

Bradbury Oak Grove Farm, Chepstow - Air Quality Assessment Report

November 2020

Prepared by

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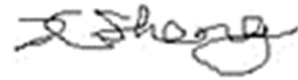
November 2020

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Limitations

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EXECUTIVE SUMMARY

An assessment has been undertaken with regards to the local air quality impact due to any increase in traffic on the A48 as result of the proposed development at Bradbury Oak Grove Farm (circa 800) taking into consideration other committed developments proposed as part of Monmouthshire County Council's (MCC) revision to their Local development Plan (LDP). The site is hereafter referred to as the 'Proposed Development' or 'Application Site'.

The committed developments that are considered include:

- Crick Rd – 285 dwellings & 50 jobs by 2026
- Church Rd Caldicot – 130 dwelling by 2026
- Sudbrook – dwelling numbers as specified by Monmouthshire County Council
- Fairfield Mabey Chepstow – 350 dwellings & 400 jobs by 2026
- Rockfield Farm Undy – 266 dwellings & 258 jobs by 2026
- Vinegar Hill Undy – 225 dwellings by 2026

A section of the A48 has been declared an Air Quality Management Area (AQMA) by MCC and is also known as the Chepstow AQMA. This AQMA was declared on 11th April 2007 due to exceedances of the annual mean nitrogen dioxide (NO₂) National Air Quality Objectives (NAQOs), attributable to road traffic emissions.

An assessment was undertaken to determine the long-term air quality impact of the operational phase of the Proposed Development due to traffic generation within the Chepstow AQMA and the local area specifically using local authority monitoring data, Defra's background maps and traffic related emissions associated with the Proposed Development.

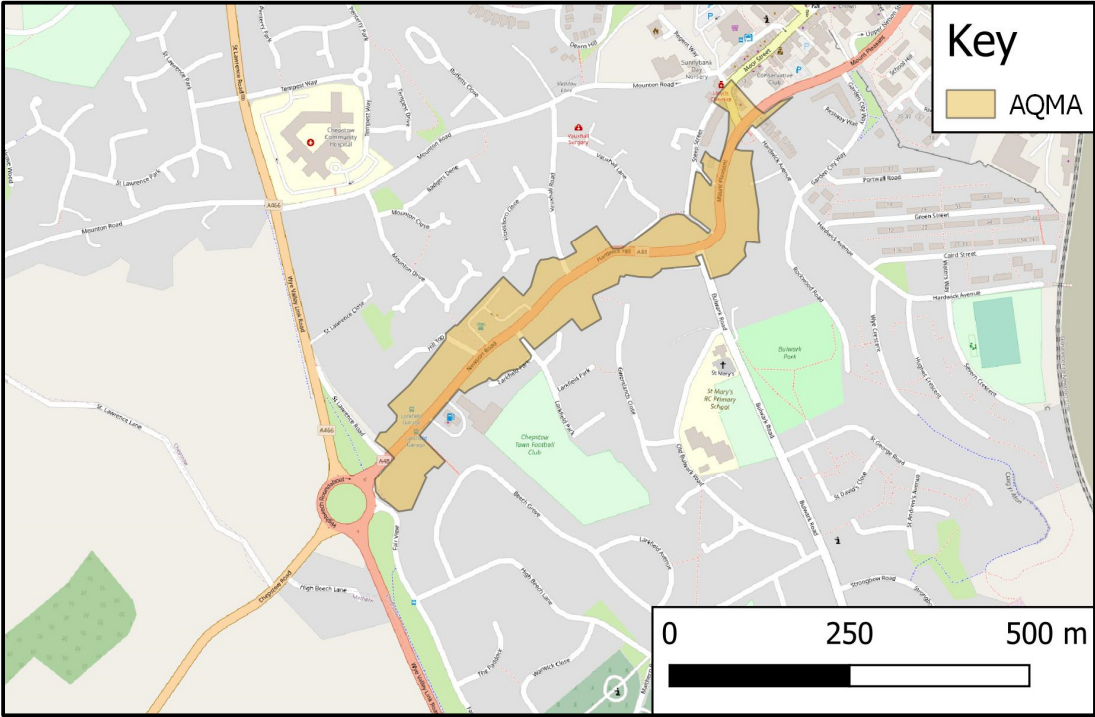
The assessment revealed that the Proposed Development is predicted to have a negligible impact on local air quality within the Chepstow AQMA.

Therefore, the Proposed Development is considered to comply with national and local air quality policy.

1 INTRODUCTION

- 1.1 GL Hearn has been commissioned to undertake an air quality assessment to determine the local air quality impact due to any increase in traffic on the A48 highway due to the proposed development at Bradbury Oak Grove Farm (circa 800) taking into consideration other committed developments proposed as part of Monmouthshire County Council's (MCC) revision to their Local development Plan (LDP). The site is hereafter referred to as the 'Proposed Development' or 'Application Site'.
- 1.2 The committed developments that are considered include:
- Crick Rd – 285 dwellings & 50 jobs by 2026
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 - Vinegar Hill Undy – 225 dwellings by 2026
- 1.3 A section of the A48 has been an Air Quality Management Area (AQMA) by MCC and is also known as the Chepstow AQMA. This AQMA was declared on 11th April 2007 due to exceedances of the annual mean nitrogen dioxide (NO₂) National Air Quality Objectives (NAQOs), attributable to road traffic emissions.
- 1.4 Although the Proposed Development is approximately 5km away from the AQMA, some of the traffic generated by the Proposed Development is expected to use the A48 within the Chepstow AQMA and other nearby surrounding roads. This assessment has been undertaken to confirm whether the operation of the Proposed Development is likely to have longer term air quality impacts within the Chesptow AQMA and surrounding area as a result of changes to road traffic emissions.
- 1.5 The location of the AQMA is illustrated below in Figure 1.

Figure 1: Chepstow AQMA



2 LEGISLATION, POLICY AND GUIDANCE

Legislation and Policy

2.1 Air quality is governed by a series of local, regional and national legislation and policies. A summary of the relevant legislation and policies relevant to this assessment is provided below. The full details can be seen in Appendix A.

- The Air Quality Strategy (2007)¹ ;
- Air Quality Standards (Amendment) Regulations (2016)²;
- Air Quality Standard Regulations (2010)³;
- The National Planning Policy Framework (2019)⁴; and
- UK Clean Air Strategy (2019)⁵.

2.2 With regards to the potential effect of the Proposed Development, the legislation is the National Air Quality Objectives (NAQOs), as set out in the Air Quality Strategy (2015) and the Air Quality Standards (Wales) Regulations (2010), which lay out the Air Quality Objectives (NAQOs). The 2010 and 2015 regulations are the latest update to the legislation which transposes into UK law the requirements of European Directives 2008/50/EC and 2004/107/EC, which apply legal responsibility to the NAQOs. The NAQOs include targets relevant to this assessment are presented in Table 1 below.

Table 1: National Air Quality Objectives (NAQO)

Pollutant	Measured As	Objective
Nitrogen dioxide (NO ₂)	Annual Mean	40µg/m ³
	1 Hour Mean	200µg/m ³ not to be exceeded more than 18 times a year
Particles (PM ₁₀)	Annual Mean	40µg/m ³
	24 Hour Mean	50µg/m ³ not be exceeded more than 35 times a year
PM _{2.5} (England only, Encouraged in Wales)*	Annual Mean	25µg/m ³ (World Health Organisation (WHO) guideline 10µg/m ³)

*EU Target Value

2.3 These air quality objectives are aimed at the protection of human health. The annual mean NAQOs apply at locations where the public may be regularly exposed, such as building facades of residential properties, schools, hospitals and care homes. The 1 hour and 24 hour mean NAQOs apply at

¹ Department for Environment, Food and Rural Affairs (Defra) (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2).

² Defra (2016) Air Quality Standards (Amendment) Regulations.

³ Defra (2010) Air Quality Standards Regulations.

⁴ Department for Communities and Local Government (2018), National Planning Policy Framework.

⁵ Defra (2019) Clean Air Strategy 2019

locations where it is reasonable to expect members of the public to spend at least these periods of time, such as busy shopping streets and school playgrounds for the 1 hour mean, and hotels or residential gardens for the 24 hour mean. For full details, see Box 1.1 of LAQM TG(16)⁶.

- 2.4 Air Quality Standards are concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment. They can also be used as a benchmark to indicate whether air pollution is getting better or worse.
- 2.5 An exceedance is a period of time (defined for each standard) where the concentration is higher than that set out in the Standard. In order to make useful comparisons between pollutants (the Standards may be expressed in terms of different averaging times), the number of days of which an exceedance has been recorded is often reported.

Guidance

- 2.6 A summary of the guidance documents that have been used and / or referred to within this assessment is provided below. The full details can be seen in Appendix A.
- National Planning Practice Guidance – Air Quality⁷;
 - Local Air Quality Management Technical Guidance (LAQM.TG(16))⁶;
 - Local Air Quality Policy Guidance for Wales⁸.
 - Land-Use Planning & Development Control: Planning for Air Quality⁹.
- 2.7 MCCs Local policy has also been considered in this assessment. Further details of the air quality specific policies included in the plan can be found in Appendix A.

⁶ Defra (April 2016) Local Air Quality Management Technical Guidance (TG16)

⁷ Department of Communities and Local Government (March 2014)

⁸ Local Air Quality Policy Guidance for Wales [LAQM.PG (17)(W) (June 2017)

⁹ EPUK / IAQM (January 2017) Land-Use Planning & Development Control: Planning for Air Quality v1.2

3 METHODOLOGY

- 3.1 A consultation letter for assessment methodology has been sent to MCC¹⁰ prior to conduct this assessment. The assessment methodology presented below is in line with guidance documents listed in paragraph 2.6.

Baseline Assessment

- 3.2 A baseline desk study has been undertaken, utilising available data from MCC's latest air quality progress report. Furthermore, information on the location of nearby Air Quality Management Areas (AQMA) and designated ecological habitats (e.g. Sites of Special Scientific Interest (SSSIs)) from the Department for Environment, Food and Rural Affairs (Defra), and aerial mapping and satellite imagery, have been used to establish locations of potential human and ecological receptors sensitive to impacts on air quality arising from the Proposed Development.

Assessment of Long-Term Impacts

- 3.3 Annual-mean oxides of nitrogen (NO_x - a mixture of nitrogen oxide (NO) and NO₂) and PM₁₀ concentrations have been predicted at selected sensitive receptors using the modelling software ADMS-Roads (v5) and information on road traffic. The model simulations apply the traffic data in conjunction with a surface roughness, uphill and downhill gradients applicable to the A48 to replicate the local built environment, and meteorological statistics to predict resulting concentrations at key specified sensitive receptors.
- 3.4 Predicted NO_x concentrations are then converted to NO₂ using NO_x to NO₂ calculator v8.1 (August 2020) provided by Defra and also taking into account background concentrations. Predicted PM₁₀ concentrations are added directly to relevant background concentrations.

Impact of Additional Road Traffic Emissions

- 3.5 The EPUK / IAQM guidance provides criteria for when an air quality assessment is required. Given the Application Site's location near an AQMA, the criteria recommends that an assessment is required when there is a change of:
- LDV (Light Duty Vehicle) flows of more than 100 AADT; or
 - HDV flows of more than 25 AADT.
- 3.6 The Proposed Development is expected to generate more than 100 AADT and as such an impact assessment is required. Capita's Transport team have provided traffic data which have been used in the modelling and is detailed in Appendix C.

¹⁰ Consultation letter sent to Environmental Health team at MCC on 19th October 2020 and a response is yet to be received at the time completed this report on 19th November 2020.

Sensitive Receptors

- 3.7 Locations of receptors sensitive to changes in pollutant concentrations (particularly NO₂ and PM₁₀) have been identified and included within the assessment. Particular attention has been paid to areas where the annual mean NO₂ and annual and daily PM₁₀ NAQOs have the potential to be exceeded. Full details of the worst case existing sensitive receptor locations located within and outside the AQMA as well as future sensitive receptor locations at the Application Site modelled within the assessment can be seen in Appendix C.

Model Verification

- 3.8 LAQM.TG(16) recommends using a combination of automatic and diffusion tube monitoring data to verify modelled concentrations of NO₂ and PM₁₀. There is one automatic monitoring site in the vicinity of the Application Site and several diffusion tubes along the A48 which have been utilised to verify the model. Further details on model verification can be found in Appendix C.

Operational Phase

- 3.9 The predicted total annual mean NO₂ and PM₁₀ concentrations were assessed against the relevant NAQOs (see Table 1).
- 3.10 The EPUK / IAQM guidance provides impact descriptors to define the magnitude of the impacts of annual mean pollutant concentrations, in relation to the total pollutant concentration and the NAQO. These are presented below in Table 2. These are designed only to be used with annual mean concentrations and not hourly or 24-hour mean concentrations.
- 3.11 Substantial and moderate air quality impacts are considered to be significant. Any change of less than 1% is deemed negligible in accordance with the IAQM guidance.

Table 2: EPUK / IAQM Impact Descriptors for Individual Receptors

Long-term average Concentration at receptor in assessment year	% Change in Concentration Relative to NAQO			
	1	2-5	6-10	>10
75% or less of NAQO	Negligible	Negligible	Slight	Moderate
76-94% of NAQO	Negligible	Slight	Moderate	Moderate
95-102% of NAQO	Slight	Moderate	Moderate	Substantial
103-109% of NAQO	Moderate	Moderate	Substantial	Substantial
110% or more of NAQO	Moderate	Substantial	Substantial	Substantial

- 3.12 The 1 hour mean NO₂ and 24 hour mean PM₁₀ NAQOs have been assessed using the following LAQM.TG (16)⁶ approach:.

- For NO₂, research undertaken as part of the LAQM.TG(16) indicates that the hourly NO₂ objective is unlikely to be exceeded where the annual-mean NO₂ concentration is predicted to be less than 60 µg/m³.
- For PM₁₀, to calculate the number of exceedances of the 24-hour mean NAQO in a year, the following equation (from LAQM.TG(16)) has been applied to the total PM₁₀ annual mean concentration:

$$\text{No. of Exceedances} = -18.5 + 0.00145 \times \text{Annual Mean}^3 + \left(\frac{206}{\text{Annual Mean}}\right)$$

This relationship suggests that the 24-hour mean NAQO is likely to be met if the predicted annual-mean PM₁₀ concentration is 31.8 µg/m³ or less. The Air Quality Strategy Volume 2: Evidence Base¹¹ states, throughout the document, that an annual-mean PM₁₀ concentration of 31.5 µg/m³ is approximately equivalent to the 24-hour mean NAQO.

- 3.13 On this basis, the 1-hour NO₂ NAQO is considered to be met where the annual-mean NO₂ concentration is less than 60 µg/m³ while the 24-hour mean PM₁₀ NAQO is considered to be met where the annual-mean PM₁₀ concentration is less than 31.5 µg/m³.

¹¹ Defra (2007) Air Quality Strategy Volume 2.

4 BASELINE CONDITIONS

Local Air Quality Management

- 4.1 MCC has declared two Air Quality Management Areas (AQMAs) within its administrative boundaries, one of which is known as the Chepstow AQMA which covers an area encompassing properties either side of the A48, between the roundabout with the A466 to the west and extending east just beyond the junction with the B4293 at Hardwick Terrace. The AQMA was declared on 11th April 2007 due to exceedances of the NAQOs for NO₂, a traffic related pollutant.

Defra Background Mapping

- 4.2 Defra provides modelled background concentrations for each 1x1km grid across all local authority areas from a base year of 2018. This data is projected up to 2030. Table 3 presents the estimated background concentrations for 1 km around the Chepstow AQMA in 2018.

Table 3: 2018 Defra Background Modelled Concentrations

Defra Grid Square Coordinates (X, Y)	Defra Background Concentration (µg/m ³)	
	NO ₂	PM ₁₀
352500,194500	7.1	12.1
352500,193500	8.2	12.3
353500,193500	9.2	12.5
352500, 192500	7.9	12.1

- 4.3 2018 background concentrations for the grid squares around the Chepstow AQMA are all well below the annual mean NAQOs.

MCC Monitoring

Automatic Monitoring

- 4.4 MCC currently undertake automatic monitoring at one location, less than 1km to the Site, on the A48 at Hardwick Hill. Details of the data collected during 2013 to 2018 at this monitoring location are presented below.

Table 4: AQMS Monitoring Data

	2013	2014	2015	2016	2017	2018
Annual Mean NO ₂ Concentration (µg/m ³)	34.5	38.6	37	35	35	36
No. of hourly mean NO ₂ Concentration >200 µg/m ₃	0	0	2	0	0	0
Annual Mean PM ₁₀ Concentration (µg/m ₃)	19	18	17	18	16	18
No. of 24-hourly mean PM ₁₀ Concentration >50 µg/m ³	4	2	5	1	2	0
Annual Mean PM _{2.5} Concentration (µg/m ³)	14	14	10	11	10	10

Source: Monmouthshire County Council 2019 Annual Status Report

- 4.5 Monitoring at the AQMS indicates that the annual and daily mean objectives for NO₂ and PM₁₀ are well below the relevant NAQOs. The annual mean objective for PM_{2.5} are also within the encouraged NAQO of 25µg/m³.

Diffusion Tube Monitoring

- 4.6 MCC also undertakes NO₂ diffusion tube monitoring at a range of locations across the Council area. There are 10 of those sites within or around the A48 section of the AQMA. Details of the data collected at these monitoring sites are presented in Table 5 below.

Table 5: MCC NO₂ Diffusion Tube Monitoring Data

Site ID	Grid Location (X, Y)	Distance from AQMA (km)	Type*	Annual Mean NO ₂ Concentration (µg/m ³)					
				2013	2014	2015	2016	2017	2018
CH1	352800,193274	Within AQMA	R	22.4	21.8	22.5	22.9	22.2	19.1
CH2a	352821,193307	Within AQMA	R	30.4	33.1	30.9	31	27.9	27..8
CH3	352970,193452	Within AQMA	R	32.7	32.5	29.8	31.1	29.9	26.5
CH4	353009,193444	Within AQMA	R	56	57.7	51.4	53.2	51.1	42.5
CH5	353141,193451	Within AQMA	R	28.4	26.1	25.9	26.7	26.8	23.5
CH6	353166,193586	Within AQMA	R	41.7	40	36.8	37.6	37.1	34.3
CH7	353164,193663	Within AQMA	R	30.6	28.4	26.9	27.9	25.9	25.1
CH8	353219,193730	Outside AQMA	K/UC	31.1	31.8	28.1	27.7	27.1	26.4
CH9	353306,193681	Outside AQMA	R	28.1	27.8	25.5	27.2	26.8	23.6
AQ1	353125,193472	Within AQMA	R	-	-	-	-	37.6	34

Source: Monmouthshire County Council 2019 Annual Status Report

Notes: - = No data R = Roadside K/UC = Kerbside / Urban Centre Exceedances in **bold**

- 4.7 Table 5 indicates that between 2013 and 2018, the annual mean NO₂ NAQO was exceeded every year at location CH4, however the concentrations appear to decline with year.
- 4.8 Monitored concentrations at location CH4 is expected to be exceeded due to the conditions surrounding the monitoring tube, i.e. it is located adjacent to a road with a gradient and is also narrower than at other locations within the AQMA. There has been a significant decrease (13.5 µg/m³) in measured concentrations across the 5-year period (2013-2018), therefore, it is likely that in the opening year 2036, concentrations at this monitoring tube will be below the NAQO.
- 4.9 For all other diffusion tube monitoring sites, there were no exceedances of the annual mean NO₂ NAQO.

Summary

- 4.10 Local monitoring and Defra background mapping indicate that concentrations of NO₂ and PM₁₀ are likely to be below the NAQOs within the AQMA, except at location CH4 which exceeds the annual mean NO₂ NAQO.

NO₂

- 4.11 Concentrations of NO₂ from the Defra background maps are significantly less than the monitored concentrations within the AQMA, therefore baseline NO₂ concentrations will be only be considered from the local monitoring within the AQMA.
- 4.12 Baseline concentrations are usually taken from a “background” site which is free from the influence of road source, and none of the monitoring within the AQMA is a typical “background” site, as they are all classified as “roadside” sites. For a conservative assessment, one of the “roadside” sites (CH1) which measures the least NO₂ concentrations has been assumed to be representative of “background” concentrations in the current and future opening year.

PM₁₀

- 4.13 Concentrations of PM₁₀ from the Defra background maps are only slightly less than the monitored concentrations within the AQMA at the AQMS, and therefore Defra mapped PM₁₀ concentrations have been used to represent baseline PM₁₀ concentrations.

5 ASSESSMENT OF LONG-TERM IMPACTS

- 5.1 Annual mean concentrations of NO₂ and PM₁₀ have been modelled at relevant existing sensitive receptors located within and outside the AQMA for the 2018 Baseline, 2036 Do Nothing and 2036 Do Something opening year scenarios.

Modelled Annual Mean NO₂ Concentrations

- 5.2 Table 6 presents the predicted annual mean NO₂ concentrations at the worst-case facades of considered receptors within the study area in line with EPUK / IAQM significance criteria.

Table 6: 2018 Baseline, 2036 DM and 2036 DS Modelled Annual Mean NO₂ Concentrations

Receptor No.	Annual Mean NO ₂ Concentrations (µg/m ³)			Change (as % of NAQO)	EPUK / IAQM Impact
	2018 Baseline	2036 DM	2036 DS		
R1	38.8	26.5	26.7	1.0	Negligible
R2	40.3	27.4	27.6	1.0	Negligible
R3	26.8	22.6	22.6	0.0	Negligible
R4	21.4	20.2	20.2	0.0	Negligible
R5	28.9	23.3	23.3	0.0	Negligible
R6	27.4	22.3	22.3	0.0	Negligible
R7	32.7	24.0	24.0	0.0	Negligible
R8	32.4	24.3	24.5	1.0	Negligible
R9	32.3	24.0	24.1	0.0	Negligible
R10	31.6	23.6	23.7	0.0	Negligible
R11	36.2	26.9	27.1	1.0	Negligible
R12	24.4	21.3	21.3	0.0	Negligible
R13	25.9	21.9	22.0	0.0	Negligible
R14	21.5	19.9	19.9	0.0	Negligible
R15	24.2	21.5	21.5	0.0	Negligible
R16	21.2	19.9	19.9	0.0	Negligible
R17	23.9	20.8	20.8	0.0	Negligible
R18	28.0	22.7	22.8	0.0	Negligible
R19	27.0	22.3	22.3	0.0	Negligible
R20	26.6	21.9	22.0	0.0	Negligible
R21	23.2	20.6	20.6	0.0	Negligible
R22	22.1	20.3	20.3	0.0	Negligible

- 5.3 The annual mean NO₂ NAQO is 40µg/m³. The annual mean NO₂ concentrations predicted at all receptors are below the NAQO both in the 2036 Do Nothing and 2036 Do Something opening year

scenarios. The change in annual mean NO₂ concentrations at all receptors was than less than 1% and the significance of the impact of this change are deemed negligible in accordance with the EPUK/IAQM guidance.

- 5.4 In accordance with the LAQM.TG(16), since the annual mean NO₂ concentrations predicted at all receptors is less than 60 µg/m³, then the hourly mean NO₂ NAQO is unlikely to be exceeded.

Modelled Annual Mean PM₁₀ Concentrations

- 5.5 Table 7 presents the predicted annual mean PM₁₀ concentrations at the worst-case facades of considered receptors within the study area in line with EPUK / IAQM significance criteria.

Table 7: 2018 Baseline, 2036 DM and 2036 DS Modelled Annual Mean PM₁₀ Concentrations

Receptor No.	Annual Mean NO ₂ Concentrations (µg/m ³)			Change (as % of NAQO)	EPUK / IAQM Impact
	2018 Baseline	2036 DM	2036 DS		
R1	15.9	14.9	15.0	0.0	Negligible
R2	16.3	15.6	15.7	0.0	Negligible
R3	14.0	13.4	13.5	0.0	Negligible
R4	12.7	11.7	11.7	0.0	Negligible
R5	14.0	13.3	13.3	0.0	Negligible
R6	13.6	12.9	12.9	0.0	Negligible
R7	14.9	13.7	13.8	0.0	Negligible
R8	14.9	14.0	14.1	0.0	Negligible
R9	14.7	13.7	13.8	0.0	Negligible
R10	14.7	13.5	13.6	0.0	Negligible
R11	15.1	14.8	14.9	0.0	Negligible
R12	13.4	12.5	12.5	0.0	Negligible
R13	13.7	12.8	12.8	0.0	Negligible
R14	12.8	11.6	11.6	0.0	Negligible
R15	13.3	12.5	12.5	0.0	Negligible
R16	12.7	11.6	11.6	0.0	Negligible
R17	13.4	12.2	12.3	0.0	Negligible
R18	13.8	13.0	13.0	0.0	Negligible
R19	13.6	12.7	12.7	0.0	Negligible
R20	13.6	12.6	12.6	0.0	Negligible
R21	13.3	12.1	12.1	0.0	Negligible
R22	13.1	11.9	12.0	0.0	Negligible

- 5.6 The annual mean PM_{10} NAQO is $40\mu g/m^3$. The annual mean PM_{10} concentrations predicted at all receptors are below the NAQO both in the 2036 Do Nothing and 2036 Do Something opening year scenarios. The change in annual mean PM_{10} concentrations at all receptors was less than 1% and the significance of the impact of this change are deemed negligible in accordance with the EPUK/IAQM guidance.
- 5.7 In accordance with the LAQM.TG(16) since the annual mean PM_{10} concentrations predicted at all receptors is less than $35\mu g/m^3$, then the 24 hourly mean PM_{10} NAQO is unlikely to be exceeded.

6 SUMMARY AND MITIGATION

Long-Term Impacts

- 6.1 The assessment has shown that the air quality impacts at sensitive receptors due to changes in traffic on the A48 as a result of the Bradbury Oak Grove Farm are deemed negligible and the NAQOS would be achieved in the future opening year.
- 6.2 Therefore, no mitigation is required for the operational phase of the Proposed Development on air quality grounds.

Cumulative Impacts

- 6.3 The assessment considered the cumulative effects of the committed developments listed in Chapter 1 to the extent that the traffic data used for the modelling included traffic associated with these developments. Nevertheless, with the operation of these committed developments, air quality levels remain below the NAQOS in the future opening year.

7 CONCLUSION

- 7.1 An assessment has been undertaken with regards to the local air quality impact due to any increase in traffic on the A48 as result of the proposed development at Bradbury Oak Grove Farm (circa 800) taking into consideration other committed developments proposed as part of Monmouthshire County Council's (MCC) revision to their Local development Plan (LDP).
- 7.2 The long-term impact of the operational phase was assessed quantitatively using a modelling software to predict future concentration of NO₂ and PM₁₀. The results of the predictions indicate that the air quality impacts at sensitive receptors due to changes in traffic on the A48 as a result of the Bradbury Oak Grove Farm are deemed negligible and the NAQOS would be achieved in the future opening year.
- 7.3 On this basis, the Proposed Development is considered to comply with national and local air quality policy.

Appendices

APPENDIX A: REVIEW OF LEGISLATION, POLICY AND GUIDANCE

Air Quality Strategy

Part IV of the Environment Act 1995 introduced a system of Local Air Quality Management (LAQM). This requires Local Authorities to regularly and systematically review and assess air quality within their boundaries against a series of objectives and appraise re-development and transport plans against these assessments.

The Air Quality Strategy (2015) establishes the policy for ambient air quality for the UK. Its primary objective is to ensure that everyone can enjoy a level of ambient air quality in public places that poses no significant risk to health or quality of life, and to protect the environment. The Strategy sets out the National Air Quality Objectives (NAQOs). Those included in LAQM are prescribed in the Air Quality Standards (Wales) Regulations 2010 and the Air Quality Standards (England) Regulations 2015. The NAQOs applied in this assessment for NO₂ and PM₁₀ are shown in Table A.1.

Table A.1 National Air Quality Objectives (NAQO)

Pollutant	Measured As	Objective
Nitrogen dioxide (NO ₂)	Annual Mean	40µg/m ³
	1 Hour Mean	200µg/m ³ not to be exceeded more than 18 times a year
Particles (PM ₁₀)	Annual Mean	40µg/m ³
	24 Hour Mean	50µg/m ³ not to be exceeded more than 35 times a year

Source: Air Quality Strategy 2015

The air quality objectives for the protection of human health apply to outdoor locations where people are regularly present, and where they might reasonably be expected to be exposed over the relevant averaging times (which vary from 15 minutes to a year). The air quality objectives do not apply to occupational, indoor or in-vehicle exposure.

Where a NAQO is unlikely to be met, the local authority must designate an Air Quality Management Area (AQMA) and draw up an Air Quality Action Plan (AQAP) setting out the measures it intends to introduce in pursuit of the objectives within its AQMA. Land use and transport planning are major components of effective AQAPs.

Local authorities' approach to establishing an AQMA may differ. Some declare the whole district/borough an AQMA, others have declared AQMAs at specific areas where NAQOs have been shown or predicted to be exceeded. The latter approach can lead to the declaration of multiple AQMAs, so some authorities have declared a whole area an AQMA, around exceedances of the relevant NAQO. Over 230 local authorities have declared AQMAs. Table A.2 presents a summary of recent Review and Assessments undertaken by MCC.

Table A.2 Summary of Recent MCC Reviews and Assessments

Review and Assessment	Summary
Updating and Screening Assessment (USA) 2015	The two new AQMA's continued exceeding NO ₂ annual mean NAQO and there were no recorded exceedances outside the AQMAs. There was further diffusion tube monitoring carried on in 2015 in Monmouth.
Progress Report 2016	Overall pollutant concentrations decreased at all locations. There was only one location that exceeded the NAQO NO ₂ objective due to being in the Chepstow AQMA.
Progress Report 2017	The air quality within Chepstow AQMA continues to exceed the NO ₂ annual mean objective at one location. On a positive note, the six monitoring locations at USK AQMA were below the NO ₂ NAQOs. There were any other exceedances recorded.
Annual Progress Report 2018	The air quality within Chepstow AQMA continues to exceed the NO ₂ annual mean objective at one location. It was the third year in a row that the air quality was not exceeded at USK AQMA. No exceedances elsewhere. Additional monitoring undertaken in Woodside south of USK AQMA.
Annual Progress Report 2019	There was one exceedance recorded in Chepstow recording the lowest concentration in comparison to previous years. It was the third year in a row that the air quality was not exceeded at USK AQMA. Overall, air quality has improved since 2012.

Source: MCC 2019 ASR

The UK government has recently prepared a Clean Air Strategy⁵ in 2019 to show how they will tackle all sources of air pollution in order to making our air healthier to breathe, protecting nature and boosting the economy.

The Strategy sets out the comprehensive action that is required from across all parts of government and society to meet these goals. New legislation will create a stronger and more coherent framework for action to tackle air pollution. This will be underpinned by new England-wide powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to take action in areas with an air pollution problem. These will support the creation

of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

Air Quality Standards Regulations

The Air Quality (Standards) (England) Regulations 2015 and the Air Quality (Wales) Regulations 2010 transpose into English and Welsh law the requirements of European Directives 2008/50/EC and 2004/107/EC on ambient air quality respectively. They include limit values for NO₂. These limit values are numerically the same as the NAQO values, but differ in terms of compliance dates, locations where they apply and legal responsibility.

The limit values are applicable at all locations except:

- Where members of the public do not have access and there is no fixed habitation;
- On factory premises or at industrial installations to which all relevant provisions concerning health and safety at work apply;
- On the carriageway of roads; and
- On the central reservations of roads except where there is normally pedestrian access.

Planning Policy

National Planning Policy

Planning policy in the UK is governed by the National Planning Policy Framework which was published in July 2018 and updated in February 2019⁴. It has an emphasis on economic, social and environmental sustainability at the forefront of the policy. It states that:

“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 soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and ...”

This is to be achieved whilst maintaining adherence to the NAQOs and taking into account the presence of AQMAs. Developments in AQMAs should also be consistent with the local air quality action plan.

Local Policy

Monmouthshire Local Plan 2014-2021

Adopted in February 2014, the Local Plan¹² set up the Council's vision and objectives for its development up to 2021 along with proposals and policies to achieve the plan. There is a major emphasis in sustainable development promoting the protection of the environment. The specific policies relevant to this air quality assessment are as follows:

- Policy EP1 – Amenity and Environmental Protection:

“Development, including proposals for new buildings, extensions to existing buildings and advertisements, should have regard to the privacy, amenity and health of occupiers of neighbouring properties. Development proposals that would cause or result in an unacceptable risk /harm to local amenity, health, the character /quality of the countryside or interests of nature conservation, landscape or built heritage importance due to the following will not be permitted, unless it can be demonstrated that measures can be taken to overcome any significant risk: Air pollution”.

- Policy SAH3 – Fairfield Mabey, Chepstow:

“16.1 hectares at the Fairfield Mabey, Chepstow, site are allocated for a mixed use residential and employment development. Planning permission will be granted provided that: c) It can be demonstrated that traffic flows can be satisfactorily accommodated and air quality standards met in relation to the highway network leading to the site and a Section 106 Agreement has been signed that, in addition to standard requirements, includes provision for any necessary off-site highway works to ensure that this is achieved”.

Guidance

Local Air Quality Management Technical Guidance

Published by the Defra, the Local Air Quality Management Technical Guidance (LAQM.TG(16)) was produced to aid local authorities in their local air quality management. This guidance also acts as guidance for planning officials and consultants.

¹² Monmouthshire Local Plan (Adopted February 2014)

Land-Use Planning & Development Control: Planning for Air Quality (2017)

Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) published updated guidance, detailing when a detailed air quality assessment is required, in relation to traffic generation (both light and heavy-duty vehicles), speed, road realignment, car park ventilation, energy and heating provision plant. The guidance also provides impact descriptors to aid in assessing the significance of the impact, as well as what should be included in the assessment and associated report.

National Planning Practice Guidance – Air Quality

The Government's Planning Practice Guidance provides information on the level of detail required in an air quality assessment and mitigation for reducing negative air quality impacts.

APPENDIX B: Model Inputs and Verification

Dispersion Model

The contribution of emissions from the road traffic to NO_x and PM₁₀ concentrations are predicted using the ADMS-Roads (V5) model. This model is widely used in the UK for this type of assessment.

The model of the Proposed Development is based on traffic data provided by Capita's Transport Team. The model simulations apply the traffic data in conjunction with a surface roughness to replicate the local built environment, and meteorological statistics to predict resulting concentrations at key specified sensitive receptors.

Sensitive receptors are locations where members of the public have the potential to be exposed to exceedances of the NAQO's, as a result of the Proposed Development. These locations correspond with the relevant mean timescales, i.e. a member of the public is likely to be present at a residential dwelling for the majority of a year, and so the annual mean is considered, whereas, areas where the public generally spend shorter amounts of time (such as restaurants) the 1-hour mean is more relevant. Box 1.1 of LAQM.TG (16) provides further details and examples of where NAQOs should or should not apply.

Receptors

Receptors included in the assessment are located on the 'worst case' facades of properties (i.e. closest to the emission source) and where significant changes in traffic are expected. The locations are shown in Table C.1 below and in Figure C.1 at the end of the Appendix.

Table C.1 Key Air Quality Receptors

ID	Name	X(m)	Y(m)	Z(m)
R1	Bulwark Road 1	353135	193452	1.5
R2	Bulwark Road 2	353132	193437	1.5
R3	Castle Court Residential Home	353165	193880	1.5
R4	Chepstow Community Hospital	352597	193553	1.5
R5	Fair View 1	352694	193117	1.5
R6	Fair View 2	352810	192763	1.5
R7	Garden City Way (CH9)	353307	193684	1.5
R8	George Road	353263	193127	1.5
R9	Hardwick Hill Lane 1	353101	193466	1.5
R10	Hardwick Hill Lane 2	353133	193499	1.5
R11	High Beech Lane	352564	193006	1.5
R12	Moor Street 1	353193	193723	4.5
R13	Moor Street 2	353187	193704	4.5
R14	Mounton Road 1	352798	193618	1.5
R15	Mounton Road 2	352561	193505	1.5
R16	Mounton Road 3	352691	193572	1.5
R17	Mounton Road 4	353112	193689	1.5
R18	Newport Road 1	352698	193202	1.5
R19	Newport Road 2	352749	193256	1.5
R20	Newport Road 3	352951	193440	1.5
R21	Riverside Day Nursery	353119	193699	1.5
R22	St Mary's CE School	353161	193172	1.5

Road Traffic

The assessment considers effects on air quality due to road traffic at properties within 200m of any roads which experience a change in traffic flow as a result of the Proposed Development. Traffic data used in this assessment was provided by Capita's Transport Team. Data was provided in one-way format AADT, %HDV and average speeds were calculated for each link. Speeds were reduced to 20 kph where necessary at junctions.

Traffic data used is shown in Table C.2 below and in Figure C.1 at the end of the Appendix.

Table C.2 Modelled Traffic Data (AADT, %HDV and Speed (km/h))

Road Link ID			2018 Baseline		2036 Do Nothing		2036 Do Something	
			AADT	HGV%	AADT	HGV%	AADT	HGV%
1	A48 Pwllmeyric	NB	8994.0	2.4%	12120	1.7%	12552	1.7%
		SB	7637.0	6.3%	10743	1.2%	10903	1.2%
2	A466 South of Roundabout	NB	8184.0	4.7%	12303	4.7%	12455	4.6%
		SB	11091.0	5.0%	12990	4.8%	13227	4.7%
3	A466 North of Roundabout	NB	5379.0	6.7%	8531	6.3%	8483	6.3%
		SB	5985.0	6.6%	7520	6.3%	7455	6.4%
4	A48 West of Bulwark Road	EB	5062.0	1.0%	6313	0.6%	6460	0.6%
		WB	6006.0	6.8%	6636	1.0%	6612	1.0%
5	A48 East of Bulwark Road	EB	7442.0	1.8%	8250	1.4%	8362	1.4%
		WB	8919.0	6.5%	8907	1.5%	8974	1.5%
6	Bulwark Road	NB	6138.0	1.8%	7539	1.5%	7768	1.5%
		SB	7136.0	3.4%	8320	1.0%	8659	1.0%
7	Mounton Road	EB	348.0	0.6%	283	1.1%	284	1.1%
		WB	965.0	0.5%	923	0.5%	928	0.5%
8	B4293	NB	2346.0	1.6%	3799	1.2%	3894	1.2%
		SB	3284.0	0.8%	4485	0.5%	4571	0.5%

Background Concentrations

The dispersion model estimates the atmospheric concentrations of traffic related pollutants across the site due to road traffic emissions. It is necessary to add an estimate of the baseline, or background, concentration to obtain the total concentration for comparison against the NAQOs.

Background concentrations from diffusion tube CH1 has been used to represent baseline NO₂ concentrations.

The monitored NO₂ value during 2018 has been utilised and the procedure to calculate baseline year NO_x and future year NO₂ and NO_x has been followed in line with TG16 guidance. PM₁₀ background values for all assessment years are derived from the Defra modelled background maps.

The background concentrations utilised at each receptor for both NO_x, NO₂ and PM₁₀ are shown in Table C.3 below

Table C.3 Background Concentrations for Modelled Receptors

	Receptor	2018		2036	
		NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)	NO ₂ (µg/m ³)	PM ₁₀ (µg/m ³)
R1	Bulwark Road 1	19.1	12.5	19.1	11.4
R2	Bulwark Road 2	19.1	12.5	19.1	11.4
R3	Castle Court Residential Home	19.1	12.5	19.1	11.4
R4	Chepstow Community Hospital	19.1	12.5	19.1	11.4
R5	Fair View 1	19.1	12.3	19.1	11.1
R6	Fair View 2	19.1	12.3	19.1	11.1
R7	Garden City Way (CH9)	19.1	12.5	19.1	11.4
R8	George Road	19.1	12.5	19.1	11.4
R9	Hardwick Hill Lane 1	19.1	12.5	19.1	11.4
R10	Hardwick Hill Lane 2	19.1	12.5	19.1	11.4
R11	High Beech Lane	19.1	12.3	19.1	11.1
R12	Moor Street 1	19.1	12.3	19.1	11.1
R13	Moor Street 2	19.1	12.1	19.1	10.9
R14	Mounton Road 1	19.1	12.5	19.1	11.4
R15	Mounton Road 2	19.1	12.5	19.1	11.4
R16	Mounton Road 3	19.1	12.5	19.1	11.4
R17	Mounton Road 4	19.1	12.5	19.1	11.4
R18	Newport Road 1	19.1	12.3	19.1	11.1
R19	Newport Road 2	19.1	12.5	19.1	11.4
R20	Newport Road 3	19.1	12.5	19.1	11.4
R21	Riverside Day Nursery	19.1	12.3	19.1	11.1
R22	St Mary's CE School	19.1	12.3	19.1	11.1

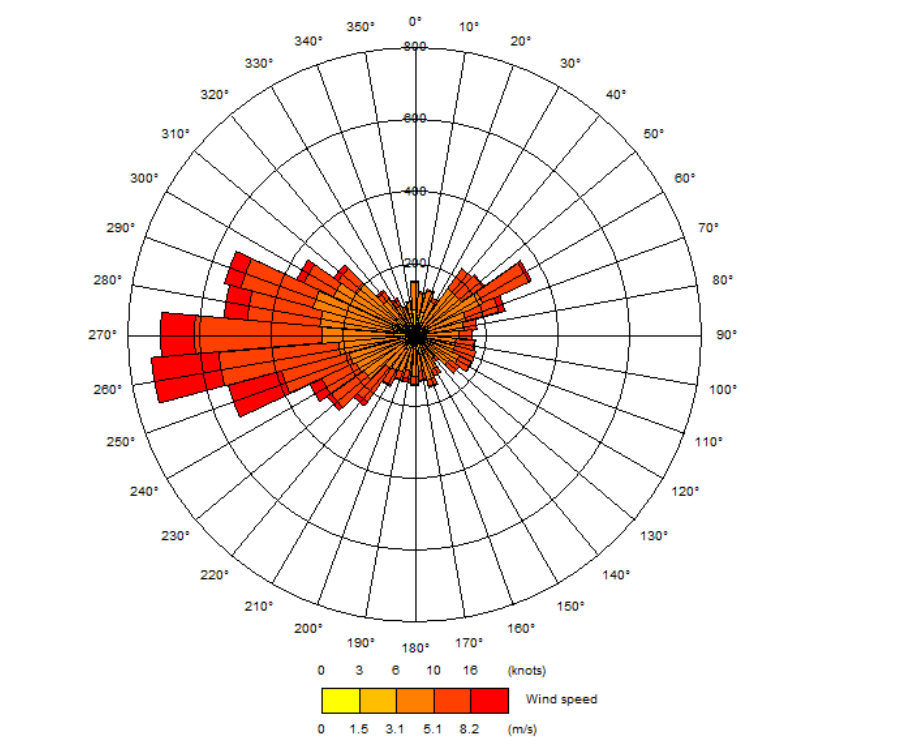
NO_x to NO₂

Predicted oxides of nitrogen (NO_x, a mixture of nitrogen oxide (NO) and NO₂) concentrations were converted to NO₂ using NO_x to NO₂ calculator v8.1 (August 2020) provided by Defra.

Meteorological Conditions

Hourly sequential meteorological data for 2018 from Rhoose near Cardiff Airport has been applied to the current assessment. This is located approximately 39km southwest of the Chepstow AQMA. The wind rose for the meteorological data used in the assessment is presented in Figure C.2.

Figure C.2 Rhoose Wind Rose 2018



Model Verification

Model verification has been undertaken following the methodology presented in Defra's guidance document LAQM.(TG16), Box 7.15. This guidance is widely recognised and followed throughout the air quality industry by local authorities and consultants alike. The process followed and data used is presented below.

An initial review of available local monitoring data was undertaken to assess the suitability of nearby sites for use in model verification. For each potential site, its proximity to the road (e.g. kerbside

locations within 1m of the roadside are not recommended for verification), data capture for the relevant period and relevance to the model area, and the availability of traffic data at the site were all taken into account.

The selected verification locations were then included in the 2018 Baseline model scenario as receptor points, to provide the modelled road contribution of NO_x at each location. This value was then compared with the monitored NO_x at each site. However, as the only data available regarding the verification sites is the total annual mean NO₂ concentration, the monitored road NO_x concentration was calculated using Defra's NO_x to NO₂ calculator and background concentrations of NO₂ and NO_x taken from Defra's background mapping. The relevant year and location is also user defined. Once processed, the calculator provides the monitored road NO_x contribution for each site.

The modelled road NO_x is then converted to the total modelled annual-mean NO₂ and compared with the monitored annual-mean NO₂ concentrations to determine whether adjustment of the model is necessary.

Table C.4 provides a comparison of the monitored and modelled annual-mean NO₂ concentrations.

Table C.4 Verification Process

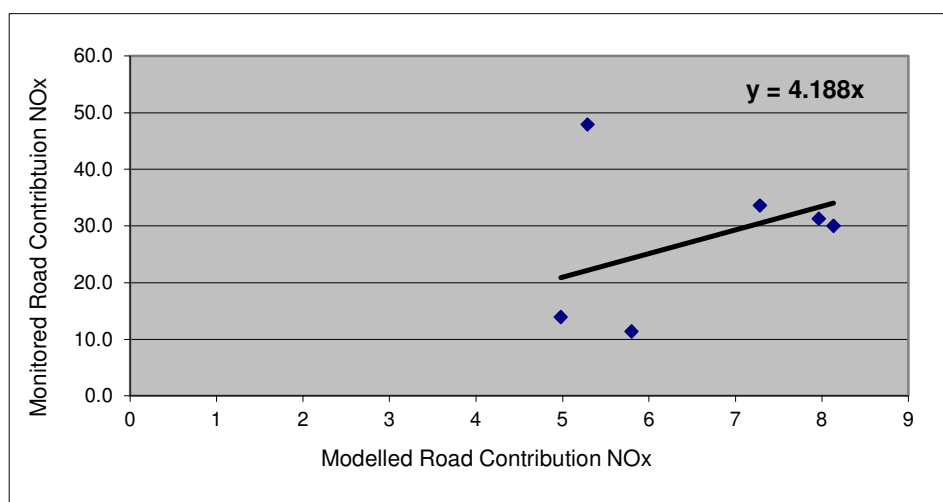
Site ID	2018 Monitored Total NO ₂ (µg/m ³)	2018 Background NO ₂ (µg/m ³)	2018 Monitored Road Contribution NO _x (µg/m ³)	2018 Modelled Road Contribution NO _x (µg/m ³)	2018 Modelled NO ₂ (includes background) (µg/m ³)	% Difference [(modelled - monitored)/monitored] x100
AQMS	36.0	19.1	16.9	7.3	22.97	-36
CH2	34.9	19.1	15.8	8.0	23.33	-33
CH4	42.5	19.1	23.4	5.3	21.92	-48
CH6	34.3	19.1	15.2	8.1	23.42	-32
CH7	25.1	19.1	6.0	5.8	22.19	-12
CH8	26.4	19.1	7.3	5.0	21.76	-18

The model is systematically underpredicting the monitored concentrations by almost 50% and as such the modelled results need to be corrected.

An adjustment factor has been calculated based on a comparison of the modelled and monitored road contribution of total NO_x concentrations. A graph of modelled vs monitored road contribution

NO_x was then created, including a trendline with the equation in the format of $y = mx$ and the intercept set at 0. “m” is the adjustment factor to be applied to the modelled road NO_x contribution.

Figure C.3 Graph of Modelled vs Monitored Road NO_x Contribution from SCC Monitoring



The relevant adjustment factor of 4.2 taken from Figure C.3 was then applied to the modelled road NO_x at each verification site and the resulting value combined with the annual mean NO₂ background in Defra’s “NO_x to NO₂” calculator. This provided the total adjusted modelled annual mean NO₂ concentration for each verification site, for comparison against the monitored total annual mean NO₂ concentration. This data is presented in Table C.5.

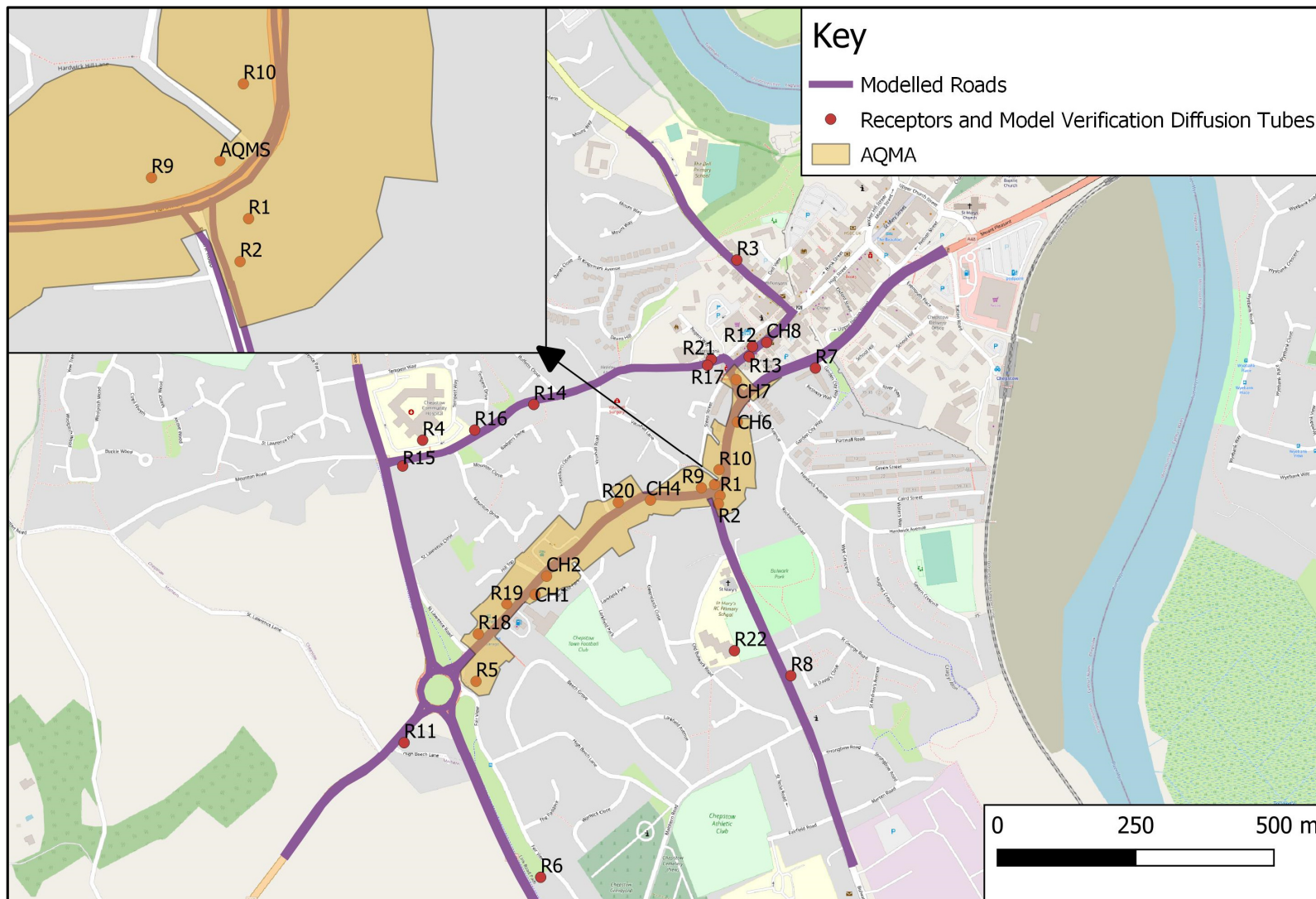
Table C.5 Post Adjustment Data

Site ID	Ratio of monitored road Contribution NO _x /modelled road contribution NO _x	Adjustment Factor Applied	Adjusted Modelled Road NO _x Contribution (µg/m³)	Adjusted Modelled Total NO ₂ (output from NO _x to NO ₂ calcs) (µg/m³)	Monitored Total NO ₂ (µg/m³)	% Difference (between Modelled and Monitored totals)
AQMS	4.6	4.2	30.4	34.5	36.0	-4
CH2	3.9		33.3	35.9	34.9	3
CH4	9.1		22.1	30.5	42.5	-28
CH6	3.7		34.0	36.2	34.3	5
CH7	2.0		24.2	31.5	25.1	26
CH8	2.8		20.8	29.9	26.4	13

The modelled results are now mostly within 25% of the monitored concentrations but with an underprediction of 28% remaining at CH4. However, this is expected as this location had an unusually higher monitored concentrations compared to the other locations and is ultimately a very localised event. As such, a correction factor of 4.2 has been applied to modelled road contribution of NOx and PM₁₀ which is appropriate for the general study area.

In Air Quality modelling, it is not always possible to remove all error from a model. The model input data comes from a range of sources, such as the traffic data and meteorological data, and compares the model outputs against additional data sources, such as the Local Authority monitoring used in model verification. All of these sources have their own errors associated with them (for example, the traffic data has been taken from a model with its own assumptions and errors). The model has been set up and corrected during the process to make it as representative as possible at this site, but it is impossible to get an exact representation of the reality, as a result of the number of variables involved. The use of an adjustment factor then accounts for the rest of the error that could not be removed. The use of an adjustment factor is a standard practice for dispersion modelling. The adjustment factor obtained in this assessment is in line with the similar assessments undertaken in the urban environment.

Figure C.4 Roads, Receptors and Monitoring Locations Utilised in the Model



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