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ENVIRONMENT

Lone Star Land Limited
Land off Balmoral Avenue
Banbury
Air Quality Assessment

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Air Quality Assessment

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October 2021

DOCUMENT ISSUE RECORD

Document Number:	**BP2-BWB-ZZ-ZZ-RP-LA-0001_AQA**
BWB Reference:	BMW-3250_AQA

Revision	Date of Issue	Status	Author:	Checked:	Approved:
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Notice

EXECUTIVE SUMMARY

BWB Consulting Limited was appointed by Lone Star Land Limited to undertake an air quality assessment for a residential development on land off Balmoral Avenue, Banbury development.

The proposed development Site is located within the administrative area of Cherwell District Council and is not located in, or in the vicinity of, an Air Quality Management Area.

A qualitative construction phase dust assessment was undertaken in accordance with Institute of Air Quality Management guidance and measures were recommended for inclusion in a Dust Management Plan to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions was considered to be 'not significant' in accordance with Institute of Air Quality Management guidance.

A detailed operational phase road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of nitrogen dioxide and particulate matter (PM_{10} and $PM_{2.5}$) were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance and Institute of Air Quality Management & Environmental Protection UK guidance. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with guidance.

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were also predicted across the proposed development Site and the suitability of the Site for the proposed residential use considered with regard to air quality. Pollutant concentrations were predicted to be below the relevant air quality objectives and the Site was therefore considered suitable for the proposed residential use with regard to the current air quality objectives.

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APPENDICES

1. INTRODUCTION

1.1 BWB Consulting Limited (BWB) was instructed by Lone Star Land Limited (the Client) to undertake an air quality assessment for a proposed residential development at land off Balmoral Avenue, Banbury ('the Site').

1.2 The assessment considers construction phase dust impacts and operational phase road traffic emissions. A qualitative construction phase dust assessment was undertaken in accordance with relevant guidance. A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified receptor locations. In addition, pollutant concentrations were predicted across the proposed development Site.

1.3 This report is necessarily technical in nature so to assist the reader a glossary of air quality terminology can be found in **Appendix A**.

Site Setting

1.4 The Site is located north of Broughton Avenue and is located within the administrative area of Cherwell District Council (CDC).

1.5 **Figure 1.1** details the location of the proposed development. The Site currently comprises open fields.

1.6 To the north of the Site lies existing residential dwellings on Thornbury Drive and to the east lies the consented residential development (planning reference 20/01643/OUT) and existing residential dwellings on Balmoral Avenue. To the south of the Site lies Broughton Road with agricultural land beyond with further agricultural land to the west.

1.7 Principal air pollution sources in the vicinity of the Site are likely to comprise road traffic emissions. The Site is not located within, or adjacent to, an existing Air Quality Management Area (AQMA); however CDC has declared an AQMA approximately 1.3km east of the Site, in Banbury town centre. This AQMA was declared for the potential exceedance of the annual mean air quality objective for nitrogen dioxide (NO_2).

Proposed Development

1.8 The proposed development comprises a residential development of 49 dwellings with public open space and other infastructure. The Site will be accessed off Balmoral Avenue from Broughton Road. The proposed development masterplan is detailed in **Appendix B**.

Figure 1.1 Site Location

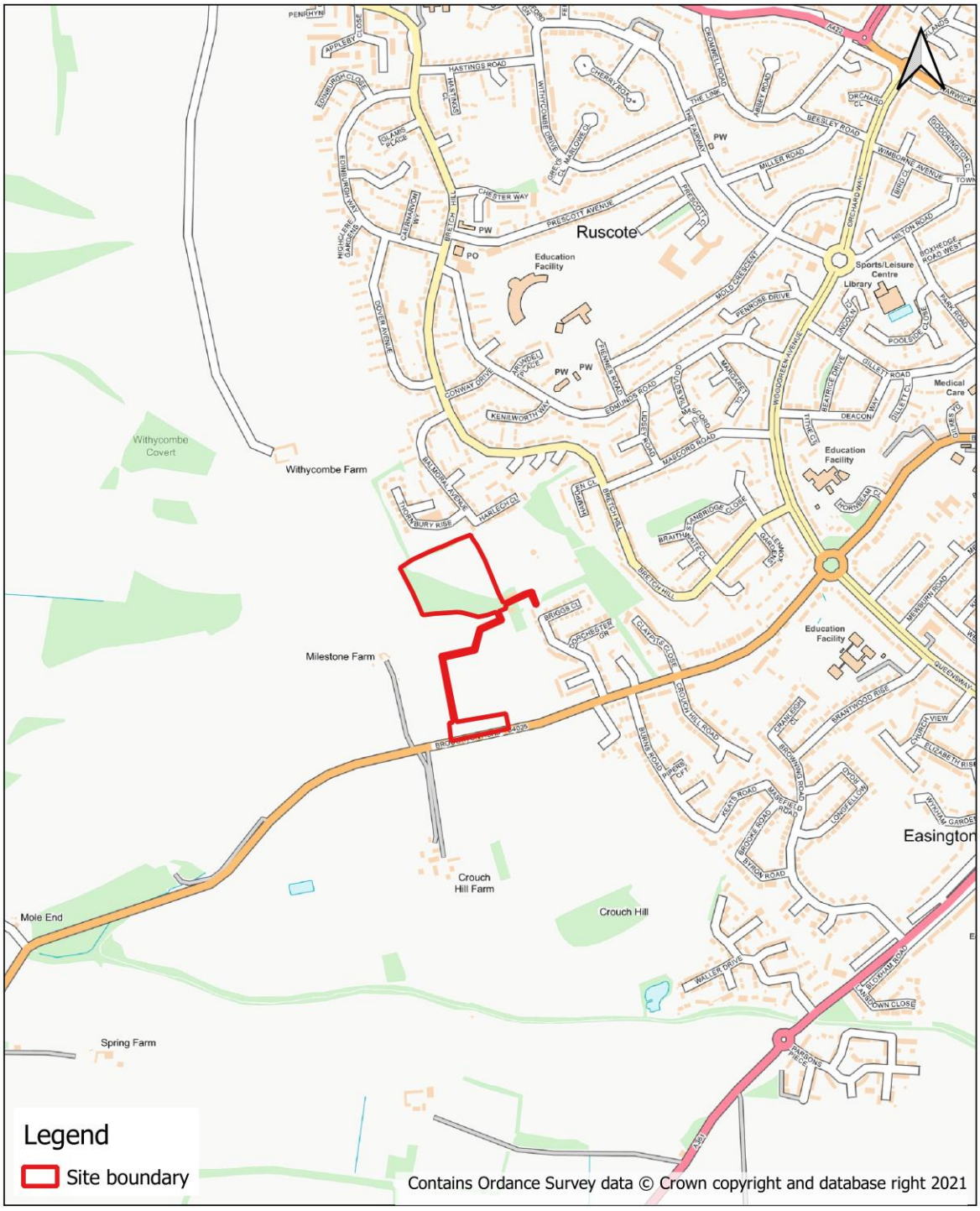

Figure 1.1: Site Location

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2. LEGLISLATION, PLANNING POLICY & GUIDANCE

National Legislation and Planning Policy

2.1 The following national legislation and planning policy is relevant to air quality and was considered in the undertaking of the assessment. A summary of the relevant national legislation and planning policy is provided in **Appendix C**:

- European Parliament, EU 2008 ambient Air Quality Directive (2008)[1];
- HMSO, Air Quality (England) Regulations (2000)[2];
- HMSO, Environment Act (1995)[3];
- Department for Environment, Air Quality Strategy (1997)[4];
- Department for the Environment, Food and Rural Affairs, Air Quality Strategy (2007)[5];
- Ministry of Housing, Communities and Local Government, National Planning Policy Framework (NPPF) (2021)[6]; and
- Ministry for Housing, Communities and Local Government, Planning Practice Guidance (PPG) for air quality (2019)[7].

Local Planning Policy

2.2 The following local and regional planning policy was considered in the undertaking of the assessment and a summary is provided in **Appendix C**:

- Cherwell District Council, Adopted Cherwell Local Plan 20211 – 2031 Part 1 (2015)[8].

Air Quality Assessment Guidance

2.3 The following guidance was utilised in the air quality assessment:

- Defra, Local Air Quality Management Technical Guidance (LAQM.TG(16)) (2021)[9];
- Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction (2014)[10]; and
- Institute of Air Quality Management and Environmental Protection UK, Land-Use Planning and Development Control: Planning for Air Quality (2017)[11].

[1] European Parliament (2008) Council Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe
[2] HMSO (2000) Statutory Instrument 2000 No. 928, The Air Quality (England) Regulations 2000 (as amended), London: HMSO
[3] HMSO (1995) The Environment Act 1995, London: TSO
[4] Department of the Environment (DoE) (1997) The UK National Air Quality Strategy, London: HMSO
[5] Department of the Environment, Food and Rural Affairs (Defra) (2007) The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, London: HMSO
[6] Ministry of Housing, Communities & Local Government (2021) National Planning Policy Framework, HMSO London
[7] Ministry for Housing, Communities and Local Government (2019) Planning Practice Guidance Air Quality
[8] Cherwell District Council (2015) Adopted Cherwell Local Plan 2011 – 2031 Part 1
[9] Defra (2021) Local Air Quality Management Technical Guidance LAQM.TG(16)
[10] Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, London
[11] Institute of Air Quality Management and Environmental Protection UK (2017) Land-Use Planning and Development Control: Planning for Air Quality

3. METHODOLOGY

3.1 The methodology utilised in the air quality assessment is summarised below and was based on the air quality assessment methodology utilised for the consented neighbouring residential development, which was accepted by CDC:

- Construction Phase - A construction phase dust assessment was under taken and relevant measures to mitigate construction phase dust emissions were recommended. The assessment was undertaken in accordance with guidance provided by the Institute of Air Quality Management (IAQM)[10].
- Operational Phase – A detailed operational phase road traffic emissions assessment was undertaken to consider the impact of development-generated traffic on local air quality and predict pollutant concentrations at the proposed development Site. The dispersion model ADMS-Roads was used to model concentrations of oxides of nitrogen (NOx) and particulate matter (PM_{10} and $PM_{2.5}$) at identified existing receptor locations for both without and with development scenarios. The change in pollutant concentrations as a result of development-generated traffic was then calculated. The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance (LAQM.TG16)[9] and Institute of Air Quality Management and Environmental Protection UK (EPUK)[11]. Pollutant concentrations were predicted across the Site to consider the suitability of the Site for residential use.

3.2 Full details of the methodology used in the assessment, are provided below.

Construction Phase Dust Assessment

3.3 An assessment of the potential impacts arising from the construction of the proposed development was undertaken in accordance with IAQM Guidance[10]. The full assessment methodology is not reproduced within this report but a summary of the assessment steps are provided below:

- Step 1 – screen the requirement for a more detailed assessment. No assessment is required if there are no receptors within a certain distance of the works.
- Step 2 – assess the risk of dust impacts separately for each of the four activities considered (demolition, earthworks, construction and trackout).
    - Step 2A – determine the potential dust emission magnitude for each of the four activities;
    - Step 2B – determine the sensitivity of the area;
    - Step 2C – determine the risk of dust impacts by combining the findings of steps 2A and 2B.
- Step 3 – determine the site-specific mitigation for each of the four activities; and
- Step 4 – examine the residual effects and determine significance.

Operational Phase Road Traffic Emissions – Detailed Assessment

Air Dispersion Modelling

3.4 The air dispersion model ADMS-Roads, version 5.0.0.1 was utilised in the assessment to predict concentrations of NOx, PM_{10} and $PM_{2.5}$ at existing and proposed receptor locations.

3.5 The assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[9] and Institute of Air Quality Management and Environmental Protection UK guidance[11].

Assessment Scenarios and Traffic Data

3.6 The following scenarios were considered in the air dispersion modelling:

- Scenario 1: 2019 Verification Year;
- Scenario 2: 2021 Base Year;
- Scenario 3: 2024 Opening Year without development;
- Scenario 4: 2024 Opening Year with development;
- Scenario 5: 2024 Opening Year without development, sensitivity analysis; and
- Scenario 6: 2024 Opening Year with development, sensitivity analysis

3.7 Traffic data were obtained from David Tucker Associates, the Transport Consultants for the project. Traffic flows associated with the neighbouring consented residential development (planning reference 20/01643/OUT) was included in model scenarios 2 – 4.

3.8 24-hour Annual Average Daily Traffic Data (AADT) and Heavy Duty Vehicle (HDV) proportions were provided for the following roads for use in the assessment:

- A361 Horsefair;
- A361 South Bar Street;
- B4035 Broughton Road;
- B4035 West Bar Street;
- Balmoral Avenue; and
- High Street.

3.9 In addition traffic data for the A361 Bloxham Road and the A4260 Oxford Road were obtained from the Department for Transport (DfT)[12] for use in the impact assessment. DfT data for the A4260 Banbury Road was used in the verification of the ADMS-Roads model.

3.10 Consideration was given to the speeds at which vehicles are likely to travel within the study area. Free-flowing traffic conditions were modelled at speeds provided by the

[12] Department for Transport (https://roadtraffic.dft.gov.uk/) [accessed 23/08/2021]

Transport Consultants. Queuing sections were modelled in accordance with Defra guidance[9].

3.11 Traffic data used in the air dispersion modelling are provided in **Appendix D** and shown in **Figure D1**.

ADMS-Roads Model Inputs

3.12 The following model inputs were utilised in the assessment:

- Emission Factors – emission factors were utilised from the Defra Emission Factor Toolkit[13] (EFT), version 10.1, for the years of assessment (2019, 2021 and 2024).
- Conversion of oxides of nitrogen – concentrations of NOx were predicted using the ADMS-Roads dispersion model. These concentrations were converted to nitrogen dioxide (NO_2) using the Defra NOx to NO_2 calculator[14], version 8.1.
- Meteorological data – hourly sequential meteorological data for the verification year of assessment (2019) were obtained for the Church Lawford recording station which is the closest and most representative meteorological station. The wind rose for 2019 is provided in **Appendix E**.
- Surface roughness and Monin-Obukhov length (MO) – Site – a surface roughness of 0.75 and an MO length of 30 were utilised in the air dispersion model to represent the suburban conditions at the Site and within the Study area.
- Surface roughness and Monin-Obukhov length (MO) – Meteorological Station – a surface roughness of 0.3 and an MO length of 10 were utilised in the air dispersion model to represent rural conditions at the meteorological station.
- Background pollutant concentrations – background concentrations of PM_{10} and $PM_{2.5}$ for the study area were obtained from the pollutant concentration maps[15] provided by Defra as a 1km x 1km grid of the UK, for the years of assessment (2019, 2021 and 2024). Background NO_2 concentrations were obtained from CDC background monitoring data and adjusted utilising the methodology provided by Defra guidance[9] for 2021 and 2024.
- Model verification – model verification was undertaken using CDC monitoring data available for the study area. Full details of the verification procedure are provided in **Appendix F**.
- Calculation of short term PM_{10} concentrations – the following calculation, as detailed in Defra guidance[9], was utilised to calculate the number of exceedances of the 24-hour mean PM_{10} air quality objective:

$$\text{Number of 24-Hour Mean Exceedance} = -18.5 + 0.00145 * \text{Annual Mean}^3 + (206 / \text{Annual Mean})$$

- The IAQM released a position statement[16] in July 2018 regarding dealing with the uncertainty in vehicle NOx emissions within air quality assessments. This recommends that sensitivity analyses be undertaken and professional judgement be applied to consider the scenario where NOx emissions do not reduce as rapidly as shown by the EFT. Defra released new versions of the air quality assessment tools in August 2020, including updated versions of the background concentration maps, EFT and NOx to NO_2 Calculator. At the time of writing the IAQM had not published a revised position

[13] Defra (2020) Emission Factor Toolkit [https://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html]
[14] Defra (2020) NOx to NO_2 Calculator [https://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOxNO2calc]
[15] Defra (2020) background pollutant concentration maps [https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2019]
[16] Institute of Air Quality Management (2018) Position Statement: Dealing with Uncertainty in Vehicle NOx Emissions within Air Quality Assessments, Version 1.1

statement. As such, and to provide a conservative assessment, a sensitivity analysis was undertaken and emission factors, NOx to NO_2 calculator inputs and background concentrations were kept at base year (2021) levels. Details of the sensitivity analysis are provided in **Appendix G**.

Receptor Locations

Existing Sensitive Receptors

3.13 Existing receptor locations were identified within close proximity of the road links detailed in paragraph 3.7 and considered in the operational phase road traffic emissions assessment. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the identified existing receptor locations for the assessment scenarios detailed in paragraph 3.6. Where possible the closest receptors to those road links were considered, as these receptors are likely to experience the greatest change in pollutant concentrations as a result of the proposed development. Ground floor receptors were modelled at a height to 1.5m whilst first floor receptors were modelled at a height of 3m.

3.14 The existing receptor locations are detailed in **Table 3.1** and **Figure 3.1.**

Table 3.1: Existing Sensitive Receptor Locations

Receptor	Grid Reference		Details	Height Modelled
	X	Y		(m)
Long Term Receptors				
R1	443991	239731	Residential dwelling on Balmoral Avenue	1.5
R2	444015	239740	Residential dwelling on Balmoral Avenue	1.5
R3	444015	239705	Residential dwelling on Broughton Road	1.5
R4	445261	240400	Residential dwelling on West Bar Street	1.5
R5	445341	240382	Residential dwelling on Horsefair above commercial use	3.0
R6	445378	240430	Residential dwelling on High Street	1.5
R7	445430	240428	Residential dwelling on High Street above commercial use	3.0
R8	445425	240447	Residential dwelling on High Street above commercial use	3.0
R9	445357	240514	Residential dwelling on Horsefair	1.5
R10	445341	240084	Residential dwelling on A361	2.0
R11	445322	240063	Residential dwelling on Bloxham Road	1.5

Receptor	Grid Reference		Details	Height Modelled
	X	Y		(m)
R12	445347	240107	St John's Priory School	1.5
R13	444982	240312	Banbury & Bicester College	1.5
R14	445186	240332	Residential dwelling on West Bar Street	1.5
R15	445270	240011	Harriers Banbury Academy	1.5
R16	445246.2	240051.8	Residential dwelling on Bloxham Road	1.5
R17	445378.3	239996.2	Residential dwelling on Oxford Road	1.5
R18	445483.1	239699.8	Horton General Hospital	1.5
R19	445361.3	239945.1	Residential dwelling on Oxford Road	1.5

Figure 3.1: Existing Receptor Locations

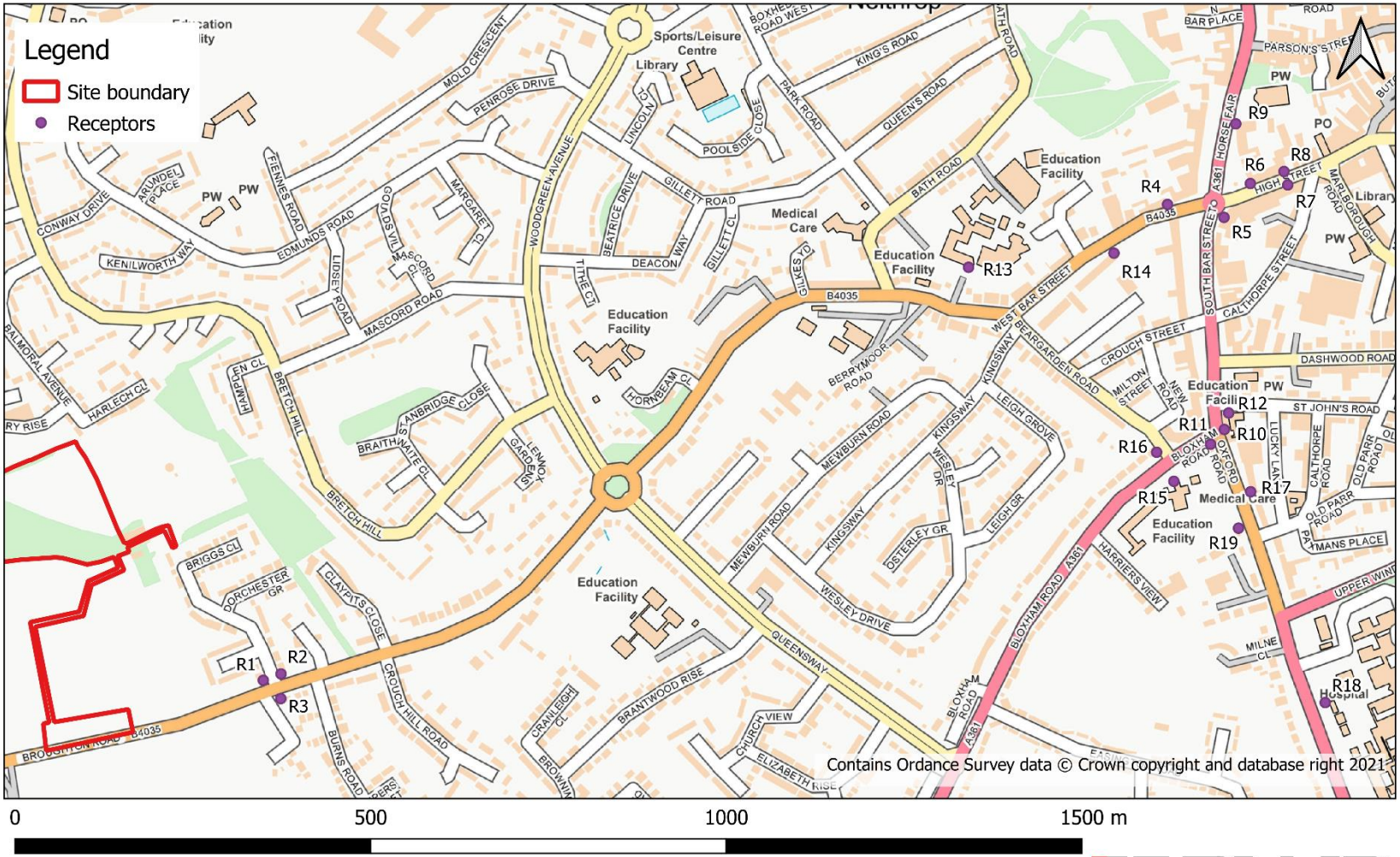

Figure 3.1: Operational Phase Road Traffic Impact Assessment - Existing Receptors

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Proposed Receptor Locations

3.15 Pollutant concentrations were predicted across the proposed development Site to consider exposure of future residents of the proposed development to air pollution. A Cartesian grid was modelled across the proposed development Site at a height of 1.5m to represent the average breathing height at ground floor of the proposed development.

Limitations and Assumptions

3.16 There are uncertainties associated with both measured and predicted pollutant concentrations. The model (ADMS-Roads) used in this assessment relies on input data, which are also subject to uncertainty. The model itself simplifies complex physical systems into a range of algorithms. In addition, local micro-climatic conditions may affect the concentrations of pollutants that the ADMS-Roads model will not take into account.

3.17 The assessment is based on traffic data provided by David Tucker Associates, the transport consultants for the project. As such any assumptions made by the transport consultants will also influence the air quality assessment.

3.18 In future years scenarios, uncertainty relates to the projection of vehicle emissions and, in particular the rate at which emissions per vehicle will improve over time. This assessment utilised the most recent version of the Defra EFT[13] to provide the most up to date estimate of current and future emission projections.

3.19 To reduce the uncertainty associated with predicted concentrations, model verification was carried out following guidance set out in Defra guidance[9]. As the models were verified using local monitoring data and adjusted accordingly, there can be reasonable confidence in the predicted concentrations.

Assessment Criteria

3.20 Predicted pollutant concentrations were compared to the relevant air quality objectives[4]. The current relevant air quality standards and objectives are detailed in **Table 3.2**.

Table 3.2: Air Quality Standards and Objectives (England)

Pollutant	Averaging Period	Air Quality Objective ($\mu g.m^{-3}$)	Date to Achieve by
NO_2	Annual Mean	40	31 December 2005
	1-hour mean not to be exceeded more than 18 times per year	200	31 December 2005
PM_{10}	Annual Mean	40	31 December 2004
	24-hour mean not to be exceeded more than 35 times per year	50	31 December 2004

Pollutant	Averaging Period	Air Quality Objective ($\mu g.m^{-3}$)	Date to Achieve by
$PM_{2.5}$	Annual mean target (15% cut in annual mean (urban background exposure)	25	2010 - 2020

3.21 Guidance is provided by the Institute of Air Quality Management and Environmental Protection UK[11] to determine the significance of the impact of development-generated road traffic emissions on local air quality. The impact descriptors at receptor locations are detailed in **Table 3.3.** These impact descriptors consider the predicted magnitude of change in pollutant concentrations and the concentration in relation to the relevant air quality objectives.

Table 3.3: Impact Descriptors for Individual Receptors

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

Note: Figures rounded up to the nearest whole number, therefore any value less than 1% after rounding (effectively less than 0.5%) will be described as negligible.

4. BASELINE CONDITIONS

Local Air Quality Management

4.1 The proposed development is not located within or adjacent to an AQMA however, CDC has declared an AQMA approximately 1.3km east of the Site in the centre of Banbury. The AQMA was designated for the potential exceedance of the annual mean NO_2 air quality objective.

Local Air Quality Monitoring

Nitrogen Dioxide

4.2 CDC undertake NO_2 monitoring utilising a network of passive diffusion tubes. The closest monitoring location to the Site is the urban background diffusion tube located on Cranleigh Close, 450m south east of the Site.

4.3 Model verification was undertaken utilising the Oxford Road 2014 monitoring location and further details regarding the verification process can be found in **Appendix E**.

4.4 Bias adjusted NO_2 monitoring results, for the locations in the vicinity of the proposed development Site, are detailed in **Table 4.1**.

Table 4.1: CDC NO_2 Monitoring Data in 2015 – 2019

Location and Reference	Grid Reference		Site Monitoring Type	Distance from and direction to Site boundary	Monitored Annual Average Concentration (µg.m^{-3})				
					2015	2016	2017	2018	2019
High Street	445407	240421	Kerbside	1.6km east	35.3	34.6	35.0	32.3	34.6
North Bar	445352	240774	Kerbside	1.7km north east	38.9	36.5	36.9	34.5	34.0
Oxford Road / South Bar	445333	240100	Kerbside	1.5km east	33.2	35.5	33.4	36.1	35.3
Horsefair	445351	240578	Roadside	1.6km east	**40.9**	38.8	**41.8**	38.7	38.6
Oxford Road 2014	446774	237620	Roadside	3.5km south east	19.4	22.1	20.3	20.0	17.1

4.5 Monitored concentrations in 2019 were below the annual mean air quality objective for NO_2 at all monitoring locations close to the Site. Annual mean NO_2 concentrations fluctuated at the monitoring locations over the last five years however, there is a slight downward trend in concentrations, suggesting air quality in the area is improving with the exception of the Oxford Road / South Bar monitoring location.

4.6 With the exception of the Oxford Road 2014 monitoring location, all monitoring locations detailed in **Table 4.1** are situated within the AQMA and therefore elevated pollutant concentrations are anticipated. These monitoring locations were therefore

not considered representative of conditions at the Site given the location of the Site outside the AQMA and in a less urban environment.

4.7 The Oxford Road 2014 monitoring location is situated on the outskirts of Banbury and is therefore considered representative of conditions at the Site. This monitoring location was therefore utilised within model verification. Further details of the model verification process are available in **Appendix E**.

Particulate Matter (PM_{10} and $PM_{2.5}$)

4.8 CDC does not undertake particulate matter monitoring within the administrative area.

Background Pollutant Concentrations

4.9 Background air quality monitoring is undertaken by CDC within the study area on Cranleigh Close, 450m south east of the Site.

Table 4.2: Background NO_2 Monitoring 2015 - 2019

Location and Reference	Grid Reference		Site Monitoring Type	Distance from and direction to Site boundary	Monitored Annual Average Concentration (µg.m^{-3})				
					2015	2016	2017	2018	2019
Cranleigh Close	444366	239654	Urban Background	450m south east	10.9	12.5	10.7	12.3	11.0

4.10 The background concentrations of NO_2 were well below the annual mean air quality objective between 2015 and 2019. The monitored NO_2 concentration was utilised within the assessment as it was considered representative of conditions at the Site. The monitored NO_2 background concentrations were adjusted utilising the methodology for utilising monitoring background concentrations for future years detailed in Defra guidance[9].

4.11 As CDC do not undertake PM_{10} or $PM_{2.5}$ background monitoring in the administrative area, background PM_{10} and $PM_{2.5}$ concentrations were obtained from the latest Defra background concentration maps[15], which are provided for the UK as a 1km x 1km grid network. The latest maps are based on 2018 monitoring and meteorological data. Background concentrations of NO_2, PM_{10} and $PM_{2.5}$ were obtained for the grid squares covering the study area for the years of assessment (2019, 2021 and 2024). The background concentrations used in the assessment are detailed in **Table 4.3.**

Table 4.3: Background Pollutant Concentrations used in the Assessment

Pollutant	Grid Square	Monitoring Locations / Receptors	Concentration (µg.m^{-3})		
			2019	2021	2024
Monitoring Locations Used in Verification					

Pollutant	Grid Square	Monitoring Locations / Receptors	Concentration (µg.m^{-3})		
			2019	2021	2024
NO_2	446500, 237620	OxfordRoad2014	11.0	10.2	9.3
PM_{10}			14.6	14.2	13.7
$PM_{2.5}$			9.4	9.2	8.7
Receptors					
NO_2	443500, 239500	R1	11.0	10.2	9.3
PM_{10}			14.8	14.4	13.9
$PM_{2.5}$			9.4	9.1	8.7
NO_2	444500, 239500	R2 - R3	11.0	10.2	9.3
PM_{10}			14.9	14.4	13.9
$PM_{2.5}$			10.1	9.8	9.4
NO_2	445500, 240500	R4 – R12, R14- R16	11.0	10.2	9.3
PM_{10}			15.4	15.0	14.4
$PM_{2.5}$			10.6	10.2	9.8
NO_2	444500, 240500	R13	11.0	10.2	9.3
PM_{10}			15.6	15.1	14.6
$PM_{2.5}$			11.0	10.6	10.2
NO_2	445500, 239500	R17 – R19	11.0	10.2	9.3
PM_{10}			14.9	14.4	13.9
$PM_{2.5}$			10.2	9.9	9.5

4.12 2019, 2021 and 2024 background concentrations are below the relevant annual mean air quality objectives for NO_2, PM_{10} and $PM_{2.5}$. The Site is located on the outskirts of Banbury and agricultural fields are located to the west of the Site. The main contribution of PM_{10} in vicinity of the Site, is residual and secondary sources which will include agriculture.

5. CONSTRUCTION PHASE DUST ASSESSMENT

5.1 The construction phase of the proposed development will involve a number of activities which have the potential to impact on local air quality. These include emissions of dust generated through demolition, excavation, construction, earthworks and trackout activities, exhaust pollutant emissions from construction traffic on the local highways network, and exhaust emissions from non-road mobile machinery (NRMM) within the construction site itself.

5.2 The location of sensitive receptors in relation to construction activities will affect the potential for such construction activities to cause dust soiling, nuisance and local air quality impacts. Meteorological conditions and the use of control measures will also contribute to the effects experienced.

Step 1: Screen the Need for a Detailed Assessment

5.3 Step 1 of the IAQM guidance[10] involves a screening assessment to consider whether a more detailed construction phase dust assessment is required.

5.4 In accordance with the guidance, a detailed assessment is required if:

- Human receptors are located within 350m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances; or
- Ecological receptors are located within 50m of the boundary of the site or 50m of routes used by construction vehicles on the public highways, up to 500m from the site entrances.

5.5 From a review of the Multi Agency Geographic Information for the Countryside (MAGIC) website[17], no ecological designations were identified within the above screening distance and therefore the impact on ecological designations was not considered further. However human receptors are located within the above screening distances, with the closest of these receptors located off Balmoral Avenue and within the consented residential development off Balmoral Avenue. A construction phase assessment was therefore undertaken.

Step 2: Assess the Risk of Dust Impacts

Step 2A: Define the Potential Dust Emission Magnitude

5.6 The dust emission magnitudes for the construction activities were defined using the criteria detailed in the IAQM guidance[10] as detailed in **Table 5.1**. Demolition is not proposed as part of the development and therefore wasn't considered further in the assessment.

[17] Defra, Multi Agency Geographic Information for the Countryside (MAGIC) [http://magic.defra.gov.uk/]

Table 5.1: Dust Emission Magnitude Criteria and Definition

Activity	IAQM Dust Emission Magnitude	IAQM Dust Emission Magnitude Criteria
Earthworks	Large	Total site area >10,000m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes.
	Medium	Total site area 2,500m^2 – 10,000m^2, moderately dusty soil type (e.g. silt), 5 - 10 heavy earth moving vehicles active at any one time, formation of bunds 4m - 8m in height, total material moved 20,000 tonnes – 100,000 tonnes.
	Small	Total site area <2,500m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4m in height, total material moved <20,000 tonnes, earthworks during wetter months.
Construction	Large	Total building volume >100,000m^3, on site concrete batching, sandblasting.
	Medium	Total building volume 25,000m^3 – 100,000m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.
	Small	Total building volume <25,000m^3, construction material with low potential for dust release (e.g. metal cladding or timber).
Trackout	Large	>50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m.
	Medium	10 - 50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m.
	Small	<10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

5.7 The following dust emissions magnitudes were defined for the proposed development:

- Earthworks – The Site area is greater than 10,000m^2, the dust emissions magnitude for earthworks was therefore defined as **Large**.
- Construction – The total building volume is less than 25,000m^3 and the dust emissions magnitude for construction was therefore defined as **Small**.
- Trackout – Less than 10 HDV movements are anticipated in any one day and therefore the dust emissions magnitude was therefore defined as **Small**.

5.8 A summary of the defined dust emissions magnitudes for the development are provided in **Table 5.2**.

Table 5.2: Summary of Project Defined Dust Emissions Magnitudes

Activity	Dust Emissions Magnitude
Earthworks	Large
Construction	Small
Trackout	Small

Step 2B: Define the Sensitivity of the Area

5.9 The assessment requires the determination of the sensitivity of the area for the purposes of dust soiling and human health impacts. The sensitivity of the study area takes into account the specific receptors in the vicinity of the Site, the proximity and number of those receptors, the local background concentration of PM_{10} and site-specific factors. **Figure 5.1** was utilised to determine the number of receptors located within the distance bands provided in the IAQM guidance[10] for determining receptor sensitivity.

5.10 The sensitivity of the area is defined below, in accordance with IAQM criteria[10] and summarised in **Table 5.3**.

- Dust Soiling – There are 10 - 100 highly sensitive residential receptors are located within 20m of the proposed Site boundary which includes consented residential dwellings. The sensitivity of the area to dust soiling is defined as '**High**'.
- Human Health – There are 10 – 100 highly sensitive residential receptors within 20m of the proposed Site boundary. The background PM_{10} concentration is less than 24µg.m^{-3} and therefore the sensitivity of the area to human health effects is '**Low'**.

Table 5.3: Determination of the Sensitivity of the Area

Potential Impact	Sensitivity		
	Earthworks	Construction	Trackout
Dust Soiling	High	High	High
Human Health	Low	Low	Low

Figure 5.1: Construction Phase Assessment Dust Distance Buffers

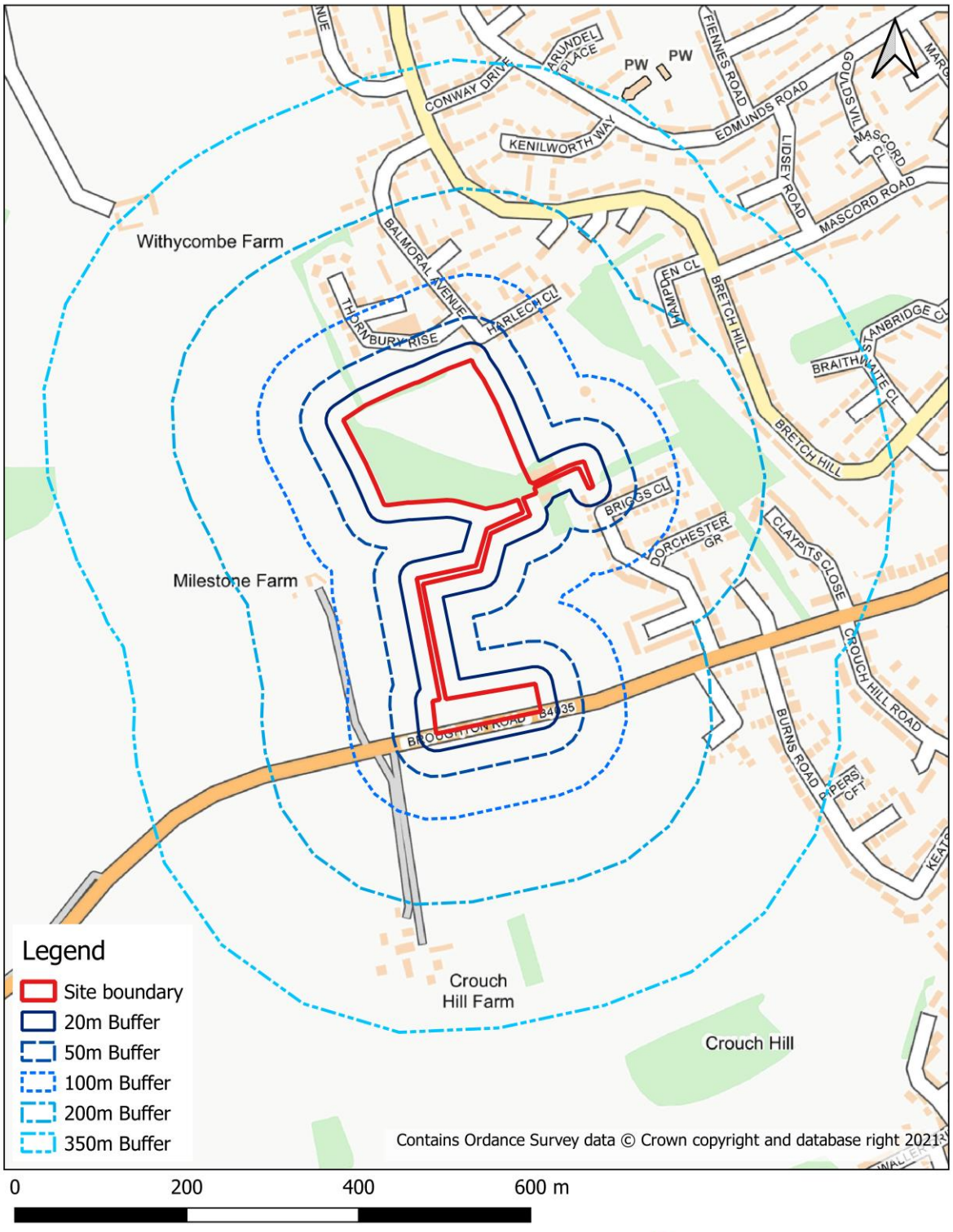

Figure 5.1: Construction Phase Dust Assessment Distance Buffers

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Step 2C: Define the Risk of Impacts

5.11 The dust emission magnitude determined in Step 2A is then combined with the sensitivity of the area determined in Step 2B to define the risk of dust impacts with no mitigation applied. The results of this assessment are detailed in **Table 5.4.**

Table 5.4: Summary Dust Risk Table to Define Site Specific Risk

Activity	Step 2A: Dust Emission Magnitude	Step 2B: Sensitivity of the Area	Step 2C: Risk of Dust Impacts
Dust Soiling Effects on People and Property			
Earthworks	Large	High	High Risk
Construction	Small	High	Low Risk
Trackout	Small	High	Low Risk
Human Health Impacts			
Earthworks	Large	Low	Low Risk
Construction	Small	Low	Negligible
Trackout	Small	Low	Negligible

Step 3: Site-Specific Mitigation

5.12 The risk of dust impacts, defined in Step 2C of the assessment, is used to determine the mitigation measures required to minimise the emission of dust during construction phase activities. The IAQM guidance[10] provides details of highly recommended and desirable mitigation measures which are commensurate with the risk of dust impacts defined in Step 2C for construction, earthworks and trackout activities. Where the mitigation measures are general in nature, the highest risk category was applied in accordance with the guidance[10]. The highest risk category identified was 'High Risk' and the recommended mitigation taken from the IAQM guidance[10] is detailed in **Table 5.5** and **Table 5.6**.

Table 5.5: Mitigation Measures for a High Risk Site

Category	Mitigation Measures for a High Risk Site	
	Highly Recommended	Desirable
Communication	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.	None
	Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may	

Category	Mitigation Measures for a High Risk Site	
	Highly Recommended	**Desirable**
	be the environmental manager/engineer or the site manager.	
	Display the head or regional office contact information.	
	Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk, and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. In London additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include monitoring of dust deposition, dust flux, real-time PM_{10} continuous monitoring and/or visual inspections.	
Site Management	Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner and record the measures taken.	None
	Make the complaints log available to the local authority when asked.	
	Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.	
	Hold regular liaison meetings with other high risk construction sites within 500m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.	
Monitoring	Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of the site boundary, with cleaning to be provided as necessary.	None
	Carry out regular site inspections to monitor compliance with the DMP, record inspections results, and make an inspection log available to the local authority when asked.	

Category	Mitigation Measures for a High Risk Site	
	Highly Recommended	**Desirable**
	Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	
Preparing and maintaining the site	Plan the site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	None
	Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.	
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.	
	Avoid site runoff of water or mud.	
	Keep site fencing, barriers and scaffolding clean using wet methods.	
	Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.	
	Cover, seed or fence stockpiles to prevent wind whipping.	
Operating vehicle/ machinery and sustainable travel	Ensure all vehicles switch off engines when stationary – no idling vehicles.	None
	Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	
	Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on un-surfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable control measures provided, subject to the approval of the nominated undertaker with the agreement of the local authority, where appropriate).	
	Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	
	Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).	
Operations	Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such	None

Category	Mitigation Measures for a High Risk Site	
	Highly Recommended	**Desirable**
	as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	
	Ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	
	Used enclose chutes and conveyors and covered skips.	
	Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.	
	Ensure equipment is readily available on site to clean and dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	
Waste Management	Avoid bonfires and burning of waste materials.	None

Table 5.6: Mitigation Measures Specific to Earthworks, Construction and Trackout

Category	Mitigation Measures	
	Highly Recommended	**Desirable**
Earthworks (High Risk Site)	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	None
	Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	
	Only remove the cover in small areas during work and not all at once.	
Construction (Low Risk Site)	None	Avoid scabbling (roughening of concrete surfaces) if possible.
		Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
Trackout (Low Risk Site)	None	Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any materials tracked out of the site. This may require the sweeper being continuously in use.
		Avoid dry sweeping of large areas.
		Ensure vehicles entering and leaving the sites are covered to prevent escape of materials during transport.

Category	Mitigation Measures	
	Highly Recommended	Desirable
		Record all inspections of haul routes and any subsequent action in a site log book.
		Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

Step 4: Determine Significant Effects

5.13 In accordance with IAQM guidance[10], with the implementation of the mitigation measures detailed in Step 3, the residual impacts from the construction phase are considered to be 'not significant'.

6. OPERATIONAL PHASE ROAD TRAFFIC EMISSIONS ASSESSMENT

Baseline Assessment

6.1 Pollutant concentrations were predicted at the identified existing sensitive receptor locations using the dispersion model ADMS-Roads. Predicted pollutant concentrations for Scenario 2: 2021 Base Year and Scenario 3: 2024 Opening Year without development are detailed in **Table 6.1.**

Table 6.1: Predicted Annual Mean Pollutant Concentrations for Scenario 2: 2021 Base Year and Scenario 3: 2024 Opening Year Without Development at Existing Receptor Locations

Receptor	Scenario 2: 2021 Base Year (µg.m^{-3})			Scenario 3: 2024 Opening Year Without Development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R1	12.6	15.0	9.4	11.1	14.5	9.0
R2	12.7	15.0	10.1	11.2	14.6	9.7
R3	12.1	14.8	10.0	10.7	14.4	9.6
R4	14.9	16.0	10.8	12.9	15.6	10.5
R5	17.5	16.6	11.2	14.9	16.1	10.8
R6	20.2	17.3	11.6	17.0	16.9	11.2
R7	17.2	16.6	11.2	14.7	16.1	10.8
R8	18.0	16.8	11.3	15.3	16.4	10.9
R9	15.5	16.2	10.9	13.3	15.7	10.5
R10	20.8	17.3	11.6	17.3	16.9	11.2
R11	17.9	16.7	11.2	15.1	16.2	10.8
R12	17.0	16.5	11.1	14.5	16.0	10.7
R13	11.5	15.4	10.8	10.3	15.0	10.4
R14	12.8	15.6	10.6	11.3	15.1	10.2
R15	13.0	15.6	10.6	11.4	15.1	10.2

Receptor	Scenario 2: 2021 Base Year (µg.m^{-3})			Scenario 3: 2024 Opening Year Without Development (µg.m^{-3})		
	NO_2	PM_{10}	$PM_{2.5}$	NO_2	PM_{10}	$PM_{2.5}$
R16	13.7	15.8	10.7	11.9	15.3	10.3
R17	16.7	16.0	10.7	14.2	15.5	10.3
R18	15.0	15.5	10.5	12.8	15.1	10.1
R19	13.8	15.3	10.3	12.0	14.8	9.9

6.2 The predicted concentrations of NO_2, PM_{10} and $PM_{2.5}$ were below the annual mean air quality objectives at all receptors in both Scenario 2: 2021 Base Year and Scenario 3: 2024 Opening Year Without Development.

6.3 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[9] it may be assumed that exceedance of the 1-hour mean objective is unlikely. The calculation detailed in paragraph 3.12 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Assessment

Detailed Operational Phase Road Traffic Emissions Assessment

6.4 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified existing receptor locations for Scenario 4: 2024 Opening Year with development, to consider the impact of development-generated vehicles on local air quality.

6.5 Predicted pollutant concentrations are detailed in **Table 6.2**, **Table 6.3** and **Table 6.4** for NO_2, PM_{10} and $PM_{2.5}$ respectively together with Scenario 3: 2024 Opening Year without development concentrations for comparison purposes. The predicted change in pollutant concentrations resulting from development-generated traffic, and the associated impact are also provided.

Table 6.2: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted NO_2 Concentration (µg.m^{-3})				
	Scenario 3: 2024 Without Development (µg.m^{-3})	Scenario 4: 2024 With Development (µg.m^{-3})	Concentration Change* (µg.m^{-3})	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	11.1	11.2	0.0	0	Negligible

Receptor	Predicted NO_2 Concentration ($\mu g.m^{-3}$)				
	Scenario 3: 2024 Without Development ($\mu g.m^{-3}$)	Scenario 4: 2024 With Development ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R2	11.2	11.3	+0.1	0	Negligible
R3	10.7	10.7	0.0	0	Negligible
R4	12.9	12.9	0.0	0	Negligible
R5	14.9	14.9	0.0	0	Negligible
R6	17.0	17.0	0.0	0	Negligible
R7	14.7	14.7	0.0	0	Negligible
R8	15.3	15.3	0.0	0	Negligible
R9	13.3	13.4	0.0	0	Negligible
R10	17.3	17.3	0.0	0	Negligible
R11	15.1	15.1	0.0	0	Negligible
R12	14.5	14.5	0.0	0	Negligible
R13	10.3	10.3	0.0	0	Negligible
R14	11.3	11.3	0.0	0	Negligible
R15	11.4	11.4	0.0	0	Negligible
R16	11.9	11.9	0.0	0	Negligible
R17	14.2	14.2	0.0	0	Negligible
R18	12.8	12.8	0.0	0	Negligible
R19	12.0	12.0	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

Table 6.3: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted PM_{10} Concentration ($\mu g.m^{-3}$)				
	Scenario 3: 2024 Without Development ($\mu g.m^{-3}$)	Scenario 4: 2024 With Development ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	14.5	14.5	0.0	0	Negligible
R2	14.6	14.6	0.0	0	Negligible
R3	14.4	14.4	0.0	0	Negligible
R4	15.6	15.6	0.0	0	Negligible
R5	16.1	16.1	0.0	0	Negligible
R6	16.9	16.9	0.0	0	Negligible
R7	16.1	16.2	0.0	0	Negligible
R8	16.4	16.4	0.0	0	Negligible
R9	15.7	15.7	0.0	0	Negligible
R10	16.9	16.9	0.0	0	Negligible
R11	16.2	16.2	0.0	0	Negligible
R12	16.0	16.0	0.0	0	Negligible
R13	15.0	15.0	0.0	0	Negligible
R14	15.1	15.1	0.0	0	Negligible
R15	15.1	15.1	0.0	0	Negligible
R16	15.3	15.3	0.0	0	Negligible
R17	15.5	15.5	0.0	0	Negligible
R18	15.1	15.1	0.0	0	Negligible

Receptor	Predicted PM_{10} Concentration ($\mu g.m^{-3}$)				
	Scenario 3: 2024 Without Development ($\mu g.m^{-3}$)	Scenario 4: 2024 With Development ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R19	14.8	14.8	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

Table 6.4: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations

Receptor	Predicted $PM_{2.5}$ Concentration ($\mu g.m^{-3}$)				
	Scenario 3: 2024 Without Development ($\mu g.m^{-3}$)	Scenario 4: 2024 With Development ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	9.0	9.0	0.0	0	Negligible
R2	9.7	9.7	0.0	0	Negligible
R3	9.6	9.6	0.0	0	Negligible
R4	10.5	10.5	0.0	0	Negligible
R5	10.8	10.8	0.0	0	Negligible
R6	11.2	11.2	0.0	0	Negligible
R7	10.8	10.8	0.0	0	Negligible
R8	10.9	10.9	0.0	0	Negligible
R9	10.5	10.5	0.0	0	Negligible
R10	11.2	11.2	0.0	0	Negligible
R11	10.8	10.8	0.0	0	Negligible
R12	10.7	10.7	0.0	0	Negligible
R13	10.4	10.4	0.0	0	Negligible

Receptor	Predicted $PM_{2.5}$ Concentration ($\mu g.m^{-3}$)				
	Scenario 3: 2024 Without Development ($\mu g.m^{-3}$)	Scenario 4: 2024 With Development ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R14	10.2	10.2	0.0	0	Negligible
R15	10.2	10.2	0.0	0	Negligible
R16	10.3	10.3	0.0	0	Negligible
R17	10.3	10.3	0.0	0	Negligible
R18	10.1	10.1	0.0	0	Negligible
R19	9.9	9.9	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

6.6 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted to be below the annual mean air quality objectives at all receptors. No exceedances of the annual mean air quality objectives were predicted.

6.7 In accordance with the IAQM and EPUK guidance[11] the impact of the development on existing sensitive receptors is negligible.

6.8 With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than $60\mu g.m^{-3}$ and therefore in accordance with Defra guidance[9] it may be assumed that exceedance of the 1-hour mean objective is unlikely. The calculation detailed in paragraph 3.12 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Impact Significance Summary

6.9 Relevant guidance, legislation and professional judgement was utilised to determine the significance of the findings of the air quality assessment. The air quality assessment was supervised by a full member of the Institute of Air Quality Management. A summary of the impact significance and justification of this are provided below.

6.10 The impact of the proposed development on air quality is considered to be 'Negligible':

- Consideration was given to local planning policy[8] and the development proposals are considered to be in accordance with this policy with regard to air quality.
- Existing concentrations of NO_2, PM_{10} and $PM_{2.5}$ in the study area are predicted to be below the annual mean air quality objectives.

- The air quality assessment undertaken utilised robust model inputs including queueing at junctions in accordance with Defra guidance[9].
- The impact of development-generated road traffic on local air quality is defined as 'Negligible' in accordance with IAQM and EPUK guidance[11].
- In addition, a sensitivity analysis was undertaken and provided in **Appendix G** considering the conservative scenario of NOx concentrations not decreasing from baseline levels in line with projected emission factors. The findings of this sensitivity analysis also predict the impact of development-generated road traffic on local air quality as 'Negligible' in accordance with IAQM and EPUK guidance[11].

Site Suitability Assessment

6.11 Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at the proposed residential dwellings within the proposed development Site for Scenario 4: 2024 Opening Year with development. Predicted pollutant concentrations are detailed in **Figures 6.1 – 6.3.**

6.12 The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 4: 2024 Opening Year with development, indicate that pollutant concentrations at the proposed residential development will be well below the annual mean air quality objectives in 2024 with the development in place.

6.13 With regard to short term air quality objectives for NO_2 and PM_{10} at the residential development, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[9] it may be assumed that exceedance of the 1-hour mean NO_2 objective are unlikely. The calculation detailed in paragraph 3.12 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Figure 6.1: Annual Mean NO_2 Concentration across the Site

Figure 6.1: Annual Mean NO_2 Concentration across the Site at Ground Floor Level

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Date: 07/10/2021

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Figure 6.2: Annual Mean PM_{10} Concentration across the Site

Figure 6.2: Annual Mean PM_{10} Concentration across the Site at Ground Floor Level

Drawn by: ET
Date: 07/10/2021

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Figure 6.3: Annual Mean $PM_{2.5}$ Concentration across the Site

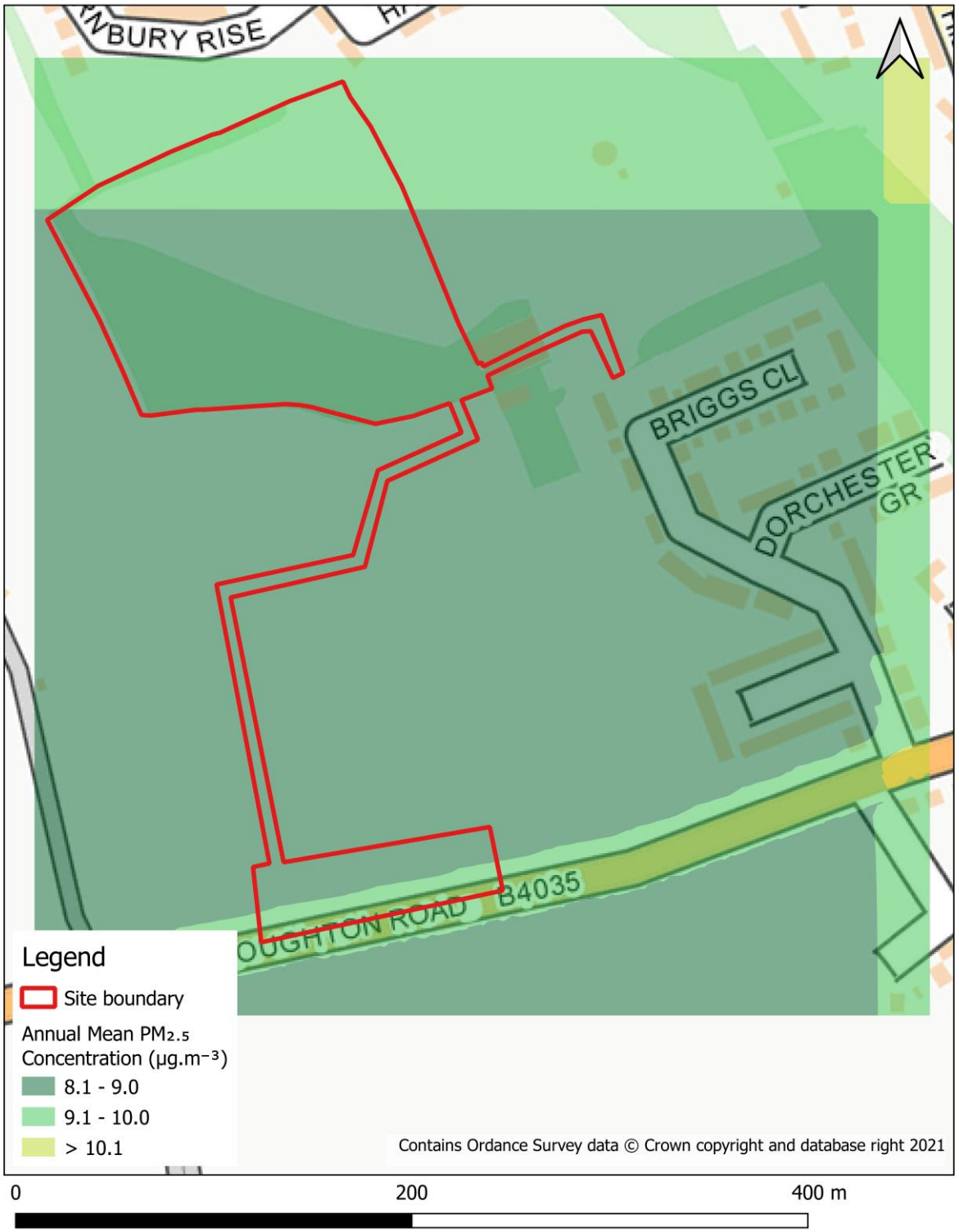


Figure 6.3: Annual Mean $PM_{2.5}$ Concentration across the Site at Ground Floor Level

Drawn by: ET
Date: 07/10/2021

Mitigation

6.14 The proposed development will result in minimal increases in pollutant concentrations and no new exceedances of the relevant air quality objectives are predicted. Therefore, no mitigation is required to minimise air quality impacts.

7. CONCLUSION

7.1 An air quality assessment was undertaken for the proposed residential development on land off Balmoral Avenue in Banbury.

7.2 A qualitative construction phase assessment was undertaken and measures were recommended for inclusion in a DMP to minimise emissions during construction activities. With the implementation of these mitigation measures the impact of construction phase dust emissions is considered to be 'not significant' in accordance with IAQM guidance[10].

7.3 A detailed road traffic emissions assessment was undertaken to consider the impact of development-generated road traffic on local air quality at identified existing receptor locations. Road traffic emissions were modelled using the dispersion model ADMS-Roads and concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted at identified sensitive receptor locations. The modelling assessment was undertaken in accordance with Defra Local Air Quality Management Technical Guidance[9]. The development was not predicted to result in any new exceedances of the relevant air quality objectives and the impact of the development on local air quality was predicted to be 'negligible' in accordance with IAQM and EPUK guidance[11].

7.4 Pollutant concentrations were also predicted across the proposed development Site. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were all predicted to be well below the relevant air quality objectives and therefore the Site was considered to be suitable for the proposed residential use with regard to the current air quality objectives.

APPENDICES

APPENDIX A: GLOSSARY OF TERMS

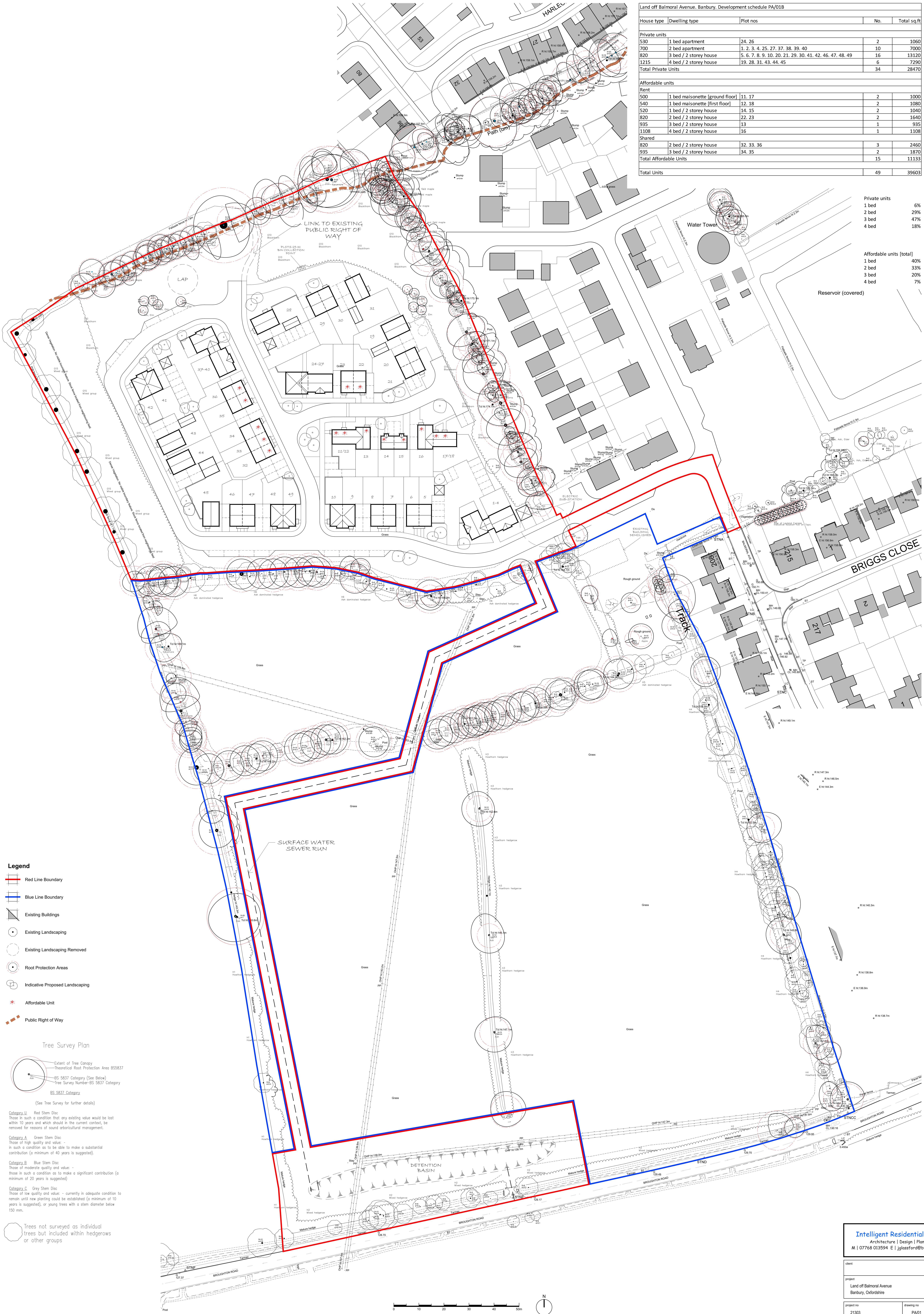
Term	Definition
AADT	Annual Average Daily Traffic flow.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between two years, which is useful for pollutants that have higher concentrations during the winter months.
AQAP	Air Quality Action Plan.
AQMA	Air Quality Management Area.
AQS	Air Quality Strategy.
Defra	Department for Environment, Food and Rural Affairs.
EPUK	Environmental Protection UK.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
HDV	Heavy Duty Vehicles (HGVs + buses and coaches)
HGV	Heavy Goods Vehicles.
IAQM	Institute of Air Quality Management.
LAQM	Local Air Quality Management.
LDV	Light Duty Vehicles (motorbikes, cars, vans and small trucks)
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 micrometres.
micrograms per cubic metre ($\mu g.m^{-3}$)	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu g.m^{-3}$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.

APPENDIX B: PROPOSED DEVELOPMENT MASTERPLAN

Land off Balmoral Avenue. Banbury. Development schedule PA/01B				
House type	Dwelling type	Plot nos	No.	Total sq.ft
Private units				
530	1 bed apartment	24. 26	2	1060
700	2 bed apartment	1. 2. 3. 4. 25. 27. 37. 38. 39. 40	10	7000
820	3 bed / 2 storey house	5. 6. 7. 8. 9. 10. 20. 21. 29. 30. 41. 42. 46. 47. 48. 49	16	13120
1215	4 bed / 2 storey house	19. 28. 31. 43. 44. 45	6	7290
Total Private Units			34	28470
Affordable units				
Rent				
500	1 bed maisonette [ground floor]	11. 17	2	1000
540	1 bed maisonette [first floor]	12. 18	2	1080
520	1 bed / 2 storey house	14. 15	2	1040
820	2 bed / 2 storey house	22. 23	2	1640
935	3 bed / 2 storey house	13	1	935
1108	4 bed / 2 storey house	16	1	1108
Shared				
820	2 bed / 2 storey house	32. 33. 36	3	2460
935	3 bed / 2 storey house	34. 35	2	1870
Total Affordable Units			15	11133
Total Units			49	39603

Private units	
1 bed	6%
2 bed	29%
3 bed	47%
4 bed	18%

Affordable units [total]	
1 bed	40%
2 bed	33%
3 bed	20%
4 bed	7%



Legend

- Red Line Boundary
- Blue Line Boundary
- Existing Buildings
- Existing Landscaping
- Existing Landscaping Removed
- Root Protection Areas
- Indicative Proposed Landscaping
- Affordable Unit
- Public Right of Way

Tree Survey Plan

Extent of Tree Canopy
Theoretical Root Protection Area BS5837
BS 5837 Category (See Below)
Tree Survey Number-BS 5837 Category

BS 5837 Category

(See Tree Survey for further details)

Category U   Red Stem Disc
Those in such a condition that any existing value would be lost within 10 years and which should in the current context, be removed for reasons of sound arboricultural management.

Category A   Green Stem Disc
Those of high quality and value: - in such a condition as to be able to make a substantial contribution (a minimum of 40 years is suggested).

Category B   Blue Stem Disc
Those of moderate quality and value: - those in such a condition as to make a significant contribution (a minimum of 20 years is suggested)

Category C   Grey Stem Disc
Those of low quality and value: - currently in adequate condition to remain until new planting could be established (a minimum of 10 years is suggested), or young trees with a stem diameter below 150 mm.

Trees not surveyed as individual trees but included within hedgerows or other groups

ILLUSTRATIVE MASTERPLAN - 1:500

Intelligent Residential Design
Architecture | Design | Planning
M | 07768 013594 E | jglassford@btinternet.com

client	
project	Land off Balmoral Avenue Banbury, Oxfordshire
project no	21303
drawing no	PA/01
drawing description -	Illustrative Masterplan
scale	1:500 @ A0
date drawn	September 2021
rev	B

APPENDIX C: PLANNING POLICY AND LEGISLATION

National Legislation and Planning Policy

The UK Air Quality Strategy

European Union (EU) legislation forms the basis of air quality policy and legislation in the UK. The EU 2008 ambient Air Quality Directive[1] sets limits for ambient concentrations of air pollutants including nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$). The air quality standards and objectives are prescribed through the Air Quality (England) Regulations 2000[2], as amended, for the purpose of the Local Air Quality Management Framework.

The UK Government are required under the Environment Act 1995[3] to produce a national Air Quality Strategy (AQS). The AQS was first published in 1997[4] and was most recently reviewed and updated in 2007[5]. The AQS provides an overview of the Government's ambient air quality policy and sets out the air quality standards and objectives to be achieved and measures to improve air quality.

Part IV of the Environment Act[3] requires local authorities in the UK to review local air quality within their administrative area and, if relevant air quality standards and objectives are likely to be exceeded, designate Air Quality Management Areas (AQMAs). Following the designation of an AQMA, local authorities are required to publish an Air Quality Action Plan (AQAP) detailing measures to be taken to improve local air quality and work towards meeting the relevant air quality standards and objectives.

National Planning Policy Framework

The National Planning Policy Framework (NPPF)[6] was amended in July 2021 and sets out the Government's planning policies for England and how these are expected to be applied.

The NPPF[6] recognises air quality within Section 15: Conserving and enhancing the natural environment, and states that:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by:*
>
> *[…]*
>
> *e) 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;*
>
> *[…]*
>
> *Ground conditions and pollution*
>
> *[…]*

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development.
[…]
Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."

With regard to assessing cumulative effects the NPPF[6] states:

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

[...]"

Planning Practice Guidance

The Planning Practice Guidance (PPG) for air quality[7] was updated in November 2019 and provides guiding principles on how the planning process can take account of the impacts of new development on air quality.

The PPG[7] sets out the following with regard to air quality and planning:

- *"What air quality considerations does planning need to address;*
- *What is the role of plan-making with regard to air quality;*
- *Air quality concerns relevant to neighbourhood planning;*
- *What information is available about air quality;*
- *When could air quality considerations be relevant to the development management process;*
- *What specific issues may need to be considered when assessing air quality impacts;*
- *How detailed does an air quality assessment need to be; and*
- *How can an impact on air quality be mitigated".*

The PPG[7] sets out the pollutants for which there are legally binding limits for concentrations and those which the UK also has national emissions reduction commitments.

The PPG[7] states that development plans may need to consider:

- *"what are the observed trends shown by recent air quality monitoring data and what would happen to these trends in light of proposed development and / or allocations;*
- *the impact of point sources of air pollution (pollution that originates from one place);*
- *the potential cumulative impact of a number of smaller developments on air quality as well as the effect of more substantial developments, including their implications for vehicle emissions;*
- *ways in which new development could be made appropriate in locations where air quality is or is likely to be a concern, and not give rise to unacceptable risks from pollution. This could, for example, entail identifying measures for offsetting the impact on air quality arising from new development including supporting measures in an air quality action plan or low emissions strategy where applicable; and*
- *opportunities to improve air quality or mitigate impacts, such as through traffic and travel management and green infrastructure provision and enhancement".*

The PPG[7] also states what may be considered relevant to determining a planning application and these include whether a development would:

- *"Lead to changes (including any potential reductions) in vehicle-related emissions in the immediate vicinity of the proposed development or further afield. This could be through the provision of electric vehicle charging infrastructure; altering the level of traffic congestion; significantly changing traffic volumes, vehicle speeds or both; or significantly altering the traffic composition on local roads. Other matters to consider include whether the proposal involves the development of a bus station, coach or lorry park; could add to turnover in a large car park; or involve construction sites that would generate large Heavy Goods Vehicle flows over a period of a year or more;*
- *Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; biomass boilers or biomass-fuelled Combined Heat and Power plant; centralised boilers or plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area; or extraction systems (including chimneys) which require approval or permits under pollution control legislation;*
- *Expose people to harmful concentrations of air pollutants, including dust. This could be by building new homes, schools, workplaces or other development in places with poor air quality;*
- *Give rise to potentially unacceptable impacts (such as dust) during construction for nearby sensitive locations;*

- *Have a potential adverse effect on biodiversity, especially where it would affect sites designated for their biodiversity value".*

The PPG[7] provides guidance regarding what should be included within an air quality assessment. Examples of potential air quality mitigation measures are also provided.

Local Planning Policy

Adopted Cherwell Local Plan 2011- 2031 Part 1

CDC adopted the Cherwell Local Plan in 2015. The Local Plan sets out the policies for determining development within the district. Policy ESD 10: Protection and Enhancement of Biodiversity and the Natural Environment states in relation to air quality:

"Protection and enhancement of biodiversity and the natural environment will be achieved by the following:

[…]

- *Air quality assessments will also be required for development proposals that would be likely to have a significantly adverse impact on biodiversity by generating an increase in air pollution.*

[…]"

The above policies were taken into consideration throughout the undertaking of the assessment.

APPENDIX D: TRAFFIC DATA UTILISED IN THE AIR QUALITY ASSESSMENT

Table D1: Traffic Data Utilised in the Air Dispersion Modelling Assessment

Road Link	Speed	Scenario 1: 2019 Verification Year		Scenario 2: 2021 Base Year		Scenario 3: 2024 Opening Year Without Development		Scenario 4: 2024 Opening Year With Development	
	Km.hr^{-1}	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow	24 hour AADT Total Flow	HDV Flow
Broughton Road West of Balmoral Avenue	48	8,036	228	8,343	237	8,970	254	8,996	254
Broughton Road East of Balmoral Avenue	48	8,036	228	8,343	237	9,237	254	9,535	254
B4035	48	9,194	281	9,546	292	10,324	313	10,415	313
A361 South of High Street	48	17,723	702	18,400	729	19,741	782	19,755	782
High Street	48	22,425	919	23,282	954	24,999	1,023	25,035	1,023
A361 North of High Street	48	10,537	313	10,939	325	11,769	348	11,810	348
Balmoral Avenue	48	466	16	484	16	837	17	1,161	17
A361 Bloxham Road	48	19,023	326	13,595	338	14,040	350	14,040	350
A4260 Oxford Road North of Weeping Cross	48	13,095	478	19,750	496	20,396	513	20,396	513
A4260 Oxford Road South of Weeping Cross	64	21,020	683	21,823	709	22,538	732	22,538	732

An illustration of the road links included in the ADMS-Roads model is provided in **Figure D1**.

Figure D1: Road Links Included in the ADMS-Roads Model

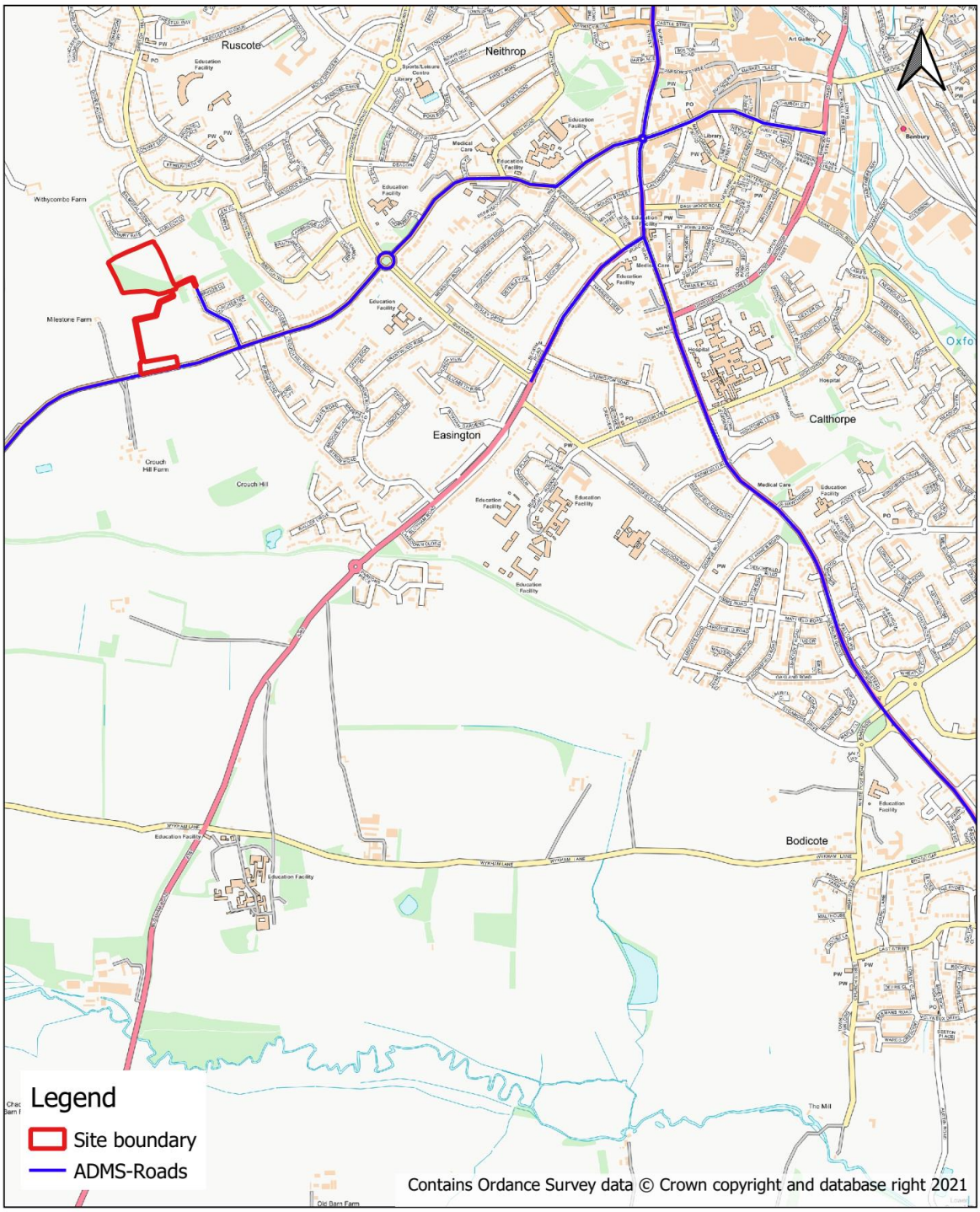


Figure D1: Modelled Road Network

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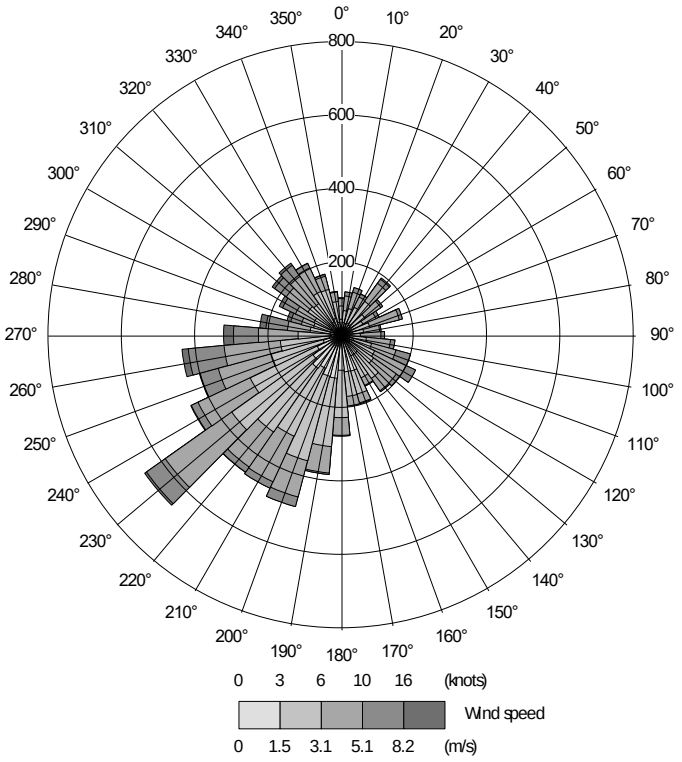
Date: 07/10/2021

APPENDIX E: WIND ROSE FOR 2019 FOR CHURCH LAWFORD METEOROLOGICAL RECORDING STATION

Meteorological data for 2019 Verification Year scenario for the Church Lawford recording station was obtained for use in the air dispersion modelling assessment. The wind rose for 2019 is detailed below and illustrates a predominant wind direction from the south west.



APPENDIX F: MODEL VERIFICATION

Whilst ADMS-Roads is widely validated for use in this type of assessment, model verification for the area around the Site will not have been included. To determine model performance at a local level, a comparison of modelled results with monitored results in the study area was done in accordance with the methodology provided by Defra. This process of verification aims to minimise modelling uncertainty by correcting modelled results by an adjustment factor to give greater confidence to the results.

The model was run for Scenario 1: 2019 Verification Year to predict the 2019 annual mean road contributions of NOx at the monitoring locations in the study area. The model NOx outputs at this location were compared to the 2019 monitored concentration to provide an adjustment factor for NOx. **Table F1** presents the verification process for NOx and **Figure F1** details the monitoring location utilised in the model verification.

Model verification was undertaken utilising the Oxford Road 2014 monitoring location which was considered representative of conditions at the Site given its location on the outskirts of Banbury. Model verification did not include monitoring locations within the AQMA as these were not considered representative of conditions at the Site and several are kerbside locations. Kerbside locations are not considered suitable for use within model verification in accordance with Defra guidance.

No monitoring of PM_{10} or $PM_{2.5}$ is undertaken within the study area. Therefore the adjustment factor calculated during the NOx verification process was utilised to adjust predicted concentrations of PM_{10} and $PM_{2.5}$.

Table F1: NOx Verification Process

Model Verification Steps	Oxford Road 2014
2019 monitored total NO_2 ($\mu g.m^{-3}$)	17.1
2019 background NO_2 concentration ($\mu g.m^{-3}$)	11.0
Monitored road contribution NOx ($\mu g.m^{-3}$)	11.3
Modelled road contribution NOx ($\mu g.m^{-3}$)	8.8
Ratio of monitored road NOx to modelled road NOx	1.3
Adjustment factor for modelled road contribution NOx	**1.2822**
Adjusted modelled road contribution NOx ($\mu g.m^{-3}$)	11.3
Modelled total NO_2 concentration ($\mu g.m^{-3}$)	17.1
Monitored total NO_2 concentration ($\mu g.m^{-3}$)	17.1
% difference between modelled and monitored total NO_2 concentration	0
RMSE % (should be less than 25% and ideally less than 10%)	0

** Road-NOx component, determined from NOx to NO_2 calculator*

A road-NOx factor of **1.2822** was determined as the slope of the best fit line between the 'measured' road contribution and the model derived road contribution, forced through zero. This factor was then applied to the modelled road-NOx concentration at each receptor, before conversion to NO_2 concentrations using the NO_x to NO_2 calculator provided by Defra and the adjusted NO_2 background concentration.

Figure F1: Monitoring Locations Utilised in the ADMS-Roads Model Verification Process

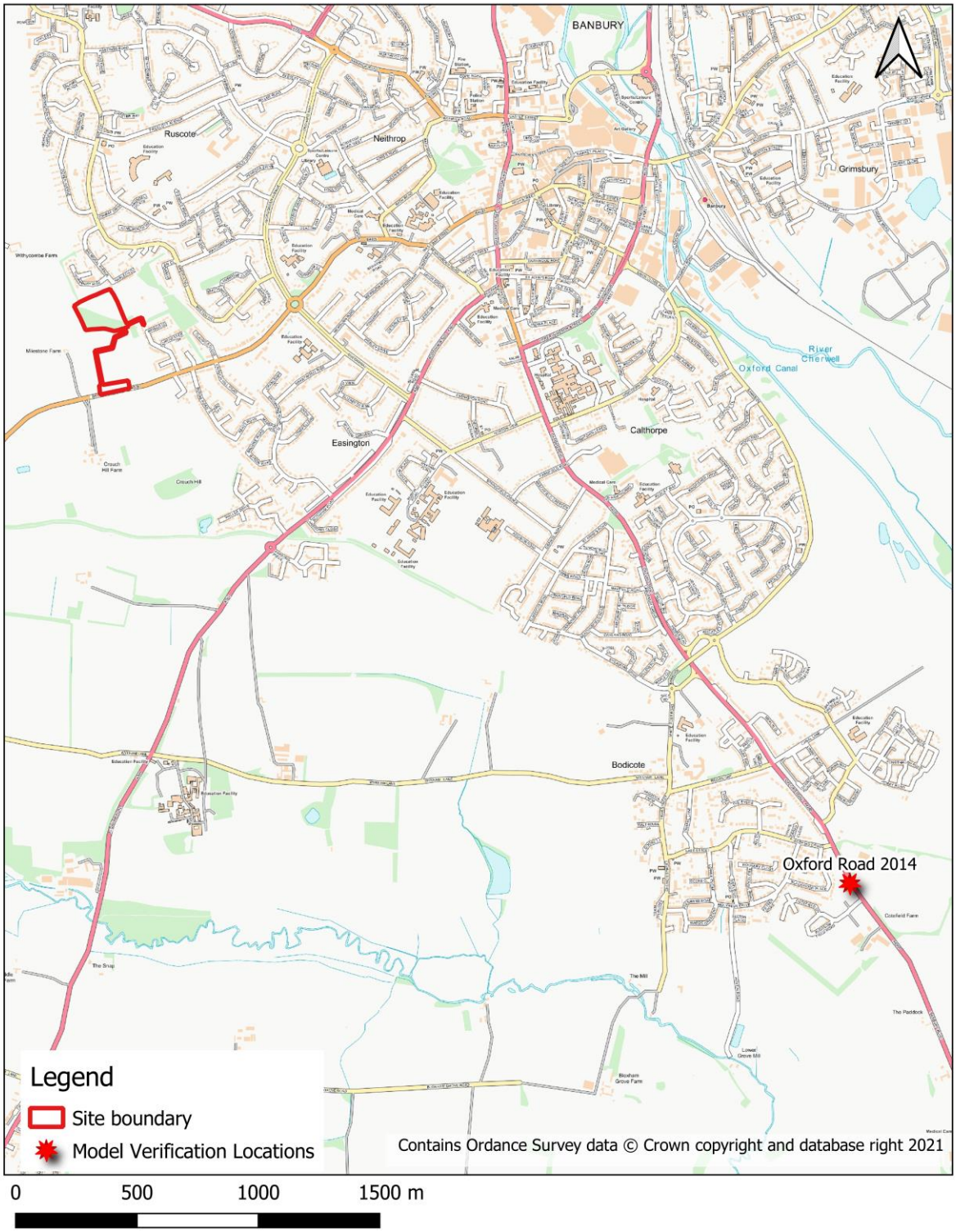


Figure F1: Model Verification Locations

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APPENDIX G: SENSITIVITY ANALYSIS

SENSITIVITY ANALYSIS

A sensitivity analysis was undertaken to consider a scenario where pollutant background concentrations do not decrease with future years. Therefore base year (2021) background concentrations, NOx to NO_2 calculator inputs and emission factors were utilised for the 2024 Opening Year with development scenario. The results of the assessment for the existing receptor locations and proposed receptor locations identified are provided in **Tables G1 – G3**.

Table G1: Predicted Annual Mean NO_2 Concentrations and Development Impact at Existing Receptor Locations – Sensitivity Analysis

Receptor	Predicted NO_2 Concentration (µg.m^{-3})				
	Scenario 5: 2024 Without Development Sensitivity Analysis (µg.m^{-3})	Scenario 6: 2024 With Development Sensitivity Analysis (µg.m^{-3})	Concentration Change* (µg.m^{-3})	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	12.8	12.9	+0.1	0	Negligible
R2	13.0	13.1	+0.1	0	Negligible
R3	12.2	12.3	0.0	0	Negligible
R4	15.2	15.2	0.0	0	Negligible
R5	18.0	18.0	0.0	0	Negligible
R6	20.9	20.9	0.0	0	Negligible
R7	17.7	17.7	0.0	0	Negligible
R8	18.6	18.6	0.0	0	Negligible
R9	15.9	15.9	0.0	0	Negligible
R10	21.3	21.3	0.0	0	Negligible
R11	18.2	18.2	0.0	0	Negligible
R12	17.4	17.4	0.0	0	Negligible
R13	11.6	11.6	0.0	0	Negligible
R14	13.1	13.1	0.0	0	Negligible
R15	13.1	13.2	0.0	0	Negligible
R16	13.9	13.9	0.0	0	Negligible

Receptor	Predicted NO_2 Concentration (µg.m^{-3})				
	Scenario 5: 2024 Without Development Sensitivity Analysis (µg.m^{-3})	Scenario 6: 2024 With Development Sensitivity Analysis (µg.m^{-3})	Concentration Change* (µg.m^{-3})	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R17	16.9	16.9	0.0	0	Negligible
R18	15.2	15.2	0.0	0	Negligible
R19	13.9	13.9	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

Table G2: Predicted Annual Mean PM_{10} Concentrations and Development Impact at Existing Receptor Locations – Sensitivity Analysis

Receptor	Predicted PM_{10} Concentration (µg.m^{-3})				
	Scenario 5: 2024 Without Development Sensitivity Analysis (µg.m^{-3})	Scenario 6: 2024 With Development Sensitivity Analysis (µg.m^{-3})	Concentration Change* (µg.m^{-3})	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	15.0	15.0	0.0	0	Negligible
R2	15.1	15.1	0.0	0	Negligible
R3	14.9	14.9	0.0	0	Negligible
R4	16.1	16.1	0.0	0	Negligible
R5	16.7	16.7	0.0	0	Negligible
R6	17.4	17.5	0.0	0	Negligible
R7	16.7	16.7	0.0	0	Negligible
R8	16.9	16.9	0.0	0	Negligible
R9	16.3	16.3	0.0	0	Negligible
R10	17.4	17.4	0.0	0	Negligible
R11	16.8	16.8	0.0	0	Negligible
R12	16.6	16.6	0.0	0	Negligible

Receptor	Predicted PM_{10} Concentration ($\mu g.m^{-3}$)				
	Scenario 5: 2024 Without Development Sensitivity Analysis ($\mu g.m^{-3}$)	Scenario 6: 2024 With Development Sensitivity Analysis ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R13	15.5	15.5	0.0	0	Negligible
R14	15.6	15.6	0.0	0	Negligible
R15	15.6	15.6	0.0	0	Negligible
R16	15.8	15.8	0.0	0	Negligible
R17	16.0	16.0	0.0	0	Negligible
R18	15.6	15.6	0.0	0	Negligible
R19	15.3	15.3	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

Table G3: Predicted Annual Mean $PM_{2.5}$ Concentrations and Development Impact at Existing Receptor Locations – Sensitivity Analysis

Receptor	Predicted $PM_{2.5}$ Concentration ($\mu g.m^{-3}$)				
	Scenario 5: 2024 Without Development Sensitivity Analysis ($\mu g.m^{-3}$)	Scenario 6: 2024 With Development Sensitivity Analysis ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R1	9.4	9.4	0.0	0	Negligible
R2	10.1	10.1	0.0	0	Negligible
R3	10.0	10.0	0.0	0	Negligible
R4	10.9	10.9	0.0	0	Negligible
R5	11.2	11.2	0.0	0	Negligible
R6	11.7	11.7	0.0	0	Negligible
R7	11.2	11.2	0.0	0	Negligible
R8	11.4	11.4	0.0	0	Negligible

Receptor	Predicted $PM_{2.5}$ Concentration ($\mu g.m^{-3}$)				
	Scenario 5: 2024 Without Development Sensitivity Analysis ($\mu g.m^{-3}$)	Scenario 6: 2024 With Development Sensitivity Analysis ($\mu g.m^{-3}$)	Concentration Change* ($\mu g.m^{-3}$)	Change in Concentration Relative to Air Quality Assessment Level (%)	Impact
R9	11.0	11.0	0.0	0	Negligible
R10	11.7	11.7	0.0	0	Negligible
R11	11.3	11.3	0.0	0	Negligible
R12	11.2	11.2	0.0	0	Negligible
R13	10.8	10.8	0.0	0	Negligible
R14	10.6	10.6	0.0	0	Negligible
R15	10.6	10.6	0.0	0	Negligible
R16	10.7	10.7	0.0	0	Negligible
R17	10.8	10.8	0.0	0	Negligible
R18	10.5	10.5	0.0	0	Negligible
R19	10.4	10.4	0.0	0	Negligible

** Discrepancies in changes due to rounding effects*

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted to be below the annual mean air quality objectives at all receptors. No exceedances of the annual mean air quality objectives were predicted.

In accordance with the IAQM and EPUK guidance[11] the impact of the development on existing receptors will be negligible.

With regard to short term air quality objectives for NO_2 and PM_{10}, the predicted annual mean NO_2 concentrations are less than $60\mu g.m^{-3}$ and therefore in accordance with Defra guidance[9] it may be assumed that exceedance of the 1-hour mean objective is unlikely. The calculation detailed in paragraph 3.12 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

Site Suitability

Concentrations of NO_2, PM_{10} and $PM_{2.5}$ were predicted across the proposed Site for Scenario 4: 2024 Opening Year with development. Predicted pollutant concentrations are detailed in **Figures G1 – G3**.

Figure G1: Annual Mean NO_2 Concentration across the Site

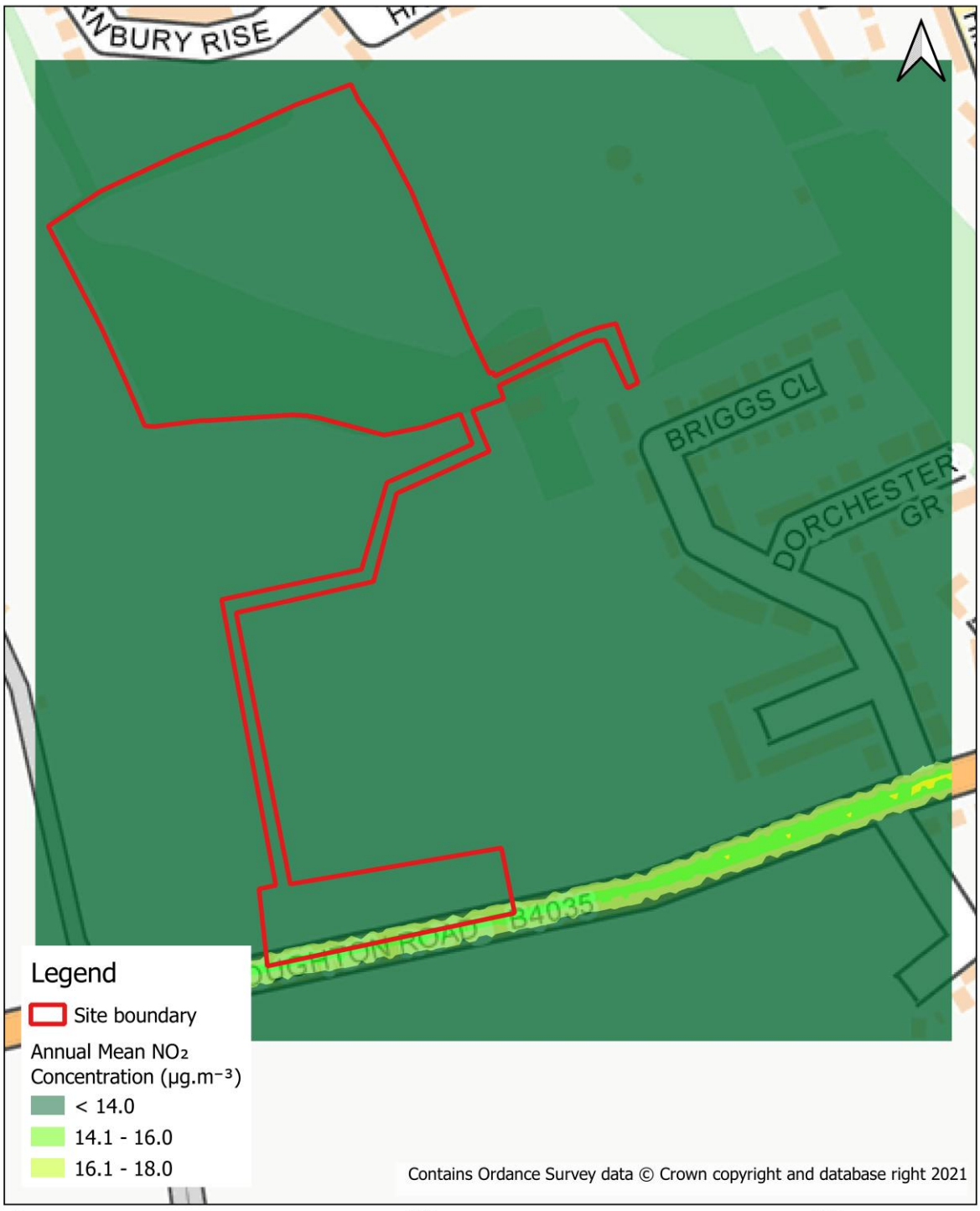

Figure G1: Annual Mean NO_2 Concentration across the Site at Ground Floor Level in the Sensitivity Analysis

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Figure G2: Annual Mean PM_{10} Concentration across the Site

Figure G2: Annual Mean PM_{10} Concentration across the Site at Ground Floor Level in the Sensitivity Analysis

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Figure G3: Annual Mean $PM_{2.5}$ Concentration across the Site

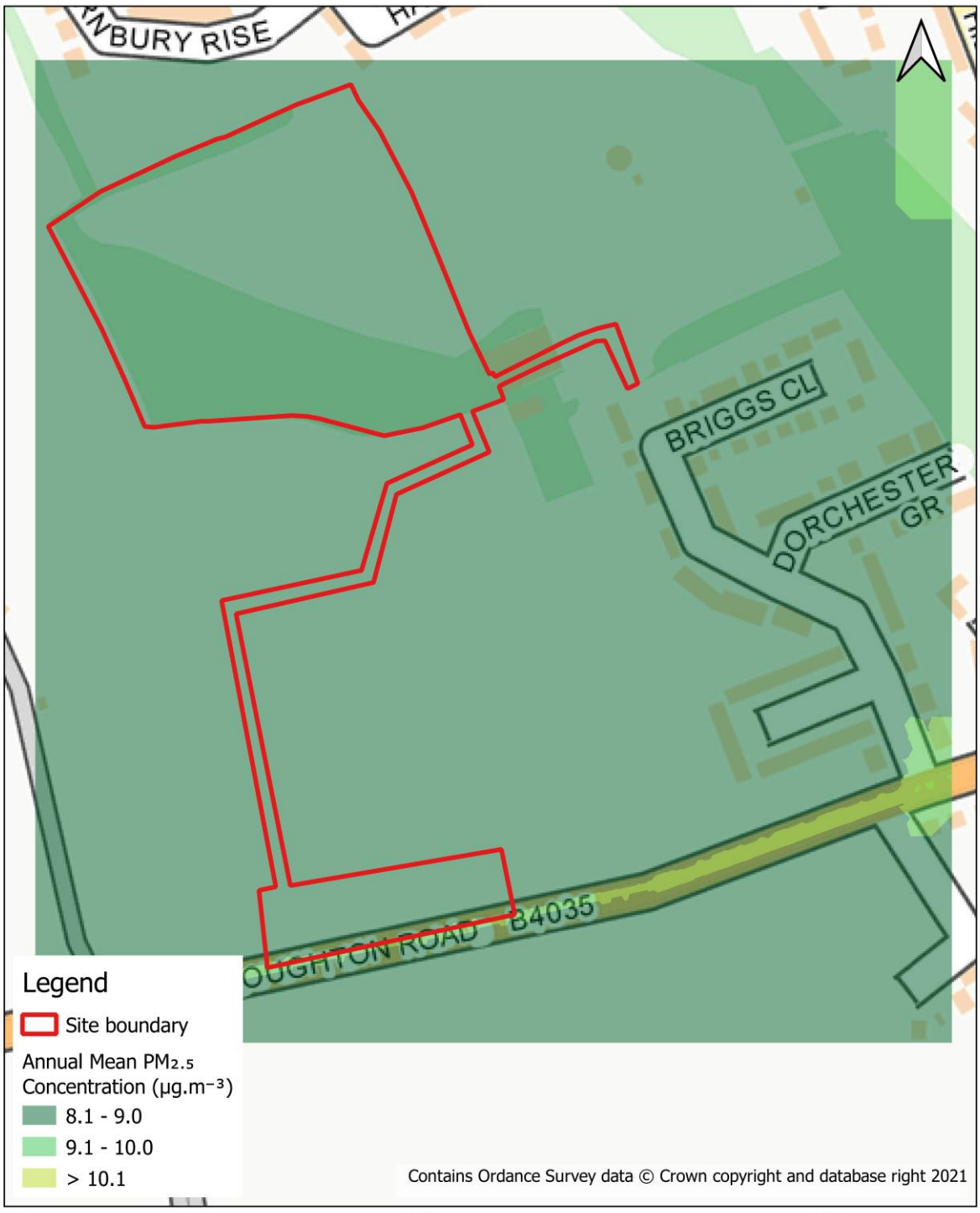

Figure G3: Annual Mean $PM_{2.5}$ Concentration across the Site at Ground Floor Level in the Sensitivity Analysis

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The predicted NO_2, PM_{10} and $PM_{2.5}$ concentrations for Scenario 4: 2024 Opening Year with development, indicate that pollutant concentrations at the proposed residential development will be well below the annual mean air quality objectives in 2024 with the development in place.

With regard to short term air quality objectives for NO_2 and PM_{10} at the residential development, the predicted annual mean NO_2 concentrations are less than 60µg.m^{-3} and therefore in accordance with Defra guidance[9] it may be assumed that exceedance of the 1-hour mean NO_2 objective are unlikely. The calculation detailed in paragraph 3.12 was used to determine potential exceedance of the 24-hour PM_{10} short term objective; no exceedances were predicted.

The Site is therefore considered suitable for the proposed residential use in accordance with current air quality objectives.

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