supporting information used to inform Sections 11.4, 11.5 and 11.6 in the Air Quality Chapter of the Environmental Statement. This should be read in conjunction with the Chapter and the other Technical Appendices.

2.0 METHODOLOGY

2.1 Construction

Fugitive Dust and PM₁₀ Emissions

- 2.1.1 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Institute of Air Quality Management (IAQM) document 'Guidance on the Assessment of Dust from Demolition and Construction V2.2'¹.
- 2.1.2 The first step will be to screen the need for a detailed assessment. Should human receptors be identified within 250m from the boundary or 50m from the construction vehicle route up to 250m from the Site entrance, then the assessment proceeds to Step 2. Additionally, should ecological receptors be identified within 50m of the Site or the construction vehicle route up to 250m from the Site entrance, then the assessment also proceeds to Step 2.
- 2.1.3 Step 2 assess the risk of potential dust impacts. A site is allocated a risk category based on two factors:
- The scale and nature of the works, which determines the magnitude of dust arising as: small, medium or large (Step 2A); and,
 - The sensitivity of the area to dust impacts, which can be defined as low, medium or high sensitivity (Step 2B).
- 2.1.4 The two factors are combined in Step 2C to determine the risk of dust impacts without mitigation applied.
- 2.1.5 Once the risk of dust impacts has been determined and the appropriate mitigation measures identified, the final step is to determine the significance of any residual impacts. For almost all construction activity, the aim should be to control effects through the use of effective mitigation. Experience shows that this is normally possible. Hence the residual effect will normally be **not significant**.

¹ Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

Road Vehicle Exhaust Emissions

2.1.6 There is the potential for road traffic exhaust emissions associated with vehicles travelling to and from the Site during the construction phase to impact on existing air quality at sensitive receptor locations. An assessment was therefore undertaken in accordance with the IAQM guidance 'Land-use Planning & Development Control: Planning for Air Quality'². This involved comparing the predicted change in vehicle flows on the local road network as a result of the Development with the following thresholds:

- A change of Light Duty Vehicle (LDV) flows of more than 100 Annual Average Daily Traffic (AADT) within or adjacent to an Air Quality Management Area (AQMA) or more than 500 AADT elsewhere, and;
- A change of Heavy Duty vehicle (HDV) flows of more than 25 AADT within or adjacent to an AQMA or more than 100 AADT elsewhere.

2.2 Completed Development

Road Vehicle Exhaust Emissions - Human Receptors

2.2.1 The Development has the potential to affect air quality as a result of road traffic exhaust emissions associated with vehicles travelling to and from the Site, as well as expose occupants to any existing air quality issues. Potential impacts have therefore been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling for the following scenarios:

- 2024 - Verification;
- Completion year Do-Minimum (DM) (predicted traffic flows in 2041 should the proposals not proceed); and,
- Completion year Do-Something (DS) (predicted traffic flows in 2041 should the proposals be completed).

2.2.2 Reference should be made to Section 4.0 for the input data and details of the verification process.

² Land-use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

2.2.3 Locations sensitive to potential changes in off-site pollutant concentrations were identified within 200m of the highway network in accordance with the guidance³ provided by National Highways on the likely limits of pollutant dispersion from road sources. The criteria provided within Department for Environment, Food and Rural Affairs (DEFRA) guidance⁴ on where the Air Quality Objectives (AQOs) apply was utilised to determine worst-case receptor positions in the vicinity of links likely to be affected by changes in traffic flows as a result of the development.

2.2.4 The sensitivity of receptors to potential changes in pollutant concentrations as a result of road vehicle exhaust emissions is outlined Table A11.3.1. It should be noted that these are based on the values provided within the IAQM guidance with additional descriptors to ensure consistency.

Table A11.3.1 Completed Development Receptor Sensitivity

Receptor Sensitivity	Descriptor - Pollutant Concentration at Receptor in Assessment year
Very High	110% or more of AQO/ Concentration Target
High	103 - 109% of AQO/ Concentration Target
Medium	95 - 102% of AQO/ Concentration Target
Low	76 - 94% of AQO/ Concentration Target
Negligible	75% or less of AQO/ Concentration Target

2.2.5 The magnitude of predicted air quality impacts was calculated based on the predicted concentration change between DM and DS scenarios as a proportion of the AQO. This is outlined in Table A11.3.2.

Table A11.3.2 Completed Development Magnitude of Impact

Predicted Concentration Change as a Proportion of AQO and Concentration Target (%)	Magnitude of Impact
0	Negligible
1	Low

³ LA 105: Air Quality, National Highways, 2024

⁴ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Predicted Concentration Change as a Proportion of AQO and Concentration Target (%)	Magnitude of Impact
2 - 5	Medium
6 - 10	High
More than 10	Very High

2.2.6 It should be noted that the categories in Table A11.3.2 are intended to be used by rounding the change in percentage pollutant concentration to whole numbers.

2.2.7 The significance of and operational phase road vehicle exhaust emissions effects was determined through the interaction between the magnitude of impact and sensitivity of the receptor, as outlined in Table A11.3.3.

Table A11.3.3 Completed Development Significance Effect Matrix

Sensitivity/ Value of Receptor	Magnitude of Impact				
	Very High	High	Medium	Low	Negligible
Very High	Major	Major	Major	Moderate	Negligible
High	Major	Major	Moderate	Moderate	Negligible
Medium	Major	Moderate	Moderate	Minor	Negligible
Low	Moderate	Moderate	Minor	Negligible	Negligible
Negligible	Moderate	Minor	Negligible	Negligible	Negligible

2.2.8 Following the prediction of impacts at discrete receptor locations, the IAQM⁵ document provides guidance on determining the overall air quality effect significance of the operation of a development. The following factors are identified for consideration by the assessor:

- The existing and future air quality in the absence of the Development;
- The extent of current and future population exposure to the impacts; and,
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

⁵ Land-Use Planning & Development Control: Planning for Air Quality, IAQM, 2017.

- 2.2.9 The IAQM guidance states that an assessment must reach a conclusion on the likely significance of the predicted impact. Where the overall effect is **moderate** or **major**, the effect is considered significant, whilst if the impact is **minor** or **negligible**, the impact is considered to be **not significant**.

Road Vehicle Exhaust Emissions - Ecological Receptors

- 2.2.10 The Development has the potential to impact on existing air quality at ecological receptors as a result of road traffic exhaust emissions associated with vehicles travelling to and from the Site during the completed development phase. These were assessed in accordance with 'Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations'⁶, which describes how competent authorities and others will assess plans and projects likely to generate road traffic emissions and subsequently affect international ecological designations. This provides a staged assessment methodology to provide consideration of potential air quality impacts from a development both alone and cumulatively with other developments.
- 2.2.11 Review of the staged assessment indicated that detailed dispersion modelling was required in order to quantify changes in pollutant concentrations at the identified receptor as a result of vehicles travelling to and from the Site. This was completed for a number of scenarios.

Potential Future Exposure

- 2.2.12 The Development has the potential to expose future occupants to poor air quality. Pollutant concentrations were therefore quantified across the Site using dispersion modelling. The results were subsequently compared with the relevant AQOs and Concentration Target to determine the potential for exceedence. Reference should be Section 4.0 for a full description of the assessment input data.

⁶ Natural England's approach to advising competent authorities on the assessment of road traffic emissions under the Habitats Regulations, Natural England, 2018.

3.0 BASELINE

3.1 Local Air Quality Management

- 3.1.1 As required by the Environment Act (1995), as amended by the Environment Act (2021), SADC has undertaken Review and Assessment of air quality within its area of jurisdiction. This process has indicated that annual mean concentrations of nitrogen dioxide (NO₂) and 24-hour mean concentrations of particulate matter with an aerodynamic diameter of less than 10µm (PM₁₀) are above the AQOs across the district. As such, one AQMA has been declared. This is described as follows:

"The area comprising of odd numbers 1-7 London Road, 1-11c Holywell Hill and even numbers London Road, St Albans."

- 3.1.2 The Development borders Dacorum Borough Council's (DBC's) administrative extents. DBC's Review and Assessment of air quality has indicated that annual mean NO₂ concentrations are above the relevant AQO. As such, two AQMAs have been declared. The closest of these to the Site is described as follows:

"AQMA Lawn Lane - An area encompassing a number of properties overlooking to Lawn Lane, and the boundary declared between Belswains Lane and Seaton Road."

- 3.1.3 The Site is located approximately 6.9km north-west of the SACDC AQMA and 4.8km north-east of the DBC AQMA. It is considered unlikely the Development would cause air quality impacts over distances of this magnitude. As such, the designations were not considered further in the context of the assessment.
- 3.1.4 SADC and DBC have concluded that concentrations of all other pollutants considered within the AQS are currently below the relevant AQOs. As such, no further AQMAs have been designated.

3.2 Local Air Quality Monitoring Data

- 3.2.1 Monitoring of pollutant concentrations has been undertaken by SADC and DBC throughout their areas of jurisdiction. Recent annual mean NO₂ results recorded in the

vicinity of the Site, as shown in SADC's 'Air Quality Annual Status Report (ASR) for 2024'⁷ and DBC's 'Air Quality ASR for 2025'⁸ are shown in Table A11.3.4. Exceedences of the AQO are shown in **bold**.

3.2.2 A three-month monitoring survey was also undertaken for the East Hemel Hempstead Development (Planning reference: 5/2024/2171) during 2024. A review of the monitoring report⁹ indicated a number of positions located within the vicinity of the Development. The results have therefore been included in Table A11.3.4. It should be noted that although the survey was undertaken during 2024, the results were annualised using 2022 calendar year data.

Table A11.3.4 Monitoring Results

Monitoring Location		Monitored NO ₂ Concentrations (µg/m ³)		
		2022	2023	2024
DB1	Queensway 1	45.6	45.8	39.1
DB2	Queensway 2	23.1	22.5	18.0
DB3	Queensway 3	28.5	25.6	20.5
DB4	Queensway 4 ^(a)	-	17.2	13.1
DB5	Queensway 5 ^(a)	-	22.6	18.2
DB6	Old Town High Street ^(a)	-	19.1	15.0
DB7	Old Town Background	13.7	11.9	10.8
DB8	Kylna Court	26.4	22.6	19.2
DB9	New Park Drive	16.0	13.5	11.1
DB10	St Albans Road 1 (formerly St Albans 2)	26.8	26.2	17.2
DB11	St Albans Road 2 (formerly St Albans 3)	25.1	22.3	16.8
DB12	Green Dell Way	16.3	15.8	11.8
DB65	Cotterrells ^(b)	27.3	25.6	19.0
DB66	Southhill Road Background ^(c)	13.1	13.2	10.3

⁷ 2024 Air Quality ASR, SADC, 2024.

⁸ 2025 Air Quality ASR, DBC, 2025.

⁹ East Hemel Air Quality Monitoring Report, The Crown Estate, 2024.

Monitoring Location		Monitored NO ₂ Concentrations (µg/m ³)		
		2022	2023	2024
DB67	Leighton Buzzard Road ^(d)	34.2	30.8	25.4
DB68	LB Road / Coombe Street ^(e)	36.5	31.1	24.9
MP1	Field (Eastern Site Boundary) ^(f)	17.20	-	-
MP2	Warwick Row ^(f)	9.85	-	-
MP3	Leverstock Green Way ^(f)	25.71	-	-
MP4	Green Lane (South) ^(f)	30.82	-	-
MP5	Green Lane / A414 Roundabout ^(f)	31.91	-	-
MP6	Green Lane (North) ^(f)	15.57	-	-
MP7	Cherry Tree Lane ^(f)	10.45	-	-
MP8	Hemel Hempstead Road ^(f)	22.22	-	-
SA107	Redbourn JMI Long Cutt ^(g)	15.8	13.5	-
SA142	Beech Tree Cottage (AL3 6AR) ^(g)	20.8	18.8	-
SA158	High Street ^(g)	17.8	15.0	-

Note: (a) Monitor commissioned in 2023.
 (b) Formerly DC1, data taken from 2023 ASR.
 (c) Formerly DC2, data taken from 2023 ASR.
 (d) Formerly DC3, data taken from 2023 ASR.
 (e) Formerly DC4, data taken from 2023 ASR.
 (f) Only data from 2022 available.
 (g) 2024 data not available.

3.2.3 As shown in Table A11.3.4, annual mean NO₂ concentrations were above the AQO of 40µg/m³ at monitor DB1 - Queensway 1 during 2022 and 2023. It is noted in the ASR that these exceedences were due to cooking practices from nearby businesses. Following DBC's consultation with the relevant premises, exceedences have been resolved and the NO₂ concentration was below the AQO during 2024. NO₂ concentrations at all other monitoring locations were below the relevant AQO in recent years.

3.2.4 SADC and DBC do not undertake monitoring of PM₁₀ or PM_{2.5} concentrations within the vicinity of the Site.

3.2.5 Reference should be made to Figure 11.3 in the Air Quality Chapter for a map of the survey positions.

3.3 **Background Concentrations**

3.3.1 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist local authorities in their Review and Assessment of air quality. The Site is located in a number of grid squares. Data for these locations were downloaded from the DEFRA website¹⁰ for the purpose of the assessment and are summarised in Table A11.3.5.

3.3.2 It should be noted that DEFRA has only released background data up to 2040. These have therefore been reviewed and considered for the completion year of 2041.

Table A11.3.5 Background Concentrations

NGR (m)	Predicted Background Pollutant Concentration (µg/m³)								
	2024			2025			2040		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
507500, 210500	8.91	12.66	7.30	8.61	12.56	7.21	5.90	11.52	6.27
508500, 209500	9.94	13.11	7.42	9.57	13.01	7.33	6.41	11.98	6.39
508500, 210500	9.19	13.50	7.33	8.85	13.40	7.24	5.98	12.37	6.31
508500, 211500	8.53	13.42	7.20	8.23	13.32	7.11	5.54	12.29	6.18
509500, 210500	12.03	15.59	7.73	11.33	15.50	7.64	6.36	14.51	6.72

3.3.3 As shown in Table A11.3.5, predicted background NO₂, PM₁₀ and PM_{2.5} concentrations are below the relevant AQOs and Concentration Target at the Site.

¹⁰ <http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2021>.

3.4 Sensitivity of Receptors

Construction

- 3.4.1 Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 250m from the Site boundary. These are summarised in Table A11.3.6. It should be noted that construction phase sensitive receptors included those from the wider Hemel Gardens Community area and the Development to provide a robust assessment.

Table A11.3.6 Construction Phase - Earthworks and Construction Sensitive Receptors

Distance from the Site Boundary (m)	Approximate Number of Human Receptors
Up to 20	More than 100
Up to 50	More than 100
Up to 100	More than 100
Up to 250	More than 100

- 3.4.2 Receptors sensitive to potential dust impacts from trackout were identified from a desk-top study of the area up to 50m from the road network within 250m of the Site access. These are summarised in Table A11.3.7.

Table A11.3.7 Construction Phase - Trackout Sensitive Receptors

Distance from the Site Access Route (m)	Approximate Number of Human Receptors
Up to 20	More than 100
Up to 50	More than 100

- 3.4.3 Based on the sensitivity criteria in IAQM guidance¹¹, the sensitivity of the receiving environment to potential dust soiling and health impacts is classified as **high**. This was because identified receptors included residential properties, Brockwood Primary School and future users of the Development.

¹¹ Guidance on the Assessment of Dust from Demolition and Construction V2.2, IAQM, 2024.

3.4.4 There are no statutory designated ecological receptors within 50m of the Site boundary or the access route within 250m of the Site entrance. As such, impacts on ecological receptors as a result of fugitive dust emissions during construction have not been considered further.

3.4.5 It should be noted that following correspondence with the Project Ecologist, it was outlined that Ancient Woodlands have been scoped out of the Ecology Chapter due to the intervening distances from the Site. It was also determined that Local Wildlife Sites are not required to be assessed from an Air Quality perspective. As such, Ancient Woodlands and Local Wildlife Sites within 250m of the Site boundary or within 50m of the construction vehicle route up to 250m from the Site entrance have not been considered within the assessment.

Completed Development

Human Receptors

3.4.6 Receptors sensitive to potential operational phase road vehicle exhaust emissions were identified from a desk top study and are summarised in Table A11.3.8. Heights were selected based on the location of residential units to allow for less sensitive land uses, such as retail, at ground level, as well differences in road elevation compared to receptor positions.

Table A11.3.8 Operational Phase Road Vehicle Exhaust Emission Sensitive Human Receptor Locations

Receptor		NGR (m)		Height (m)
		X	Y	
R1	Residential - Hemel Hempstead Road	509951.5	211372.2	1.5
R2	Residential - Hemel Hempstead Road	509474.3	210811.6	1.5
R3	Hemel Hempstead Road Caravan Park	509073.1	210463.0	1.5
R4	Residential - Proposed Development 1	509038.9	210420.3	1.5
R5	Residential - Proposed Development 2	508941.6	210288.0	1.5
R6	Residential - Proposed Development 3	508836.1	210193.5	1.5
R7	Residential - Proposed Development 4	508633.8	210088.0	1.5

Receptor		NGR (m)		Height (m)
		X	Y	
R8	Residential - Proposed Development 5	508408.3	209975.9	1.5
R9	Residential East Hemel Development 1	508680.0	210065.7	1.5
R10	Residential East Hemel Development 2	508597.9	210020.8	1.5
R11	Residential East Hemel Development 3	508452.1	209945.5	1.5
R12	Residential East Hemel Development 4	508916.5	209733.1	1.5
R13	Residential East Hemel Development 5	509034.9	209621.2	1.5
R14	Residential East Hemel Development 6	509124.4	209410.0	1.5
R15	Residential East Hemel Development 7	508984.9	209213.5	1.5
R16	East Hemel Primary School	508939.2	209144.1	1.5
R17	Residential - Holtsmere End Lane	508365.0	209932.4	1.5
R18	Residential - Redbourn Road	508194.9	209750.9	1.5
R19	Residential - Redbourn Road	507622.9	209555.7	1.5
R20	Residential - Redbourn Road	507570.8	209438.7	1.5
R21	Residential - Redbourn Road	507182.2	209212.2	1.5
R22	Residential - St Agnells Lane	507135.6	209196.7	1.5
R23	Mapel Grove Primary School	507061.1	209634.2	1.5
R24	The Astley Cooper School	507147.6	209682.7	1.5
R25	Aspire Academys Trust	506686.9	208974.6	1.5
R26	Residential - A4147 Redbourn Road	506545.3	208941.3	1.5
R27	Residential - A4147 Redbourn Road	506164.1	208848.9	1.5
R28	Residential - Pittcotts End Road	505324.8	208688.2	1.5
R29	Residential - Pittcotts End Road	504878.5	209389.4	1.5
R30	Residential - Leighton Buzzard Road	504993.1	209167.4	1.5
R31	Residential - Leighton Buzzard Road	505076.1	208604.5	1.5
R32	Residential - Warners End Road	505281.9	207618.2	1.5
R33	The Collett School	504985.0	207610.2	1.5
R34	Gade Valley Primary School	504930.9	207633.2	1.5

Receptor		NGR (m)		Height (m)
		X	Y	
R35	Laureate Academy	504758.0	207556.6	1.5
R36	West Herts College	505342.4	207536.4	1.5
R37	Residential - Leighton Buzzard Road	505330.7	207188.9	1.5
R38	Residential - Leighton Buzzard Road	505333.6	206924.5	1.5
R39	Residential - Leighton Buzzard Road	505337.2	206685.7	1.5
R40	Residential - Leighton Buzzard Road	505422.2	206394.3	1.5
R41	Residential - Leighton Buzzard Road	505372.1	207237.5	1.5
R42	Residential - Station Road	505430.7	206376.1	4.5
R43	Residential - St Albans Road	505549.2	206438.4	1.5
R44	Residential - St Albans Road	505883.4	206591.2	1.5
R45	Residential - St Albans Road	506311.7	206804.5	1.5
R46	Assisted Living Mountbatten Lodge	506380.0	206751.2	1.5
R47	Residential - St Albans Road	506670.7	206845.7	1.5
R48	Residential - St Albans Road	507061.6	206744.4	1.5
R49	Residential - St Albans Road	507993.3	207207.7	1.5
R50	Residential - Leverstock Green Way	508109.9	207241.4	1.5
R51	Residential East Hemel Development 8	508222.0	206719.1	1.5
R52	Residential East Hemel Development 9	509114.5	207566.4	1.5
R53	Residential East Hemel Development 10	508966.0	207508.8	1.5
R54	Residential East Hemel Development 11	509441.0	207232.3	1.5
R55	Residential East Hemel Development 12	509097.8	207175.9	1.5
R56	Residential East Hemel Development 13	509687.	206856.7	1.5
R57	Residential East Hemel Development 14	509518.5	206630.7	1.5
R58	Residential East Hemel Development 15	509934.2	206417.3	1.5
R59	East Hemel Primary School	509687.7	206333.5	1.5
R60	Residential - Adjacent to M1	509285.6	207781.9	1.5
R61	Residential - Punch Bowl Lane	508905.2	209040.8	1.5

Receptor		NGR (m)		Height (m)
		X	Y	
R62	Residential - Cherry Tree Lane	508513.1	209462.4	1.5
R63	Residential - Karina Court	508302.9	208955.5	1.5
R64	Residential - Swallowdale Lane	507630.2	209469.4	1.5
R65	Residential - Maylands Avenue	507844.7	208003.0	4.5
R66	Residential - Hawk Court	507230.3	208614.0	1.5
R67	Residential - Queensway	507123.7	208535.5	1.5
R68	Residential - Queensway	506923.7	208319.9	1.5
R69	Squirrels Nurseries	506776.9	208347.2	1.5
R70	Residential - Queensway	506664.8	208130.6	1.5
R71	Residential - Queensway	506169.0	207857.2	1.5
R72	George Street Primary School	505808.8	207814.5	1.5
R73	Residential - Queensway	505537.7	207663.4	4.5
R74	West Herts College	505457.7	207589.6	1.5

Ecological Receptors

3.4.7 A receptor sensitive to potential operational phase road vehicle exhaust emissions was identified from a desk top study and is summarised below:

- Howe Grove Wood Local Nature Reserve (LNR).

3.4.8 Howe Grove Wood LNR is located within 200m of a road link subject to changes in traffic flow as a result of the Development and have therefore been included within the completed development assessment. No other designations were identified with 200m of the affected road network.

3.4.9 Reference should be made to Figure 11.4 in the Air Quality Chapter for a map showing the locations of the human and ecological receptors.

3.4.10 In order to identify whether the designation is sensitive to air pollution, critical loads and levels for the qualifying features were obtained from the Air Pollution Information System (APIS) website¹². The critical loads for nitrogen deposition are presented in Table A11.3.9.

Table A11.3.9 Critical Loads for Nitrogen Deposition

Interest Feature	Nitrogen Critical Load Class	Nitrogen Critical Load (kgN/ha/yr)	
		Low	High
Broadleaved, Mixed and Yew Woodland	Broadleaved Deciduous Forest	10	15

3.4.11 The critical levels for oxides of nitrogen (NO_x) and ammonia (NH₃) are presented in Table A11.3.10.

Table A11.3.10 Critical Levels for NO_x and NH₃

Interest Feature	Annual Mean Critical Level (µg/m ³)	
	NO _x	NH ₃
Broadleaved, Mixed and Yew Woodland	30	1

3.4.12 As shown in Table A11.3.9 and Table A11.3.10, Howe Grove Wood LNR contains features sensitive to changes in atmospheric pollution levels. Discrete receptor locations were therefore defined to represent the location of sensitive qualifying features based on the habitat survey information available from MAGIC¹³. The discrete receptors are summarised in Table A11.3.11.

Table A11.3.11 Operational Phase Road Vehicle Exhaust Emission Sensitive Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
E1	Howe Grove Wood LNR	506233.2	208786.4
E2	Howe Grove Wood LNR	506199.6	208802.6
E3	Howe Grove Wood LNR	506152.1	208790.1

¹² <https://www.apis.ac.uk/src1>

¹³ https://magic.defra.gov.uk/Magic_redirect.htm?aspxerrorpath=/MagicMap.aspx

Receptor		NGR (m)	
		X	Y
E4	Howe Grove Wood LNR	506128.0	208782.2
E5	Howe Grove Wood LNR	506105.0	208833.8
E6	Howe Grove Wood LNR	506072.2	208822.1
E7	Howe Grove Wood LNR	506002.2	208805.7
E8	Howe Grove Wood LNR	505867.8	208772.7
E9	Howe Grove Wood LNR	505824.4	208762.4
E10	Howe Grove Wood LNR	505757.4	208744.1
E11	Howe Grove Wood LNR	505729.0	208734.1
E12	Howe Grove Wood LNR	505697.3	208673.0
E13	Howe Grove Wood LNR	505655.9	208664.3

3.4.13 The critical loads and levels identified in Table A11.3.9 and Table A11.3.10 were applied to all receptors identified in Table A11.3.11.

4.0 DISPERSION MODEL

4.1.1 Dispersion modelling was undertaken using the ADMS-Roads dispersion model (version 5.1.0.2). ADMS-Roads is developed by Cambridge Environmental Research Consultants (CERC) and is routinely used throughout the world for the prediction of pollutant dispersion from road sources. Modelling predictions from this software package are accepted within the UK by the Environment Agency and DEFRA.

4.1.2 The model requires input data that details the following parameters:

- Assessment area;
- Traffic flow data;
- Vehicle emission factors;
- Spatial co-ordinates of emissions;
- Street width;
- Meteorological data;
- Roughness length (z_0); and,
- Monin-Obukhov length.

4.1.3 Additional options can also be selected within the ADMS-Roads user interface in order to take account of site specific characteristics that may affect model outputs, such as canyons.

4.1.4 The relevant inputs are detailed in the following Sections.

4.2 Assessment Area

4.2.1 The assessment area was defined based on the Site location and anticipated vehicle trip distribution from the Development. Ambient concentrations were predicted over National Grid Reference (NGR): 504720, 206120 to 510030, 211640. One Cartesian grid was used within the model to produce data suitable for contour plotting using the Surfer software package. Reference should be made to Figure 11.1 in the Air Quality Chapter for a map of the assessment extents.

4.2.2 Receptors sensitive to potential changes in pollutant concentrations were included in the assessment as outlined in the Air Quality Chapter. Reference should be made to Figure 11.4 for a map of the receptor locations.

4.3 Traffic Flow Data

- 4.3.1 Traffic data for use in the assessment, including 24-hour AADT flows and fleet composition as HDV proportion, was provided by i-Transport, the Transport Consultants for the project.
- 4.3.2 A summary of the traffic flow data is provided in Table A11.3.12.
- 4.3.3 It should be noted that an updated road layout is proposed as part of the Development and the East Hemel Hempstead Development located to the south of the Site (Planning reference: 5/2024/2171). As such, additional links were included within the DM and DS scenarios.

Table A11.3.12 Traffic Data

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L1	B487 East of Site	17,133	22,821	24,213	2.12	1.71	1.52
L2	B487 West of Site	17,133	22,821	24,213	2.12	1.71	1.52
L3	Holtsmere End Lane Slow Phase (SP)	168	-	-	5.90	-	-
L4	Holtsmere End Lane	168	-	-	5.90	-	-
L5	B487 Redbourn Road, West of Holtsmere End Lane	23,264	29,036	30,475	1.99	1.74	1.56
L6	B487 Redbourn Road SP, Between Shenley Road	23,264	29,036	30,475	1.99	1.74	1.56
L7	B487 Redbourn Road, West of Shenley Road	23,264	29,036	30,475	1.99	1.74	1.56
L8	B487 Redbourn Road SP, East of Swallowdale Lane Roundabout	23,264	29,036	30,475	1.99	1.74	1.56
L9	B487 Redbourn Road SP, West of Swallowdale Lane Roundabout	26,433	31,622	32,724	1.93	1.78	1.63
L10	B487 Redbourn Road, West of Swallowdale Lane Roundabout	26,433	31,622	32,724	1.93	1.78	1.63
L11	B487 Redbourn Road SP, East of Redbourn Road Roundabout	26,433	31,622	32,724	1.93	1.78	1.63

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L12	St Agnells Lane SP	8,936	8,678	8,753	5.00	5.53	5.37
L13	St Agnells Lane	8,936	8,678	8,753	5.00	5.53	5.37
L14	A4147 SP, West of Redbourn Road Roundabout	22,621	25,129	25,292	2.82	2.21	2.17
L15	A4147, West of Redbourn Road Roundabout	22,621	25,129	25,292	2.82	2.21	2.17
L16	A4147 SP, East of Aycliffe Drive Roundabout	22,621	25,129	25,292	2.82	2.21	2.17
L17	A4147 SP, West of Aycliffe Drive Roundabout	24,760	25,936	26,102	2.41	2.02	2.02
L18	A4147, West of Aycliffe Drive Roundabout	24,760	25,936	26,102	2.41	2.02	2.02
L19	Piccotts End Road, North of Roundabout	493	457	494	3.77	3.79	3.76
L19a	Piccotts End Road, South of Roundabout	4,032	4,167	4,041	2.24	2.73	2.48
L20	A4147 Link Road	24,760	25,936	26,102	2.41	2.02	2.02
L21	Leighton Buzzard Road	20,448	21,736	21,711	3.84	4.04	3.97
L22	Galley Hill	14,268	14,627	14,700	2.16	2.24	2.19
L23	A4146 Leighton Buzzard Road	19,027	22,170	22,220	2.30	2.46	2.31
L24	A4146 Leighton Buzzard Road SP	19,027	22,170	22,220	2.30	2.46	2.31
L25	Warners End Road SP	18,395	21,145	21,239	1.49	1.32	1.34
L26	Warners End Road	18,395	21,145	21,239	1.49	1.32	1.34
L27	Warners End Road SP, Between Gadebridge Road	18,395	21,145	21,239	1.49	1.32	1.34
L28	Warners End Road, West of Gadebridge Road	18,395	21,145	21,108	1.49	1.32	1.38
L29	Leighton Buzzard Road SP, South of Roundabout	22,950	29,145	29,323	3.47	3.58	3.43
L30	Leighton Buzzard Road, South of Roundabout	22,950	29,145	29,323	3.47	3.58	3.43

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L31	Leighton Buzzard Road SP, North of Combe Street	22,950	29,145	29,323	3.47	3.58	3.43
L32	Leighton Buzzard Road SP, South of Combe Street	29,250	32,084	32,373	2.91	3.04	2.97
L33	Leighton Buzzard Road, South of Combe Street	29,250	32,084	32,373	2.91	3.04	2.97
L34	A4146 Slow Southbound (SB), Towards Station Road Roundabout	14,625	16,042	16,187	2.91	3.04	2.97
L35	A4146 Slow Northbound (NB), Towards Station Road Roundabout	14,625	16,042	16,187	2.91	3.04	2.97
L36	Station Road Westbound (WB)	12,365	11,833	11,927	4.86	5.26	5.13
L37	Station Road Eastbound (EB)	12,365	11,833	11,927	4.86	5.26	5.13
L38	Station Road EB SP	12,365	11,833	11,927	4.86	5.26	5.13
L39	Station Road	24,729	23,666	23,853	4.86	5.26	5.13
L40	A414 South of Roundabout	27,504	33,234	33,568	3.81	3.26	3.18
L41	A414 EB, East of Station Road Roundabout	18,013	21,394	21,484	3.36	3.34	3.12
L42	A414 EB SP, West of Jarman Road Roundabout	9,007	10,697	10,742	3.36	3.34	3.12
L43	A414 WB SP, East of Station Road Roundabout	18,013	21,394	21,484	3.36	3.34	3.12
L44	A414 WB, East of Station Road Roundabout	18,013	21,394	21,484	3.36	3.34	3.12
L45	Jarman Way Roundabout Slip	9,007	10,697	10,742	3.36	3.34	3.12
L46	A414 EB, East of Jarman Way Roundabout	9,534	11,903	11,938	3.70	3.36	3.15
L47	A414 SP, WB, East of Jarman Way Roundabout	19,067	23,807	23,875	3.70	3.36	3.15
L48	A414 EB, East of Jarman Way Roundabout Slip	19,067	23,807	23,875	3.70	3.36	3.15
L49	A414 EB SP, West of White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L50	A414 WB, West of White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15
L51	A414 EB, East of White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15
L52	A414 WB SP, East of White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15
L53	A414 WB, East of White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15
L54	Leverstock Green Way SP	11,150	12,414	12,435	2.43	2.58	2.63
L55	Leverstock Green Way	22,301	24,828	24,871	2.43	2.58	2.63
L56	Leverstock Green Way Roundabout Slip	11,150	12,414	12,435	2.43	2.58	2.63
L57	A414 EB, East of Leverstock Green Way Roundabout	15,967	24,717	25,031	6.79	4.73	4.70
L58	A414 WB SP, East of Leverstock Green Way Roundabout	15,967	24,717	25,031	6.79	4.73	4.70
L59	A414 WB, East of Leverstock Green Way Roundabout	15,967	24,717	25,031	6.79	4.73	4.70
L60	Breakspear Way EB	28,928	36,061	36,675	5.40	6.56	6.46
L61	Breakspear Way WB SP	28,928	36,061	36,675	5.40	6.56	6.46
L62	Breakspear Way WB	28,928	36,061	36,675	5.40	6.56	6.46
L63	Breakspear Way EB, Slip onto A414	9,877	11,476	11,406	5.12	7.14	7.16
L64	A414 NB Slip onto M1	15,531	17,583	17,509	7.87	9.02	9.04
L65	M1 NB	86,429	94,349	94,318	12.94	13.32	13.34
L65a	M1 NB, Between B487	86,429	94,349	94,318	12.94	13.32	13.34
L65b	M1 NB, North of B487	86,429	94,349	94,318	12.94	13.32	13.34
L66	M1 SB	86,429	94,349	94,318	12.94	13.32	13.34
L66a	M1 SB, Between B487	86,429	94,349	94,318	12.94	13.32	13.34
L66b	M1 SB, South of B487	86,429	94,349	94,318	12.94	13.32	13.34
L67	A414 Slip Road off M1 SB	16,356	18,092	18,063	8.35	9.59	9.63

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L68	A414 SB	22,936	29,495	30,329	5.30	5.99	5.94
L69	Breakspear Way Slip onto A414 SB	16,308	22,259	23,088	3.97	5.13	5.05
L70	Breakspear Way Slip Off A414 NB	22,016	27,607	28,245	5.22	5.96	5.87
L71	M1 NB, North of Westwick Row	70,572	76,638	76,631	14.04	14.25	14.27
L72	M1 SB, North of Westwick Row	70,572	76,638	76,631	14.04	14.25	14.27
L73	A414 NB	27,716	33,743	34,369	6.75	7.16	7.05
L74	Redbourn Road SP, South of Redbourn Road Roundabout	22,217	30,063	31,207	4.73	3.55	3.37
L75	Redbourn Road, South of Redbourn Road Roundabout	22,217	30,063	31,207	4.73	3.55	3.37
L76	Redbourn Road SP, North of A4147 Roundabout	22,217	30,063	31,207	4.73	3.55	3.37
L77	B487 SP	18,235	22,021	22,455	4.59	4.27	4.13
L78	B487 Queensway	18,235	22,021	22,455	4.59	4.27	4.13
L79	B487 SP, West of Alexandra Road	18,235	22,021	22,455	4.59	4.27	4.13
L79a	B487 Queensway SP, West of Alexandra Road	18,235	22,021	22,455	4.59	4.27	4.13
L80	B487 Queensway, West of Alexandra Road	18,235	22,021	22,455	4.59	4.27	4.13
L81	A4147 SP, East of Redbourn Road	23,791	26,370	27,186	5.18	4.84	4.69
L82	A4147, East of Redbourn Road	23,791	26,370	27,186	5.18	4.84	4.69
L83	Maylands Avenue	22,687	27,662	28,520	7.75	7.03	6.84
L84	Maylands Avenue Canyon SP	22,687	27,662	28,520	7.75	7.03	6.84
L85	Maylands Avenue, North of Leverstock Green Way Roundabout	22,687	27,662	28,505	7.75	7.03	7.03
L86	Swallowdale Lane	10,301	11,151	11,317	4.54	5.78	5.46
L87	Three Cherry Lane	5,845	1,908	1,817	2.20	0.32	0.27
L88	Hogg End Lane SP	196	-	-	17.05	0.00	0.00
L89	Hogg End Lane	196	-	-	17.05	0.00	0.00

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
L90	Cherry Tree Lane	1,678	-	-	0.00	0.00	0.00
L91	Cherry Tree Lane SP	1,678	-	-	0.00	0.00	0.00
L92	Punch Bowl Lane	198	-	-	11.22	0.00	0.00
L93	Green Lane SP	5,823	414	404	2.25	11.35	14.40
L94	Green Lane	5,823	414	404	2.25	11.35	14.40
L95	Green Lane South of Boundary Way	21,516	30,455	31,452	5.83	8.19	7.95
L96	Hempstead Road, West of New Roundabout	-	22,821	24,213	-	1.71	1.52
L97	Hempstead Road, East of New Roundabout	-	22,821	24,213	-	1.71	1.52
L98	East Hemel Link, South of Hemel Hempstead Road	-	2,028	3,008	-	1.22	0.99
L99	East Hemel Link, South of Punch Bowl Road	-	3,143	4,202	-	4.41	3.59
L100	East Hemel Link, North of Boundary Way	-	4,967	5,840	-	2.91	2.59
L101	East Hemel Link, South of Green Lane	-	2,298	2,342	-	1.40	2.06
R1	Swallowdale Lane Roundabout	19,999	23,936	24,838	2.40	2.39	2.18
R2	Redbourn Road Roundabout	20,052	23,873	24,494	3.30	2.79	2.66
R3	Aycliffe Drive Roundabout	23,690	25,532	25,697	2.61	2.11	2.09
R4	Piccotts End Road Roundabout	13,511	14,124	14,185	2.41	2.09	2.07
R5	Leighton Buzzard Road Roundabout	19,626	21,117	21,183	2.71	2.69	2.62
R6	Bury Hill Roundabout	19,652	23,620	23,809	2.98	2.97	2.87
R7	Combe Street Roundabout	26,100	30,615	30,848	3.16	3.29	3.19
R8	Station Road Roundabout	16,787	18,825	18,966	3.67	3.59	3.46
R9	Jarman Way Roundabout	13,905	16,950	17,010	3.53	3.35	3.14
R10	White Hart Road Roundabout	19,067	23,807	23,875	3.70	3.36	3.15

Link		24-hour AADT Flow			HDV Prop. of Fleet (%)		
		2024 Verif	2041 DM	2041 DS	2024 Verif	2041 DM	2041 DS
R11	Leverstock Green Way Roundabout	17,318	22,854	23,125	5.40	4.52	4.46
R12	Green Lane Roundabout	22,261	25,718	26,201	5.88	6.22	6.13
R13	A4147 Roundabout	21,414	26,151	26,949	4.86	4.18	4.02
R14	Eastman Way Roundabout	18,926	21,728	22,341	6.09	5.93	5.73
R15	Hogg End Lane Roundabout	3,955	1,366	1,606	2.47	3.51	3.33
R16	Boundary Way Roundabout	13,670	15,435	15,928	5.07	8.23	8.03
R17	New Hemel Hempstead Road Roundabout	-	15,890	17,145	-	1.69	1.49

4.3.4 Reference should be made to Figure 11.1 for a graphical representation of the road link locations in the DM and DS scenarios and Figure 11.2 for a graphical representation of the verification scenario.

4.3.5 Road parameters for input into the model were based on the following:

- Road widths were estimated from aerial photography and UK highway design standards;
- Vehicle speeds were estimated as an average for the relevant road link over the course of a 24-hour period;
- Vehicle speeds were determined following review of speed limits within the study extents, as well as congestion data available from GoogleMaps;
- Vehicle speeds specific to slow phases were determined using the methodology outlined in the DEFRA guidance¹⁴;
- Necessary adjustments to slow phase vehicle speeds were based upon congestion data available from GoogleMaps; and,
- The length for slow phases were derived using the approaching distance of 25m outlined in the DEFRA guidance¹⁵ and adjusted accordingly based on aerial photography and congestion data available from GoogleMaps.

¹⁴ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

¹⁵ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

4.3.6 A summary of the link parameters is provided in Table A11.3.13.

Table A11.3.13 Road Parameters

Link		Road Width (m)	Average Vehicle Speed (km/h)
L1	B487 East of Site	6.2	95
L2	B487 West of Site	6.8	95
L3	Holtsmere End Lane SP	6.4	20
L4	Holtsmere End Lane	5.0	60
L5	B487 Redbourn Road, West of Holtsmere End Lane	6.8	60
L6	B487 Redbourn Road SP, Between Shenley Road	10.0	20
L7	B487 Redbourn Road, West of Shenley Road	7.5	60
L8	B487 Redbourn Road SP, East of Swallowdale Lane Roundabout	11.9	20
L9	B487 Redbourn Road SP, West of Swallowdale Lane Roundabout	10.8	20
L10	B487 Redbourn Road, West of Swallowdale Lane Roundabout	7.5	80
L11	B487 Redbourn Road SP, East of Redbourn Road Roundabout	11.1	20
L12	St Agnells Lane SP	8.0	20
L13	St Agnells Lane	7.9	45
L14	A4147 SP, West of Redbourn Road Roundabout	11.8	20
L15	A4147, West of Redbourn Road Roundabout	7.4	60
L16	A4147 SP, East of Aycliffe Drive Roundabout	14.0	20
L17	A4147 SP, West of Aycliffe Drive Roundabout	12.8	20
L18	A4147, West of Aycliffe Drive Roundabout	7.5	80
L19	Piccotts End Road, North of Roundabout	6.6	45
L19a	Piccotts End Road, South of Roundabout	6.6	45
L20	A4147 Link Road	6.6	80

Link		Road Width (m)	Average Vehicle Speed (km/h)
L21	Leighton Buzzard Road	8.1	95
L22	Galley Hill	6.8	45
L23	A4146 Leighton Buzzard Road	7.0	80
L24	A4146 Leighton Buzzard Road SP	14.2	20
L25	Warners End Road SP	12.2	20
L26	Warners End Road	8.1	45
L27	Warners End Road SP, Between Gadebridge Road	6.7	20
L28	Warners End Road, West of Gadebridge Road	6.7	45
L29	Leighton Buzzard Road SP, South of Roundabout	17.0	20
L30	Leighton Buzzard Road, South of Roundabout	7.4	45
L31	Leighton Buzzard Road SP, North of Combe Street	12.0	20
L32	Leighton Buzzard Road SP, South of Combe Street	11.6	20
L33	Leighton Buzzard Road, South of Combe Street	7.1	45
L34	A4146 Slow SB, Towards Station Road Roundabout	9.9	30
L35	A4146 Slow NB, Towards Station Road Roundabout	9.9	30
L36	Station Road WB	6.7	45
L37	Station Road EB	7.0	45
L38	Station Road EB SP	6.4	20
L39	Station Road	7.8	45
L40	A414 South of Roundabout	9.1	45
L41	A414 EB, East of Station Road Roundabout	7.3	60
L42	A414 EB SP, West of Jarman Road Roundabout	6.9	20
L43	A414 WB SP, East of Station Road Roundabout	11.2	20
L44	A414 WB, East of Station Road Roundabout	7.5	60
L45	Jarman Way Roundabout Slip	4.0	60
L46	A414 EB, East of Jarman Way Roundabout	4.8	60

Link		Road Width (m)	Average Vehicle Speed (km/h)
L47	A414 SP, WB, East of Jarman Way Roundabout	10.1	20
L48	A414 EB, East of Jarman Way Roundabout Slip	7.4	60
L49	A414 EB SP, West of White Hart Road Roundabout	9.8	20
L50	A414 WB, West of White Hart Road Roundabout	6.8	60
L51	A414 EB, East of White Hart Road Roundabout	9.0	60
L52	A414 WB SP, East of White Hart Road Roundabout	8.7	20
L53	A414 WB, East of White Hart Road Roundabout	7.8	60
L54	Leverstock Green Way SP	14.4	20
L55	Leverstock Green Way	7.2	45
L56	Leverstock Green Way Roundabout Slip	3.7	45
L57	A414 EB, East of Leverstock Green Way Roundabout	10.5	80
L58	A414 WB SP, East of Leverstock Green Way Roundabout	7.6	20
L59	A414 WB, East of Leverstock Green Way Roundabout	6.5	80
L60	Breakspear Way EB	7.9	80
L61	Breakspear Way WB SP	11.6	20
L62	Breakspear Way WB	7.1	80
L63	Breakspear Way EB, Slip onto A414	4.1	80
L64	A414 NB Slip onto M1	7.4	100
L65	M1 NB	14.2	100
L65a	M1 NB, Between B487	14.2	100
L65b	M1 NB, North of B487	14.2	100
L66	M1 SB	13.9	100
L66a	M1 SB, Between B487	13.9	100
L66b	M1 SB, South of B487	13.9	100
L67	A414 Slip Road off M1 SB	7.5	100
L68	A414 SB	6.7	100

Link		Road Width (m)	Average Vehicle Speed (km/h)
L69	Breakspear Way Slip onto A414 SB	7.0	60
L70	Breakspear Way Slip Off A414 NB	11.0	60
L71	M1 NB, North of Westwick Row	15.1	100
L72	M1 SB, North of Westwick Row	14.5	100
L73	A414 NB	4.1	100
L74	Redbourn Road SP, South of Redbourn Road Roundabout	11.5	20
L75	Redbourn Road, South of Redbourn Road Roundabout	7.3	60
L76	Redbourn Road SP, North of A4147 Roundabout	10.0	20
L77	B487 SP	18.3	20
L78	B487 Queensway	11.0	60
L79	B487 SP, West of Alexandra Road	6.0	20
L79a	B487 Queensway SP, West of Alexandra Road	9.7	20
L80	B487 Queensway, West of Alexandra Road	7.9	45
L81	A4147 SP, East of Redbourn Road	18.9	20
L82	A4147, East of Redbourn Road	13.1	45
L83	Maylands Avenue	10.0	45
L84	Maylands Avenue Canyon SP	8.8	20
L85	Maylands Avenue, North of Leverstock Green Way Roundabout	10.0	45
L86	Swallowdale Lane	6.2	45
L87	Three Cherry Lane	6.9	45
L88	Hogg End Lane SP	8.0	20
L89	Hogg End Lane	5.3	45
L90	Cherry Tree Lane	4.0	45
L91	Cherry Tree Lane SP	6.8	20
L92	Punch Bowl Lane	3.0	45
L93	Green Lane SP	9.1	20

Link		Road Width (m)	Average Vehicle Speed (km/h)
L94	Green Lane	6.3	95
L95	Green Lane South of Boundary Way	8.0	80
L96	Hempstead Road, West of New Roundabout	6.3	20
L97	Hempstead Road, East of New Roundabout	6.3	20
L98	East Hemel Link, South of Hemel Hempstead Road	6.3	30
L99	East Hemel Link, South of Punch Bowl Road	6.3	30
L100	East Hemel Link, North of Boundary Way	6.3	30
L101	East Hemel Link, South of Green Lane	6.3	30
R1	Swallowdale Lane Roundabout	8.1	20
R2	Redbourn Road Roundabout	8.0	20
R3	Aycliffe Drive Roundabout	7.3	20
R4	Piccotts End Road Roundabout	7.2	20
R5	Leighton Buzzard Road Roundabout	8.1	20
R6	Bury Hill Roundabout	9.5	20
R7	Combe Street Roundabout	11.1	20
R8	Station Road Roundabout	11.6	20
R9	Jarman Way Roundabout	12.7	20
R10	White Hart Road Roundabout	7.9	20
R11	Leverstock Green Way Roundabout	8.6	20
R12	Green Lane Roundabout	8.5	20
R13	A4147 Roundabout	8.9	20
R14	Eastman Way Roundabout	11.2	20
R15	Hogg End Lane Roundabout	8.4	20
R16	Boundary Way Roundabout	10.1	20
R17	New Hemel Hempstead Road Roundabout	8.0	20

- 4.3.7 A number of roads included within the model are raised above ground level. The relevant links and associated elevation included within the assessment are shown in Table A11.3.14.

Table A11.3.14 Elevated Road Links

Link		Height Above Ground (m)
L65a	M1 NB, Between B487	7.0
L66a	M1 SB, Between B487	7.0

- 4.3.8 The Cartesian grid applied in the model was run at a height of 1.5m to replicate pollutant concentrations at the average breathing height of human receptors. In areas with elevated road links, missing sections may be visible in the contour plots due to the height difference between the road surface and the modelled plane.

4.4 Canyons

- 4.4.1 Where buildings or walls surround roads, pollutant dispersion patterns are altered which can lead to high pollutant concentrations. These street canyons can significantly influence air quality along a road and therefore it is important to take consideration of their effects when undertaking dispersion modelling.
- 4.4.2 The release of ADMS-Roads version 4.0.1.0 in December 2015 incorporated a number of new features including an advanced street canyon module, which have been retained in version 5.1.0.2. Advanced street canyon modelling allows a number of parameters to be included in the dispersion model in order to predict pollutant dispersion patterns which better reflect air flow within complex urban geometries.
- 4.4.3 Canyons have five principal effects on dispersion which can influence pollutant concentrations. These are:
- Pollutants are channelled along street canyons;
 - Pollutants are dispersed across street canyons by circulating flow at road height;
 - Pollutants are trapped in recirculation regions;
 - Pollutants leave the canyon through gaps between buildings as if there was no canyon; and,
 - Pollutants leave the canyon from the canyon top.

- 4.4.4 The combined modelling of these effects will result in concentration patterns unique to each canyon. The parameters used in the assessment are outlined in Table A11.3.15. It should be noted that where buildings are only present on one side of L84, canyon parameters were purposefully included at 0m.

Table A11.3.15 Canyon Parameters

Link	Parameter (m)					
	Canyon Width to Left	Average Height of Buildings to Left	Building Length Left	Canyon Width Right	Average Height of Buildings to Right	Building Length Right
L84	0	0	0	13.1	18.5	47.7

- 4.4.5 A choice of two modes is provided for use in the advanced canyon module. Standard mode assumes that each road is part of a continuous network of roads with similar properties. Network mode analyses the road network to determine transport of pollutants between adjoining street canyons, allows for varying concentrations along the canyon and accounts for transport of pollutants out of the end of a canyon. Network mode is considered most accurate for detailed local analysis and as such was selected for use in the model.

4.5 Emission Factors

- 4.5.1 The emission factors were calculated using the relevant traffic flows and the Emissions Factor Toolkit (version 13.1). This has been produced by DEFRA and incorporates COPERT 5.8 vehicle emission factors and fleet information.
- 4.5.2 There is current uncertainty over NO₂ concentrations within the UK, with the implementation of new vehicle emission standards not resulting in the previously expected reduction in roadside levels. Therefore, 2024 emission factors were utilised in preference to the development completion year in order to provide robust model outputs. As predictions for 2024 were verified, it is considered the results are a robust indication of concentrations for the future year.

4.6 Meteorological Data

4.6.1 Meteorological data used in the assessment was taken from Luton Airport meteorological station over the period 1st January 2024 to 31st December 2024 (inclusive). Luton Airport is located at NGR: 511948, 221574, which is approximately 11.1km north-east of the development. It is anticipated that conditions would be reasonably similar over a distance of this magnitude. The data was therefore considered suitable for an assessment of this nature.

4.6.2 All meteorological records used in the assessment were provided by Atmospheric Dispersion Modelling (ADM) Ltd, which is an established distributor of data within the UK. Reference should be made to Figure 11.11 in the Air Quality Chapter for a wind rose of the utilised meteorological data.

4.7 Roughness Length

4.7.1 The z_0 is a modelling parameter applied to allow consideration of surface height roughness elements. A z_0 of 0.5m was used to describe the modelling extents and meteorological site. This is considered appropriate for the morphology of both areas and is suggested within ADMS-Roads as being suitable for 'parkland, open suburbia'.

4.8 Monin-Obukhov Length

4.8.1 A minimum Monin-Obukhov length of 30m was used to describe the modelling extents. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for 'cities and large towns'.

4.8.2 A minimum Monin-Obukhov length of 30m was used to describe the meteorological site. This value is considered appropriate for the nature of the area and is suggested within ADMS-Roads as being suitable for 'mixed urban/industrial'.

4.9 Background Concentrations

4.9.1 Annual mean NO₂, PM₁₀ and PM_{2.5} background concentrations were taken from the DEFRA mapping study for the grid square containing the site, NGR: 509500, 210500, as shown in A11.3.2.

4.9.2 Similarly, to emission factors, background concentrations from 2024 were utilised in preference to the development completion year. This provided a robust assessment and is likely to overestimate pollutant concentrations during the operation of the proposal.

4.10 NO_x to NO₂ Conversion

4.10.1 Predicted annual mean NO_x concentrations were converted to NO₂ concentrations using the spreadsheet (version 9.1) provided by DEFRA, which is the method detailed within DEFRA guidance¹⁶.

4.11 Verification

4.11.1 The predicted results from a dispersion model may differ from measured concentrations for a large number of reasons, including:

- Estimates of background concentrations;
- Uncertainties in source activity data such as traffic flows and emission factors;
- Variations in meteorological conditions;
- Overall model limitations; and,
- Uncertainties associated with monitoring data, including locations.

4.11.2 Model verification is the process by which these and other uncertainties are investigated and where possible minimised. In reality, the differences between modelled and monitored results are likely to be a combination of all of these aspects.

4.11.3 For the purpose of the assessment model verification was undertaken for 2024 using traffic data, meteorological data and monitoring results from this year.

4.11.4 Monitoring of NO₂ concentrations was undertaken at 13 locations within the vicinity of roads included within the model during 2024. The results were obtained and the road contributions to total NO_x concentrations calculated following the methodology contained within DEFRA guidance¹⁷. The monitored annual mean NO₂ concentrations and calculated road NO_x concentrations are summarised in Table A11.3.16.

¹⁶ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

¹⁷ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

4.11.5 It should be noted that a number of monitoring locations identified in Table A11.3.16 were not included in the verification process for the following reasons:

- MP7, MP2, DB7, DB9, DB12 and DB66 - In accordance with DEFRA guidance¹⁸, only roadside diffusion tubes were included the verification process. As these locations are classified as urban background, they were excluded from verification;
- SA107, SA142, SA152, MP1 - Traffic data for nearby the road network was not available. Therefore, vehicle emissions could not be accurately represented;
- MP6 - Initial modelling indicated that predicted NO₂ concentrations at this location were below background levels. As such, this result was excluded from the verification process;
- DB1 - Initial modelling results showed that NO₂ concentrations were significantly underestimated at this location. As discussed previously, this discrepancy is likely due to emissions from cooking activities at nearby premises, which cannot be represented within the model; and,
- DB3 and DB4 - A review of the monitoring locations indicated that these sites are adjacent to each other; however, the initial model results were not comparable. As such, both sites were removed from the verification dataset.

Table A11.3.16 Verification - Monitoring Results

Monitoring Location		Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO _x Concentration (µg/m ³)
DB2	Queensway 2	18.0	12.98
DB5	Queensway 5	18.2	13.44
DB6	Old Town High Street	15.0	6.31
DB8	Kylina Court	19.2	15.74
DB10	St Albans Road 1 (formerly St Albans 2)	17.2	11.17
DB11	St Albans Road 2 (formerly St Albans 3)	16.8	10.28
DB65	Cotterrells	19.0	15.28
DB67	Leighton Buzzard Road	25.4	30.93
DB68	LB Road / Coombe Street	24.9	29.64

¹⁸ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Monitoring Location		Monitored NO ₂ Concentration (µg/m ³)	Calculated Road NO _x Concentration (µg/m ³)
MP3 ^(a)	Leverstock Green Way	18.4	13.83
MP4 ^(a)	Green Lane (South)	22.0	22.44
MP5 ^(a)	Green Lane / A414 Roundabout	22.8	24.33
MP8 ^(a)	Hemel Hempstead Road	15.9	8.22

Note: (a) East Hemel Monitoring Tubes. Results were converted from 2022 to 2024 using a ratio calculated from the 2025 Dacorum Borough Council Air Quality ASR data.

4.11.6 The annual mean road NO_x concentrations predicted from the dispersion model and the road NO_x concentrations calculated from the monitoring results are summarised in Table A11.3.17.

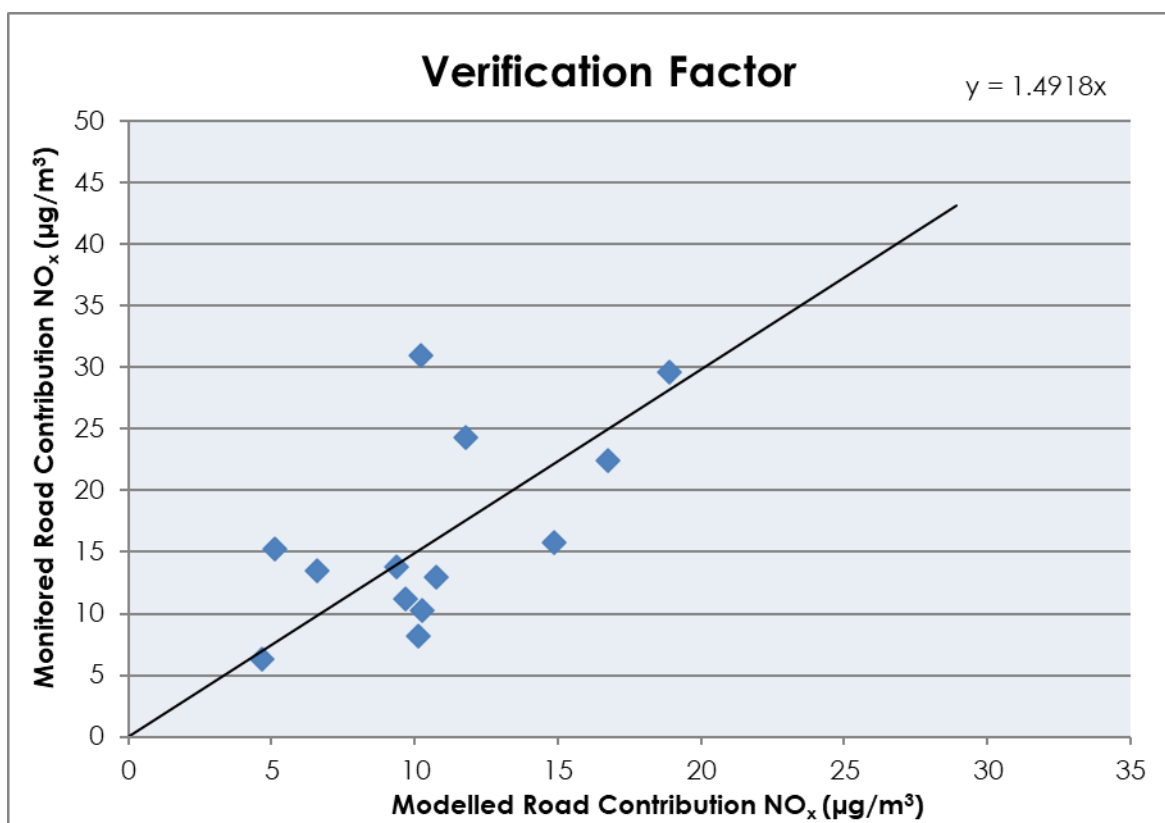
Table A11.3.17 Verification - Modelling Results

Monitoring Location		Calculated Road NO _x Concentration (µg/m ³)	Modelled Road NO _x Concentration (µg/m ³)
DB2	Queensway 2	12.98	10.74
DB5	Queensway 5	13.44	6.60
DB6	Old Town High Street	6.31	4.67
DB8	Kylna Court	15.74	14.87
DB10	St Albans Road 1 (formerly St Albans 2)	11.17	9.70
DB11	St Albans Road 2 (formerly St Albans 3)	10.28	10.27
DB65	Cotterrells	15.28	5.10
DB67	Leighton Buzzard Road	30.93	10.20
DB68	LB Road / Coombe Street	29.64	18.91
MP3 ^(a)	Leverstock Green Way	13.83	9.36
MP4 ^(a)	Green Lane (South)	22.44	16.77
MP5 ^(a)	Green Lane / A414 Roundabout	24.33	11.79
MP8 ^(a)	Hemel Hempstead Road	8.22	10.13

Note: (a) East Hemel Monitoring Tubes

4.11.7 The monitored and modelled road NO_x concentrations were graphed and the equation of the trendline based on linear progression through zero calculated. This indicated that a verification factor of 1.4918 was required to be applied to all road NO_x modelling results, as shown in Graph 1.

Graph 1 NO_x Verification Factor



4.11.8 Monitoring of PM₁₀ and PM_{2.5} concentrations is not undertaken within the assessment extents. The NO_x verification factor was therefore used to adjust model predictions of these species in lieu of more accurate data in accordance with DEFRA guidance¹⁹.

4.11.9 Further analysis of model performance is recommended in DEFRA guidance²⁰ in order to provide additional confidence in assessment predictions. As such, a comparison of the modelled and monitored NO₂ concentrations was undertaken. The NO_x verification factor was initially applied to the modelled road NO_x concentrations at the monitoring locations and the total NO₂ concentrations calculated using the NO_x to NO₂ spreadsheet. This is summarised in Table A11.3.18.

¹⁹ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

²⁰ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

Table A11.3.18 NO₂ Verification - Difference between Monitored and Modelled NO₂ Concentrations

Monitoring Location		Modelled Road NO _x Concentration - Verified (µg/m ³)	Modelled Road NO ₂ Concentration (µg/m ³)	Monitored NO ₂ Concentration (µg/m ³)	Difference between Monitored and Modelled NO ₂ Concentration (%)
DB2	Queensway 2	16.03	19.33	18.00	7.39
DB5	Queensway 5	9.85	16.61	18.20	-8.74
DB6	Old Town High Street	6.96	15.30	15.00	2.00
DB8	Kylna Court	22.19	21.92	19.20	14.17
DB10	St Albans Road 1 (formerly St Albans 2)	14.46	18.65	17.20	8.43
DB11	St Albans Road 2 (formerly St Albans 3)	15.32	19.02	16.80	13.21
DB65	Cotterrells	7.61	15.60	19.00	-17.89
DB67	Leighton Buzzard Road	15.22	18.97	25.40	-25.31
DB68	LB Road / Coombe Street	28.21	24.34	24.90	-2.25
MP3 ^(a)	Leverstock Green Way	13.97	18.43	18.37	0.33
MP4 ^(a)	Green Lane (South)	25.01	23.06	22.02	4.72
MP5 ^(a)	Green Lane / A414 Roundabout	17.58	19.99	22.79	-12.29
MP8 ^(a)	Hemel Hempstead Road	15.12	18.93	15.87	19.28

Note: (a) East Hemel Monitoring Tubes

4.11.10 DEFRA guidance²¹ states that the majority of modelled results should be within +/-25% of monitored concentrations, and preferably within +/-10%. As shown in Table A11.3.18, the difference between the modelled and monitored NO₂ concentrations at 7 of the 13 survey sites was less than +/-10% and less than +/- 25% at 12 of the 13 sites.

²¹ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

4.11.11 Monitor DB67 - Leighton Buzzard Road slightly exceeds the +/- 25% criterion. However, this is considered acceptable as the overall model performance demonstrates sound agreement with the monitoring data and falls well within the expected level of uncertainty for dispersion modelling.

4.11.12 In addition, the Root Mean Squared Error (RMSE) has been calculated to define the average error or uncertainty of the model. In accordance with the DEFRA guidance²², if the RMSE value is higher than +/-25% of the AQO being assessed, it is recommended that the model inputs and verification are revisited in order to make improvements. The annual mean AQO of relevance to the assessment is 40µg/m³. As such, a RMSE value of +/- 10µg/m³ is required in order to have confidence in the predicted values. The RMSE calculated for the study is 2.6µg/m³ or 6.5% of the AQO, which is within the stated limits.

4.11.13 As such, the model is considered to be performing to an acceptable standard in accordance with DEFRA guidance²³.

²² Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

²³ Local Air Quality Management Technical Guidance (TG22), DEFRA, 2022.

5.0 **ABBREVIATIONS**

AADT	Annual Average Daily Traffic
ADM	Air Dispersion Modelling
AQMA	Air Quality Management Area
APIS	Air Pollution Information System
AQO	Air Quality Objective
ASR	Annual Status Report
CERC	Cambridge Environmental Research Consultants
DBC	Dacorum Borough Council
DEFRA	Department of Environment, Food and Rural Affairs
DM	Do-Minimum
DS	Do-Something
EB	Eastbound
HDV	Heavy Duty Vehicles
IAQM	Institute of Air Quality Management
LDV	Light Duty Vehicle
LNR	Local Nature Reserve
NB	Northbound
NGR	National Grid Reference
NH ₃	Ammonia
NO _x	Nitrogen oxide
NO ₂	Nitrogen dioxide
PM ₁₀	Particulate matter with an aerodynamic diameter of less than 10µm
RMSE	Root Mean Square Error
SADC	St Albans City and District Council
SB	Southbound
SP	Slow Phase
WB	Westbound
Z ₀	Surface Roughness