Air Quality Assessment:

Water Eaton Lane, Kidlington

Hill Residential Ltd

2nd December 2022

Report Details:

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V1	30th November 2022	Original Issue	Will Totty MSc AMIEnvSc	Nick Hawkins MSc MIOA MIAQM
V22	2nd December 2022	Minor Amendments	Will Totty MSc AMIEnvSc	Nick Hawkins MSc MIOA MIAQM

This report has been prepared by Hawkins Environmental Limited for the sole purpose of assisting in gaining planning consent for the proposed development described in the introduction of this report.

This report has been prepared by Hawkins Environmental Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This assessment takes into account the prevailing conditions at the time of the report and assesses the impact of the development (if applicable) using data provided to Hawkins Environmental Limited by third parties. The report is designed to assist the developer in refining the designs for the proposed development and to demonstrate to agents of the Local Planning Authority that the proposed development is suited to its location. This should be viewed as a risk assessment and does not infer any guarantee that the site will remain suitable in future, nor that there will not be any complaints either from users of the development or from impacts emanating from the development site itself.

This report is for the exclusive use by the client named in the report. Hawkins Environmental Limited does not accept any liability in negligence for any matters arising outside of the agreed scope of works.

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1. INTRODUCTION

1.1. Overview

Hawkins Environmental Limited has been instructed by Hill Residential Ltd to undertake an air quality assessment for the proposed redevelopment of land at Water Eaton Road, situated in the village of Kidlington in the district of Cherwell, Oxfordshire.

During the planning process, it has been identified that the site may require an air quality assessment to determine whether the site is suitable for residential use, and to determine whether the proposed development would have an adverse impact on the surrounding environment. Consequently, this assessment has been completed in order to determine whether the proposed development achieves compliance with the National Air Quality Objectives, as well as national, regional and local planning policy.

This assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG22)* (April 2021) and the Institute for Air Quality Management and Environmental Protection UK's *Land-Use Planning & Development Control: Planning for Air Quality* (January 2017).

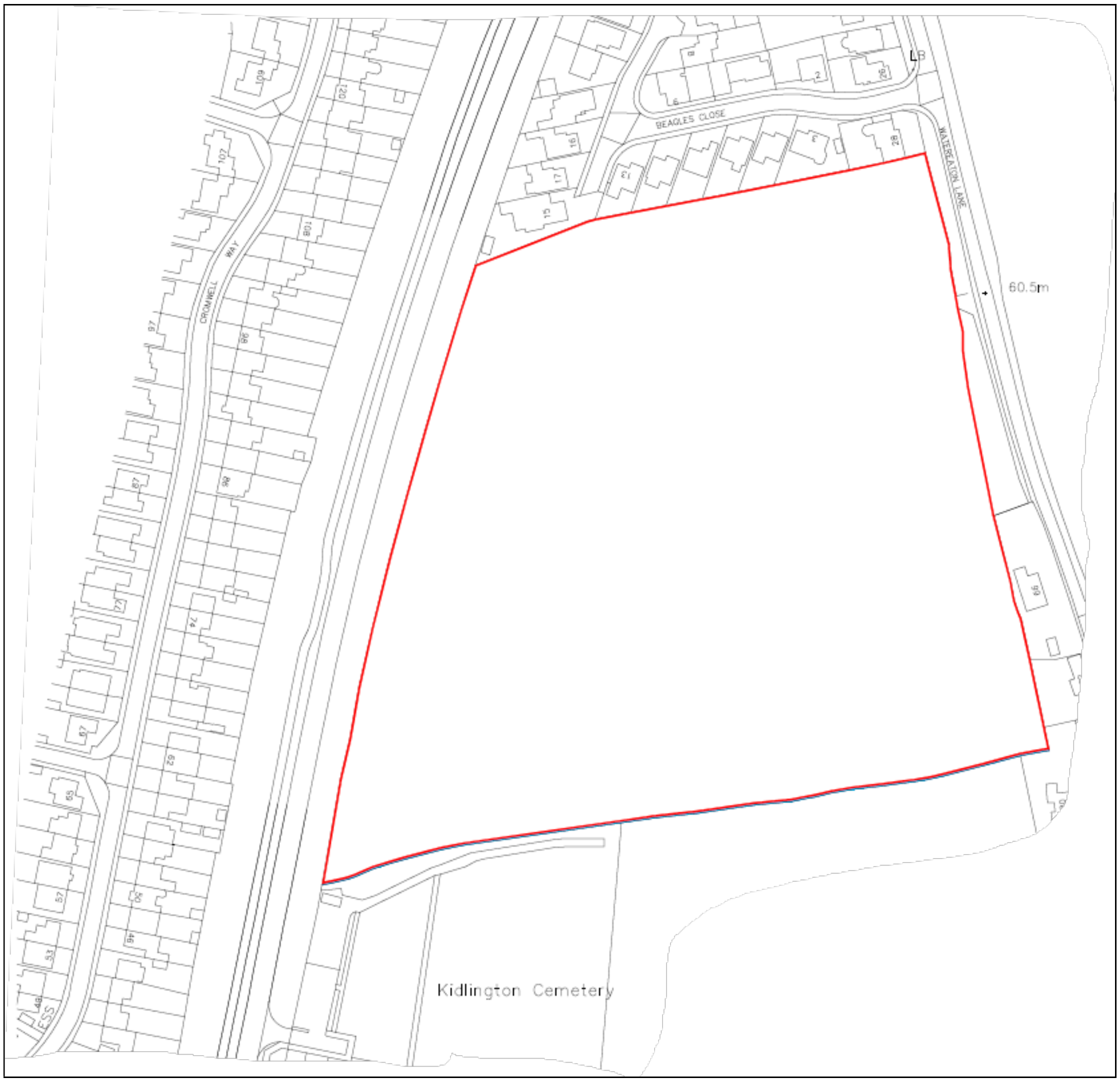
The assessment addresses the effects of air pollutant emissions from traffic using the adjacent roads and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction.*

This report assesses the overall levels of nitrogen dioxide (NO_2) and particulates (PM_{10} and $PM_{2.5}$) in the vicinity of the site. A glossary of terms is detailed in **Appendix 1.** The constraints which existing air quality may have on the proposed development have been considered and forms part of this assessment. However, the impacts of the development on the air quality of surrounding properties have also been considered.

1.2. Site Description

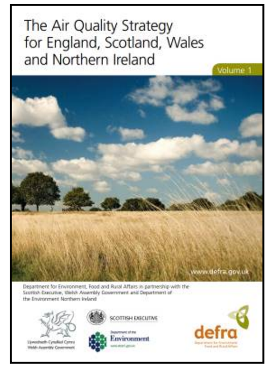
The development site is situated along Bicester Road and to the north of Bicester Road Cemetery within Kidlington, a village and civil parish in Oxfordshire. The site is currently a greenfield site that was formerly used for agriculture. The proposed development will see the construction of approximately 96 residential dwellings featuring paved access roads as well as a large external amenity area to the north-east of the site that features an area of allotments. A location plan of the proposed site can be seen in **Figure 1.1**.

Figure 1.1: Site Location Plan



2. LEGISLATION, PLANNING POLICY & GUIDANCE

2.1. National Legislation



Part IV of the Environment Act (1995), requires the UK government to produce a national Air Quality Strategy which contains standards, objectives and measures for improving ambient air quality. The National Air Quality Strategy sets out National Air Quality Objectives (NAQOs) that are maximum ambient pollutant concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale.

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC, its associated Daughter Directives 1999/30/EC, 2000/69/EC, 2002/3/EC, and the Council Decision 97/101/EC, with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC.

Directive 2008/50/EC is currently transcribed into UK legislation by the Air Quality Standards Regulations 2010, which came into force on 11th June 2010. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole. These limit values are the basis of the NAQOs.

The National Air Quality Objectives (NAQOs) and their Limit Values will form the basis of this air quality assessment of the proposed development. The NAQOs are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether, under normal circumstances, the air quality in the vicinity of a development is likely to be detrimental to human health. In determining whether air pollutant levels may constrain development, the results of studies are compared against the acceptability criteria. The Air Quality Standards are displayed in **Table 2.1**.

Table 2.1: Air Quality Standards

Pollutant	Average Period	NAQO Limit Value
Sulphur Dioxide	One Hour	350 µg/m^3 Not to be exceeded more than 24 times per calendar year
	One Day	150 µg/m^3 Not to be exceeded more than 3 times per calendar year
Nitrogen Dioxide	One Hour	200 µg/m^3 Not to be exceeded more than 18 times per calendar year
	Calendar Year	40 µg/m^3
Benzene	Calendar Year	5 µg/m^3

Pollutant	Average Period	NAQO Limit Value
Lead	Calendar Year	0.5 µg/m³
PM_{10}	One Day	50 µg/m³ Not to be exceeded more than 35 times per calendar year
	Calendar Year	40 µg/m³
$PM_{2.5}$	Calendar Year	25 µg/m³
Carbon Monoxide	Maximum daily running 8-hour mean	10 mg/m³

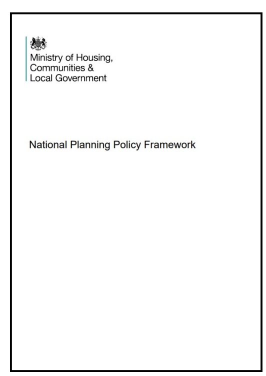
2.2. Clean Air Strategy (2019)

The Government's Clean Air Strategy was launched on the 14th January 2019 and sets out a range of initiatives that will help reduce air pollution, providing healthier air to breathe, enhancing the economy and protecting nature.

The Clean Air Strategy highlights action to be taken to reduce emissions across all sectors, including transport, the home, farming, and industrial sources. This includes actions to reduce particulate matter from domestic emissions, by introducing new legislation to prohibit the sales of the most polluting fuels and ensuring only the cleanest stoves are available for sale by 2022.

In addition, the Clean Air Strategy sets out proposals to halve the population living in areas with concentrations of fine particulate matter ($PM_{2.5}$) above the World Health Organisation (WHO) guideline levels of 10 µg/m³ by 2025. Since the publication of the Clean Air Strategy, the WHO has further reduced its guideline level for $PM_{2.5}$ to 5 µg/m³.

2.3. National Planning Policy Framework (2021)

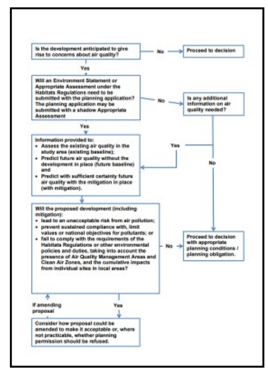


The National Planning Policy Framework (NPPF) was first published in March 2012 and revised in July 2018, February 2019 and most recently July 2021. The NPPF outlines the Government's environmental, economic and social policies for England. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 7, 8 10 and 11). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.

The NPPF states that in the planning system *"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"* (Paragraph 174).

The NPPF also states that *"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"* (Paragraph 186).

2.4. Planning Practice Guidance (2019)



The Planning Practice Guidance (PPG) was launched on 6th March 2014 and has undergone regular revision, with the most recent changes to Air Quality in November 2019. It provides additional guidance and interpretation to the Government's strategic policies, outlined within the NPPF, in a web-based resource. This is updated regularly.

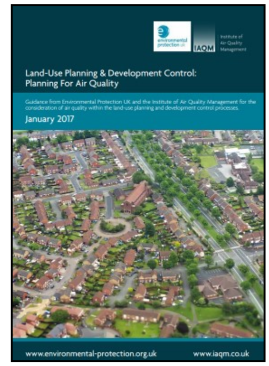
Matters of relevance to the air quality assessment include:

- The provision of *"guidance on how planning can take account of the impact of new development on air quality"*. The PPG provides signposts as to how to address air quality in planning applications and highlights the importance of local plans.
- The statement that *"The Department for Environment, Food and Rural Affairs carries out an annual national assessment of air quality using modelling and monitoring to determine compliance with relevant Limit Values"* and *"It is important that the potential impact of new development on air quality is taken into account where the national assessment indicates that relevant limits have been exceeded or are near the limit"* (Reference ID: 32-001-20191101). The PPG goes on to say that *"Whether air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to have an adverse effect on air quality in areas where it is already known to be poor, particularly if it could affect the implementation of air quality strategies and action plans and/or breach legal obligations (including those relating to the conservation of habitats and species)"* (Reference ID: 32-005-20191101).
- The identification of the content of an air quality assessment, stating clearly that *"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific"* (Reference ID: 32-007-20191101).

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

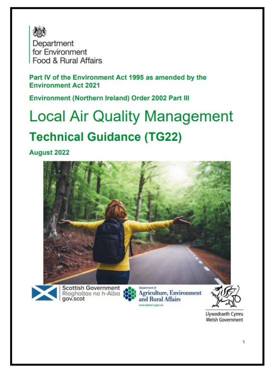
Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, provides general guidance on air quality and planning.

Specifically, the guidance provides details on the scoping of effects, how to assess the impacts in relation to air quality, as well as details on how to assess the significance of impacts.



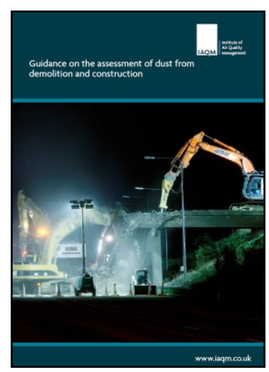
2.6. Local Air Quality Management Technical Guidance TG22 - (2022)

Specifically designed to provide technical guidance to Local Planning Authorities (LPAs) in relation to their review and assessment of air quality, TG(22) provides useful guidance in relation to the appropriate methods of air quality modelling and monitoring, which can be as equally useful to the assessment of air quality impacts.

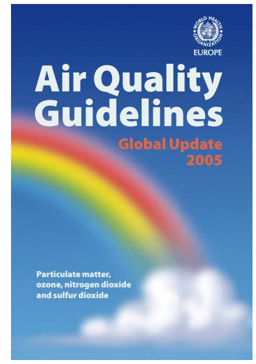


2.7. Guidance on the Assessment of Dust from Demolition and Construction (2014)

Published in 2014, the IAQM's Guidance on the Assessment of Dust from Demolition and Construction provides guidance on preparing an Air Quality Statement for construction and demolition activities, specifically in relation to dust risk assessments, as well as providing details on how best to mitigate the impacts of construction dust. Much of the detail within the IAQM's Guidance was adopted within the Control of Dust and Emissions from Construction and Demolition SPG.



2.8. World Health Organization Air Quality Guidelines (2021)



The WHO Air Quality Guidelines propose threshold limits for key air pollutants that pose health risks. The guidelines cover a range of pollutants and suggest threshold levels at which health effects are unlikely to occur, based on the latest scientific evidence. For a number of pollutants, the WHO levels are equivalent to the levels determined by the EU, which were then exacted into the National Air Quality Objectives in the UK; however, the guidelines offer recommended exposure levels for particulate matter (PM_{10} and $PM_{2.5}$) which are lower than the National Air Quality Objectives as set out in the Air Quality Standards Regulations 2010. The WHO Guidelines also provides interim targets for areas of high air pollution.

Since WHO's last 2005 global update, there has been a marked increase of evidence that shows how air pollution affects different aspects of health. For that reason, and after a systematic review of the accumulated evidence, WHO has adjusted almost all the AQGs levels downwards in 2021.

Table 2.2 summarises the WHO Guideline values.

Table 2.2: WHO Air Quality Guidelines

Pollutant	Average Period	WHO Guideline Value
Nitrogen Dioxide	One Day	25 µg/m^3
	Calendar Year	10 µg/m^3
PM_{10}	One Day	45 µg/m^3 (99th Percentile)
	Calendar Year	15 µg/m^3
$PM_{2.5}$	One Day	15 µg/m^3 (99th Percentile)
	Calendar Year	5 µg/m^3

2.9. Use of 2020 and 2021 Monitoring Datasets (2021)


IAQM
Use of 2020 and 2021 Monitoring Datasets
August 2021 | Version 1.0

Published in 2021 by the IAQM, *Use of 2020 and 2021 Monitoring Datasets* provides guidance relating to the use of datasets effected by the COVID-19 pandemic when validating air quality models. As noted by the IAQM, "*Ambient monitoring data is used routinely for model verification and validation. The coronavirus (SARS-CoV-2) pandemic has disrupted activity from 'business-as-usual' and therefore care is needed in selecting appropriate monitoring data.*".

The two main points to consider when considering datasets from 2020 and 2021 are:

- The pandemic may have meant that monitors were not maintained, or diffusion tubes changed according to planned schedule. The percentage of missing data may therefore be higher than usual, and diffusion tubes may have been exposed for different periods, and

- Activity (traffic, industrial, commercial, domestic) and hence emissions during 2020 and for a significant part of 2021 has been interrupted by lockdowns and restrictions. This means that – even if monitoring data is present – the monitored levels are atypical compared with previous years and the business-as-usual assumption.

It is also noted that the social and economic impact of the pandemic may affect the previously trend in future emissions and background concentrations.

The IAQM position based on the above is that "*If you are carrying out an air quality study that includes validation against monitoring data, use 2019 monitoring data as the last typical year.*".

3. ASSESSMENT METHODOLOGY

3.1. Methodology Overview

The assessment of air quality considered several different areas, specifically:

1. The constraints that the existing air quality has on the Proposed Development;
2. The impact of the changes in road traffic flows on air pollutant concentrations, at nearby sensitive receptors;
3. The impact of emissions from the Proposed Development's plant (such as biomass boilers or combined heat and power (CHP) plants) on air pollutant concentrations at nearby sensitive receptors (if applicable); and
4. The impact of construction and demolition dust at nearby sensitive receptors.

Land-Use Planning & Development Control: Planning for Air Quality states with respect to the identification of local receptors, they should include *"residential and other properties close to and within the proposed development, as well as alongside roads significantly affected by the development, even if well away from the development site, and especially if within AQMAs. These receptors will represent locations where people are likely to be exposed for the appropriate averaging time (dependent on the air quality objective being assessed against)"*. The last point is critical as this identifies that sensitivity in relation to air quality is directly related to the amount of time one spends in a location. For example, when considering annual mean objectives (such as that of NO_2), any area where one might spend large parts of the year might be considered a sensitive receptor. An example could be a dwelling, where one might expect to spend at least half of their time during one day. Health centres, hospitals, schools and nurseries could all expect to be considered sensitive receptors, partially due to the length of exposure spent in these locations, but also due to vulnerable members of society (e.g. the very young, the very old, or the ill) spending significant amounts of time at these locations. Offices would not normally be considered to be a highly sensitive receptor since most visitors would be healthy adults and would only spend around 8 hours per day, 5 days per week there (i.e. less than 25% of the year), whereas people could spend over 50% of their time within a dwelling. Hotels would not be considered sensitive receptors in terms of the annual mean since residents would only normally expect to spend a small number of nights in that location; however, hostels, sheltered accommodation and student accommodation would be considered as sensitive as dwellings, as residents could be expected to stay for several months.

The baseline scenario will consider two separate sets of site conditions, specifically the existing 2019 baseline conditions (the latest date for which data is available) and the future 2027 baseline site conditions, which represents the opening year of the proposed development. The consideration of a future baseline for air quality is important as it takes into account future changes in both traffic flow, but also pollutant concentrations, which could vary.

To determine the baseline conditions, the following was undertaken:

- A review of the most recent progress reports on air quality carried out by the local planning authority, as submitted to the Department for the Environment, Food and Rural Affairs (Defra);

- Determination of whether the site is situated within a designated Air Quality Management Area (AQMA);
- A review of local air quality monitoring within the area of the site;
- A review of the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) to determine whether industrial sources of air pollution could be affecting the site;
- Review of the list of registered Part A2 and Part B permitted premises under the PPC Regulations to determine whether any other sources of air pollution could be affecting the site;
- Using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**), predict concentrations of air pollutants on-site within the current baseline year and the future baseline year.

3.2. Methodology for Determining Demolition and Construction Effects

The determination of demolition and construction effects of the Proposed Development was based on the IAQM's Guidance on the Assessment of Dust from Demolition and Construction, which provides a risk-based assessment methodology to determine the significance of an air quality impact arising from the construction of a new development, based on the magnitude of change. The methodology provides a five-step approach to determining the significance:

*"**STEP 1** is to screen the requirement for a more detailed assessment. No further assessment is required if there are no receptors within a certain distance of the works.*

***STEP 2** is to assess the risk of dust impacts. This is done separately for each of the four activities (demolition; earthworks; construction; and trackout) and takes account of:*

the scale and nature of the works, which determines the potential dust emission magnitude (STEP 2A); and

the sensitivity of the area (STEP 2B).

These factors are combined in STEP 2C to give the risk of dust impacts.

Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities. Where there are low, medium or high risks of an impact, then site-specific mitigation will be required, proportionate to the level of risk.

Based on the threshold criteria and professional judgement one or more of the groups of activities may be assigned a 'negligible' risk. Such cases could arise, for example, because the scale is very small and there are no receptors near to the activity.

***STEP 3** is to determine the site-specific mitigation for each of the four potential activities in STEP 2. This will be based on the risk of dust impacts identified in STEP 2. Where a local authority has issued guidance on measures to be adopted at demolition/construction sites, these should also be taken into account.*

***STEP 4** is to examine the residual effects and to determine whether or not these are significant.*

***STEP 5** is to prepare the dust assessment report."*

3.3. Methodology for Determining Operational Effects

To determine the operational effects of the Proposed Development, the change in traffic flow at sensitive receptors in the future opening year of the proposed development, both with and without development related traffic, was modelled using the methodology described in the ADMS-Roads Detailed Dispersion Model (details of which can be seen in **Appendix 2**, utilising data described in **Appendix 3**).

To determine the impact of the proposed development on surrounding local sensitive receptors, the impact magnitude has been derived from Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the IAQM and EPUK. **Table 3.1** identifies the advice given in the IAQM / EPUK Guidance regarding impact descriptors upon individual receptors.

Table 3.1: Impact Descriptors for Individual Receptors

Long-Term Average Concentration at Receptor in Assessment Year	% Change in Concentrations 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

Source: Table 6.3 of the IAQM Guidance

The guidance goes on to offer the following explanation (taken from the footnotes of Table 6.3 of the IAQM Guidance):

"AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.

The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e.. less than 0.5% will be described as Negligible.

The Table is only designed to be used with annual mean concentrations.

Descriptors for individual receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.

When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.

The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.

It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it."

3.4. Significance Criteria

Land-Use Planning & Development Control: Planning for Air Quality provides a framework to assess significance in air quality assessments. As described in the guidance, the *"assessment framework for describing impacts can be used as a starting point to make a judgement on significance of effect, but there will be other influences that might need to be accounted for. The impact descriptors set out in Table 6.3* [Replicated in **Table 3.1** of this chapter] *are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. These impact descriptors are intended for application at a series of individual receptors. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances (Paragraph 7.4)".*

The Land-Use Planning & Development Control guidance goes on to state that any significance needs to be assessed using a certain amount of professional judgement and should take into account *"the existing and future air quality in the absence of the development; the extent of current and future population exposure to the impacts; and the influence and validity of any assumptions adopted when undertaking the prediction of impacts"* (Paragraph 7.7). For example, for a large development, a major adverse impact on a single dwelling might be considered insignificant; however, a minor impact to 100,000 dwellings might be considered to be highly significant. Furthermore, the absolute level of pollutant concentrations are also important in determining significance; for example, a moderate impact to a small group of dwellings might be considered highly significant if the concentrations of NO_2 were well in excess of the NAQO level, however, that same moderate impact might be considered insignificant if concentrations were well below the NAQO.

4. SCOPING

4.1. Overview

The National Planning Practice Guidance on Air Quality is explicit in stating that *"Assessments need to be proportionate to the nature and scale of development proposed and the potential impacts (taking into account existing air quality conditions), and because of this are likely to be locationally specific"* (Reference ID: 32-007-20191101). This is reiterated in *Land-Use Planning & Development Control: Planning for Air Quality*, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 and updated in January 2017, which provided guidance on screening as to whether an air quality assessment is required and what needs to be assessed.

4.2. Impacts of the Local Area on the Development

The IAQM/EPUK Guidance suggests that whether an assessment of the impacts of the local area on the proposed development is required is a matter of judgement, but should take into account:

- *"the background and future baseline air quality and whether this will be likely to approach or exceed the values set by air quality objectives;*
- *the presence and location of Air Quality Management Areas as an indicator of local hotspots where the air quality objectives may be exceeded;*
- *the presence of a heavily trafficked road, with emissions that could give rise to sufficiently high concentrations of pollutants (in particular NO_2), that would cause unacceptably high exposure for users of the new development; and*
- *the presence of a source of odour and/or dust that may affect amenity for future occupants of the development."*

4.3. Impacts of the Development on the Local Area

To determine whether an assessment of the impacts of the development on the local environment is required, the IAQM/EPUK Guidance suggests a two-stage approach. The guidance states that *"The **first stage** is intended to screen out smaller development and/or developments where impacts can be considered to have insignificant effects. The **second stage** relates to specific details regarding the proposed development and the likelihood of air quality impacts."*

Figure 4.1 reproduces Stage 1 of the IAQM/EPUK Guidance' two-stage approach. In order to proceed to Stage 2, development needs to meet both one of the criteria in "A", and one of the criteria in "B". If the development fails to meet these criteria, then an air quality assessment looking at the impacts of the development on the local area will not be required.

Figure 4.2 reproduces Stage 2 of the IAQM/EPUK Guidance' two-stage approach. If the development meets the criteria contained within Stage 1, *"more specific guidance as to when an air quality assessment is likely to be required to assess the impacts of the proposed development on the local area."* If the development then meets any of the eight criteria in Stage 2, an assessment of the impacts of the proposed development on the surrounding environment will be required.

Figure 4.1: IAQM/EPUK Guidance – Stage 1 Criteria

Criteria to Proceed to Stage 2

A. If any of the following apply:

- 10 or more residential units or a site area of more than 0.5ha
- more than 1,000 m^2 of floor space for all other uses or a site area greater than 1ha

B. Coupled with any of the following:

- the development has more than 10 parking spaces
- the development will have a centralised energy facility or other centralised combustion process

Note: Consideration should still be given to the potential impacts of neighbouring sources on the site, even if an assessment of impacts of the development on the surrounding area is screened out.

Figure 4.2: IAQM/EPUK Guidance – Stage 2 Criteria

The development will:	Indicative Criteria to Proceed to an Air Quality Assessment [a]
1. Cause a significant change in Light Duty Vehicle (LDV) traffic flows on local roads with relevant receptors. (LDV = cars and small vans <3.5t gross vehicle weight).	A change of LDV flows of: - more than 100 AADT within or adjacent to an AQMA - more than 500 AADT elsewhere.
2. Cause a significant change in Heavy Duty Vehicle (HDV) flows on local roads with relevant receptors. (HDV = goods vehicles + buses >3.5t gross vehicle weight).	A change of HDV flows of: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
3. Realign roads, i.e. changing the proximity of receptors to traffic lanes.	Where the change is 5m or more and the road is within an AQMA.
4. Introduce a new junction or remove an existing junction near to relevant receptors.	Applies to junctions that cause traffic to significantly change vehicle accelerate/decelerate, e.g. traffic lights, or roundabouts.
5. Introduce or change a bus station.	Where bus flows will change by: - more than 25 AADT within or adjacent to an AQMA - more than 100 AADT elsewhere.
6. Have an underground car park with extraction system.	The ventilation extract for the car park will be within 20 m of a relevant receptor. Coupled with the car park having more than 100 movements per day (total in and out).
7. Have one or more substantial combustion processes, where there is a risk of impacts at relevant receptors. NB. this includes combustion plant associated with standby emergency generators (typically associated with centralised energy centres) and shipping.	Typically, any combustion plant where the single or combined NO_x emission rate is less than 5 mg/sec[a] is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion. In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates. Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

[a] As a guide, the 5 mg/s criterion equates to a 450 kW ultra low NO_x gas boiler **or** a 30kW CHP unit operating at <95mg/Nm^3. Users of this guidance should quantify the NO_x mass emission rate from the proposed plant, based on manufacturers' specifications and operational conditions.

4.4. Site Specific Scoping Assessment

4.4.1. Impacts of the Development on the Local Area

The proposed development consists of 96 new dwellings with associated car parking; therefore Stage 1 “A” and Stage 1 “B” criteria are both met.

The transport assessment prepared by TPA indicates that the trip generation as a consequence of the proposed development will be 279 AADT south of the site and 101 north of the site.

Cherwell District Council AQMA no.3 is located ~250 m north of the proposed development, and therefore the 101 AADT generated north of the site meets the criteria for an assessment within an AQMA.

Additionally, 137 AADT are expected to be generated on the A34 south of the Peartree Interchange, which is within 200 m of receptors in the City of Oxford AQMA, therefore an impact assessment will also be required here.

Although not within an AQMA, receptors have also been included either side of the site entrance close to the proposed development site, for completeness. The assessment of the impacts of the development on the local area is detailed in **Section 7**.

4.4.2. Impacts of the Local Area on the Development

The proposed development is not situated within an AQMA, and air pollutant concentrations are expected to be below the NAQOs. However, as air quality modelling is required as per **Section 4.4.1** above, on-site receptors have been included for completeness. The assessment of the local area on the proposed development is detailed in **Section 6**.

4.4.3. Construction Dust Impact Assessment

A qualitative assessment of air quality impacts during the demolition and construction phase of the proposed development has been carried out in accordance with IAQM Guidance. The findings of the assessment can be incorporated into a Construction and Environmental Management Plan as appropriate. This is detailed in **Section 8.**

5. BASELINE CONDITIONS

5.1. Air Quality Review and Assessment

Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the NAQOs. Where these objectives are unlikely to be achieved, local authorities must designate these areas as Air Quality Management Areas (AQMAs) and prepare a written action plan to achieve the NAQOs.

The review of air quality takes on several prescribed stages, of which each stage is reported. The review of historic Air Quality Assessment reports for Cherwell District Council indicates that exceedances of the annual mean objective for NO_2 have been experienced at isolated locations across the District. It is understood that exceedances of the annual mean objectives for both PM_{10} and $PM_{2.5}$ are not expected within the District in future years.

As a consequence of the exceedances of the NAQOs, Cherwell District Council have declared Air Quality Management Areas (AQMAs) in Kidlington, Bicester, and two in Banbury. The Kidlington AQMA is situated ~250 m north of the proposed development site and encompasses several properties at the junction of Bicester Road with Water Eaton Lane.

Concentrations of SO_2, Benzene, Lead and CO are not considered to be significant within the District. Consequently, no further consideration is given to these pollutants as it is highly unlikely that they would be of concern on the proposed development site.

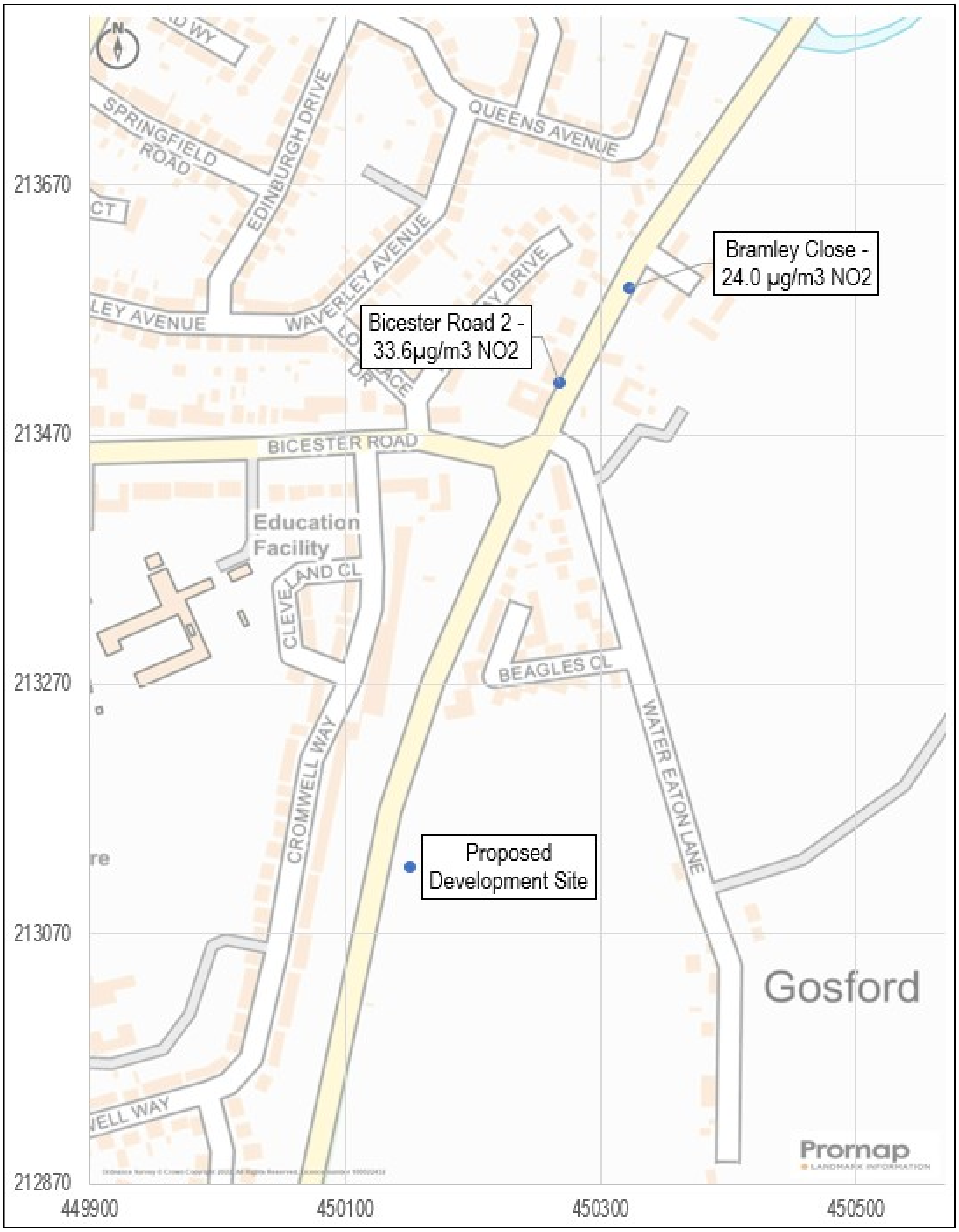
5.2. Local Air Quality Monitoring

Cherwell District Council has conducted air quality monitoring, including at two sites in the vicinity of the proposed development site. Both sites are designated to be roadside monitoring locations and therefore would be suitable for verification of the air quality model. **Table 5.1** summarises the air quality monitoring data which is displayed graphically in **Figure 5.1**.

Table 5.1: Air Quality Monitoring

Location	Site Type	Annual Mean Concentrations of NO_2 (µg/m^3)				
		2015	2016	2017	2018	2019
Bicester Road (2)	Roadside	41.1	41.9	41.0	37.9	**33.6**
Bramley Close	Roadside	29.5	28.5	26.7	26.3	**24.0**

Figure 5.1: Monitoring Locations



5.3. Industrial Emissions

Both the Environment Agency's register of industrial sites under the EC Integrated Pollution Prevention and Control Directive (IPPC) and the Local Authority's list of registered Part A2 and Part B permitted premises under the Pollution, Prevention and Control Act 1999 and the Environmental Permitting (England and Wales)

Regulations 2010 have shown that there are no sites within close proximity of the development site that could be affecting air pollutant levels.

5.4. Baseline Onsite Pollution Concentrations

To characterise the air quality at the development site at present, predictions of air pollutant concentrations at the development site have been made using the air quality model for the baseline year (2019). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO_2 from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for two representative points across the development site. The locations of these receptors can be seen on the site plan in **Appendix 3**. For each location, concentrations have been calculated for each floor level at which residential receptors are proposed. The results of these predictions can be seen in **Table 5.2**.

Table 5.2: Baseline Air Quality Concentrations 2019 – Development Site

Receptor		NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
		Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
Proposed Development Site - North	Ground Floor	20.24	18.18	1.55	11.69
	1st Floor	18.34	17.76	1.22	11.45
Proposed Development Site - South	Ground Floor	19.69	18.06	1.45	11.62
	1st Floor	18.12	17.71	1.19	11.42
National Air Quality Objective		**40**	**40**	**35**	**25**

If pollutant concentrations in **Table 5.2** are compared to the National Air Quality Objectives, it can be seen that on the development site at present, concentrations of all pollutants are below the National Air Quality Objectives.

6. IMPACTS OF THE LOCAL AREA ON THE DEVELOPMENT

6.1. Annual Mean Concentrations

To characterise the air quality at the development site when constructed, predictions of air pollutant concentrations at the development site have been made using the air quality model for the proposed year of occupation (2027). **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO_2 from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations and receptor locations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for two representative points across the development site. The locations of these receptors can be seen on the site plan in **Appendix 3**. For each location, concentrations have been calculated for each floor level at which residential receptors are proposed. The results of these predictions can be seen in **Table 6.1**.

Table 6.1: Predicted Future Air Quality Concentrations 2027 – Development Site

Receptor		NO_2 (µg/m^3)	PM_{10} (µg/m^3)		$PM_{2.5}$ (µg/m^3)
		Annual Mean	Annual Mean	Days >50 µg/m^3	Annual Mean
Proposed Development Site - North	Ground Floor	16.76	18.26	1.61	11.70
	1st Floor	15.88	17.81	1.26	11.45
Proposed Development Site - South	Ground Floor	16.50	18.13	1.50	11.63
	1st Floor	15.77	17.76	1.22	11.43
National Air Quality Objective		**40**	**40**	**35**	**25**

If pollutant concentrations in **Table 6.1** are compared to the National Air Quality Objectives, it can be seen that on the development site during the opening year, concentrations of pollutants are below the National Air Quality Objectives.

6.2. NO_2 1-hour Exposure

In order to meet the hourly Air Quality Standard on NO_2, the average hourly concentration of NO_2 must not exceed the hourly objective level of 200 µg/m^3 more than 18 times in one calendar year. If this standard is not met, there would be concern that even short duration exposure to pollutant concentrations could be prejudicial to health, which could be a concern for gardens, balconies and other outdoor amenity spaces associated with the development.

According to research conducted in 2003[1], there is only a risk that the NO_2 1-hour objective (200 µg/m^3) could be exceeded if the annual mean nitrogen dioxide concentration is greater than 60 µg/m^3. At the development site, the worst-case annual mean is 16.76 µg/m^3, therefore hourly exceedances are not expected to occur. Consequently, local short duration pollutant concentrations would not be considered a cause for concern in gardens, balconies and other outdoor amenity spaces associated with the development.

[1] Analysis of Relationship between 1-Hour and Annual Mean Nitrogen Dioxide at UK Roadside and Kerbside Monitoring Sites, Laxen and Marner, 2003.

7. IMPACTS OF THE DEVELOPMENT ON THE LOCAL AREA

7.1. Traffic-Related Emissions

To assess the impact of a proposed development on local air quality, the methodology from Land-Use Planning & Development Control: Planning for Air Quality, jointly published by the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) in May 2015 (updated 2017) has been implemented.

Transport data has been prepared for the planning application by TPA which indicates the number of vehicle movements generated by the proposed development. To characterise the change in air quality as a consequence of the proposed development, predictions of air pollutant concentrations at sensitive receptors have been carried out for the proposed opening year of the development (2027) both with and without the proposed development traffic. **Appendix 2** provides a description of the methodology used in the assessment, including the method to calculate NO_2 from NO_x. **Appendix 3** outlines the input data, including traffic data, background concentrations. In addition, details of the verification factor applied to the predicted concentrations of NO_x can also be found in **Appendix 3**.

Concentrations have been calculated for 10 sensitive receptors at locations likely to be most affected by changes in both relative and absolute traffic flows. The results of these predictions can be seen in **Table 7.1** and **Table 7.2**, for with and without development related traffic flows respectively.

The results of these predictions can be used to identify the increase in pollutant concentrations as a consequence of the proposed traffic generation. These calculations can be seen in **Table 7.3**. The results show that the impact of the increase in traffic flow is very small at the worst affected sensitive receptors, such that the percentage change in concentrations relative to AQAL is very small. Consequently, the proposed development will not have an impact on the air quality of the local area and the impact is considered to be *"negligible"*.

Table 7.1: Air Quality Concentrations 2027 – Without Development Related Traffic

Receptor		NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
		Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
123 Bicester Road	Ground Floor	23.17	20.87	4.56	13.15
	1st Floor	18.10	18.52	1.83	11.85
127 Bicester Road	Ground Floor	22.58	20.82	4.48	13.11
	1st Floor	17.84	18.50	1.81	11.84
129 Bicester Road	Ground Floor	21.06	20.11	3.54	12.72
	1st Floor	17.60	18.42	1.75	11.79
131 Bicester	Ground Floor	18.87	19.13	2.42	12.18

Receptor		NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
		Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
Road	1st Floor	17.00	18.22	1.57	11.68
Gosford House	Ground Floor	21.05	20.26	3.72	12.80
	1st Floor	17.37	18.41	1.74	11.79
1 Water Eaton Lane	Ground Floor	18.90	18.57	1.88	11.88
	1st Floor	17.04	17.96	1.37	11.55
16 Beagles Close	Ground Floor	16.52	18.13	1.50	11.63
	1st Floor	15.78	17.76	1.22	11.42
38 Cromwell Way	Ground Floor	15.13	17.44	1.01	11.25
	1st Floor	14.96	17.36	0.95	11.21
77 Home Close	Ground Floor	16.91	18.06	1.45	11.59
	1st Floor	16.80	18.02	1.42	11.57
73 Rosamund Road	Ground Floor	15.97	17.67	1.16	11.38
	1st Floor	15.91	17.65	1.15	11.37
NAQO		**40**	**40**	**35**	**25**

Table 7.2: Air Quality Concentrations 2027 – With Development Related Traffic

Receptor		NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
		Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
123 Bicester Road	Ground Floor	23.19	20.88	4.57	13.16
	1st Floor	18.11	18.52	1.84	11.85
127 Bicester Road	Ground Floor	22.60	20.83	4.49	13.12
	1st Floor	17.85	18.50	1.82	11.84
129 Bicester	Ground Floor	21.08	20.12	3.55	12.73

Receptor		NO_2 (µg/m³)	PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)
		Annual Mean	Annual Mean	Days >50 µg/m³	Annual Mean
Road	1st Floor	17.61	18.43	1.75	11.80
131 Bicester Road	Ground Floor	18.88	19.14	2.43	12.18
	1st Floor	17.01	18.22	1.58	11.68
Gosford House	Ground Floor	21.06	20.27	3.73	12.80
	1st Floor	17.38	18.42	1.75	11.79
1 Water Eaton Lane	Ground Floor	18.95	18.58	1.89	11.89
	1st Floor	17.07	17.97	1.38	11.55
16 Beagles Close	Ground Floor	16.55	18.14	1.51	11.64
	1st Floor	15.81	17.77	1.23	11.43
38 Cromwell Way	Ground Floor	15.17	17.46	1.02	11.26
	1st Floor	14.99	17.38	0.96	11.21
77 Home Close	Ground Floor	16.91	18.07	1.45	11.59
	1st Floor	16.81	18.02	1.42	11.57
73 Rosamund Road	Ground Floor	15.97	17.68	1.16	11.38
	1st Floor	15.91	17.65	1.15	11.37c
NAQO		**40**	**40**	**35**	**25**

Table 7.3: Assessment of the Impacts of the Increases in Traffic Flow

Receptor		NO_2 (µg/m³) Annual Mean		% Change in Conc. Relative to Air Quality Assessment Level (AQAL)	Long-Term Average Concentration at Receptor in Assessment Year	Impact Descriptor
		Without Development	With Development			
123 Bicester	Ground Floor	23.17	23.19	0.05	58% of AQAL	*Negligible*

Receptor		NO_2 (µg/m³) Annual Mean		% Change in Conc. Relative to Air Quality Assessment Level (AQAL)	Long-Term Average Concentration at Receptor in Assessment Year	Impact Descriptor
		Without Development	With Development			
Road	1st Floor	18.10	18.11	0.025	45% of AQAL	*Negligible*
127 Bicester Road	Ground Floor	22.58	22.6	0.05	57% of AQAL	*Negligible*
	1st Floor	17.84	17.85	0.025	45% of AQAL	*Negligible*
129 Bicester Road	Ground Floor	21.06	21.08	0.05	53% of AQAL	*Negligible*
	1st Floor	17.60	17.61	0.025	44% of AQAL	*Negligible*
131 Bicester Road	Ground Floor	18.87	18.88	0.025	47% of AQAL	*Negligible*
	1st Floor	17.00	17.01	0.025	43% of AQAL	*Negligible*
Gosford House	Ground Floor	21.05	21.06	0.025	53% of AQAL	*Negligible*
	1st Floor	17.37	17.38	0.025	43% of AQAL	*Negligible*
1 Water Eaton Lane	Ground Floor	18.90	18.95	0.125	47% of AQAL	*Negligible*
	1st Floor	17.04	17.07	0.075	43% of AQAL	*Negligible*
16 Beagles Close	Ground Floor	16.52	16.55	0.075	41% of AQAL	*Negligible*
	1st Floor	15.78	15.81	0.075	40% of AQAL	*Negligible*
38 Cromwell Way	Ground Floor	15.13	15.17	0.1	38% of AQAL	*Negligible*
	1st Floor	14.96	14.99	0.075	37% of AQAL	*Negligible*
77 Home Close	Ground Floor	16.91	16.91	0	42% of AQAL	*Negligible*

Receptor		NO_2 (µg/m³) Annual Mean		% Change in Conc. Relative to Air Quality Assessment Level (AQAL)	Long-Term Average Concentration at Receptor in Assessment Year	Impact Descriptor
		Without Development	With Development			
	1st Floor	16.80	16.81	0.025	42% of AQAL	*Negligible*
73 Rosamund Road	Ground Floor	15.97	15.97	0	40% of AQAL	*Negligible*
	1st Floor	15.91	15.91	0	40% of AQAL	*Negligible*
NAQO		**40**	**40**	**-**	**-**	**-**

8. CONSTRUCTION DUST IMPACT ASSESSMENT

8.1. Overview

The main air quality impacts that may arise during construction activities are:

- Dust deposition, resulting in the soiling of surfaces;
- Visible dust plumes; and
- An increase in concentrations of airborne particles (e.g. PM_{10}, $PM_{2.5}$) and nitrogen dioxide due to exhaust emissions from site plant and traffic that can impact adversely on human health.

The most common impacts are dust soiling and increased ambient PM_{10} concentrations due to dust arising from the site. Most of this PM_{10} is likely to be in the $PM_{2.5-10}$ fraction, known as coarse particles.

It is very difficult to quantify emissions of dust from construction activities. It is, therefore, common practice to provide a qualitative assessment of potential impacts. The Institute of Air Quality Management's *Guidance on the assessment of dust from demolition and construction (February 2014)* contains a complex methodology for determining the significance of construction impacts on air quality. The following sections outline the steps outlined in the IAQM methodology.

8.2. Step 1 – Screening the Need for a Detailed Assessment

The IAQM guidance states that:

"An assessment will normally be required where there is:

- *a 'human receptor' within:*
  - *350 m of the boundary of the site; or*
  - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s).*
- *an 'ecological receptor' within:*
  - *50 m of the boundary of the site; or*
  - *50 m of the route(s) used by construction vehicles on the public highway, up to 500 m from the site entrance(s)."*

There are existing receptors within 350m of the boundary of the development site and within 50m of the route used by construction vehicles on the public highway. Therefore, a detailed assessment is required to determine potential dust impacts.

<u>Step 1 Summary:</u>
A detailed assessment is required to determine potential dust impacts.

8.3. Step 2 – Assess the Risks of Dust Impacts

The IAQM guidance states that:

"The risk of dust arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts should be determined using four risk categories: negligible, low, medium and high risk.

A site is allocated to a risk category based on two factors:

- *the scale and nature of the works, which determines the potential dust emission magnitude as small, medium or large (STEP 2A); and*
- *the sensitivity of the area to dust impacts (STEP 2B), which is defined as low, medium or high sensitivity.*

These two factors are combined in STEP 2C to determine the risk of dust impacts with no mitigation applied. The risk category assigned to the site can be different for each of the four potential activities (demolition, earthworks, construction and trackout). More than one of these activities may occur on a site at any one time."

8.3.1. Step 2a – Dust Emission Magnitude

The first step (Step 2a) is therefore to assess the magnitude of the anticipated works. **Table 9.1** summarises the dust emission magnitude for each activity.

Table 8.1: Dust Emission Magnitude

Activity	Dust Emission Magnitude	Justification
Demolition	**N/A**	*None required.*
Earthworks	**Large**	*Site area exceeds 10,000 m^2, clayey soil type prone to suspension.*
Construction	**Medium**	*Total building volume likely 25,000-100,000 m^3, some higher risk materials and methods likely.*
Trackout	**Medium**	*Number of daily HGV movements not known; clayey soil type with lengths of unpaved roads on site likely.*

8.3.2. Step 2b – Sensitivity of the Area

The next step (Step 2b) is therefore to assess the sensitivity of the area that could be affected by the anticipated works. **Figure 9.1** shows the distance bands into which receptors fall as described in the guidance, both from the site (20, 50, 100 and 350 metres) and **Figure 9.2** shows the relevant bands for the associated haul routes (20 and 50 metres).

Figure 8.1: Receptor distance bands from proposed development site

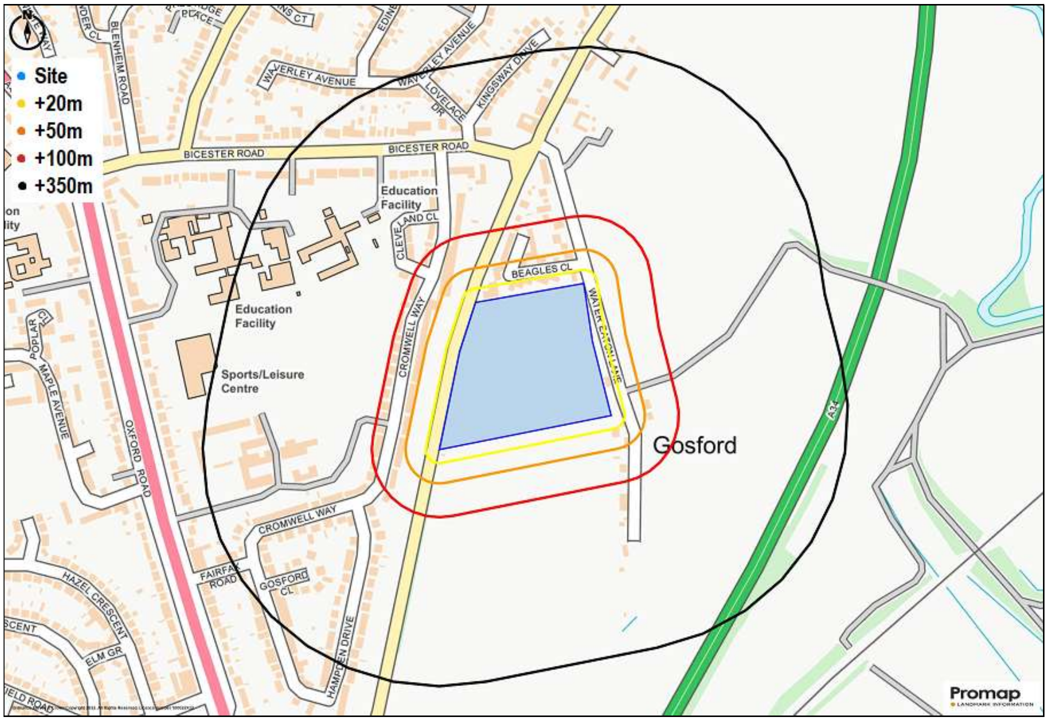
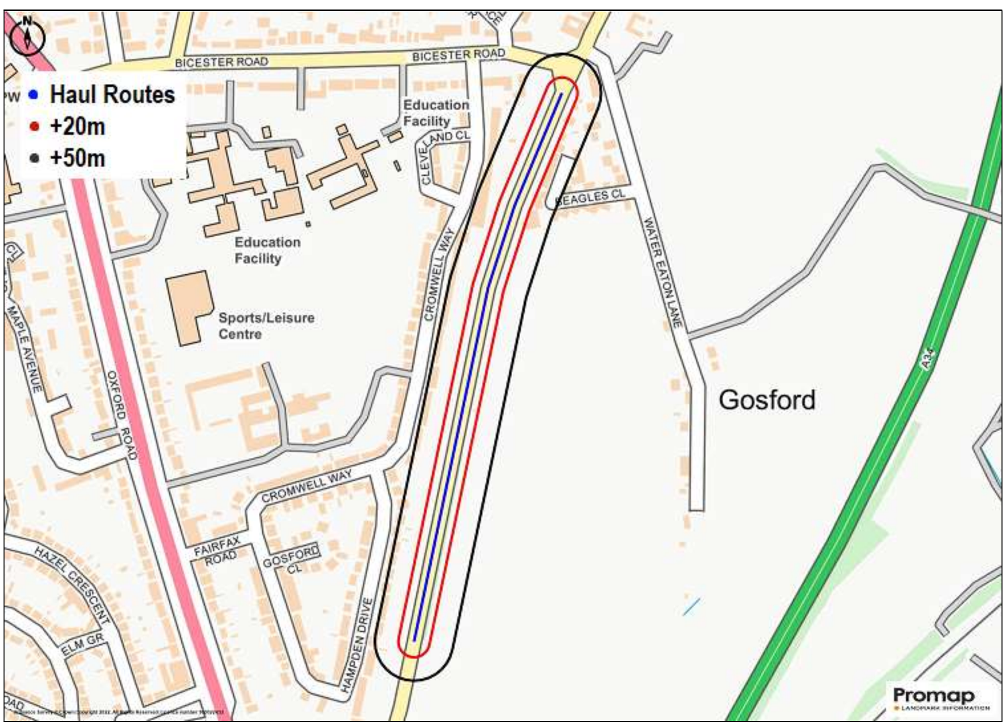


Figure 8.2: Receptor distance bands from proposed haul routes



There are a number of existing dwellings in the area that are considered to be high sensitivity receptors. There are between 10 and 100 high sensitivity receptors within 20 m of the site boundary; therefore, the sensitivity to dust soiling effects on people and property is *"high"* for all activities.

The annual mean concentration of PM_{10} is less than 24 µg/m^3; despite the number of high sensitivity receptors outlined above, this results in a *"low"* sensitivity of the area to human health impacts for all activities.

There are no ecological receptors that are considered to be anything greater than low sensitivity receptors within 50 m of the site; this results in a *"low"* sensitivity of the area to ecological impacts for all activities.

Table 9.2 summarises the sensitivity of the area for each activity.

Table 8.2: Outcome of Defining the Sensitivity of the Area

Potential Impact	Sensitivity of Surrounding Area			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	Low	Low	Low	Low
Ecological	Low	Low	Low	Low

8.3.3. Step 2c – Define the Risks

The next step (Step 2c) is to assign the level of risk for each activity, based on the receptor sensitivity and the dust emission magnitude. **Table 9.3** summarises the dust risk for each activity.

Table 8.3: Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	N/A	High	Medium	Medium
Human Health	N/A	Low	Low	Low
Ecological	N/A	Low	Low	Low

Step 2 Summary:

- *Dust Emission Magnitude is "High" for earthworks and "Medium" for construction and trackout.*
- *The Sensitivity of the area of is "High" for dust soiling and "Low" for human health and ecological impacts.*
- *The site is considered a "High Risk Site" in respect of earthworks and a "Low Risk Site" in respect of*

construction and trackout. It is therefore considered a "High Risk Site" overall.

8.4. Step 3 – Site Specific Mitigation

Stage 2 determines that the site is considered a "*High Risk Site*" in respect of earthworks and a "*Medium Risk Site*" in respect of construction and trackout. It is therefore considered a "*High Risk Site*" overall.

The IAQM guidance provides a list of potential mitigation measures and suggests where these measures are highly recommended, desirable or not required based upon the risk of the site. For all sites that are a *"Medium Risk Site*" or higher, a Dust Management Plan is highly recommended and should incorporate the mitigation measures recommended based on the site risk.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all High risk sites:

- Communications: Develop and implement a stakeholder communications plan that includes community engagement before work commences – *Highly Recommended.*
- Communications: Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary – *Highly Recommended*.
- Communications: Display the head or regional office contact information – *Highly Recommended*.
- Communications: Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the LPA. 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 – *Highly Recommended*.
- Site management: Record all dust and air quality complaints, identify the cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken – *Highly Recommended*.
- Site management: Make the complaints log available to the local authority when asked – *Highly Recommended*.
- Site management: 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 – *Highly Recommended.*
- Site management: 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 – *Highly Recommended*.
- 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 LPA when asked.

This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of Site boundary, with cleaning to be provided if necessary - *Highly Recommended.*

- Monitoring: Carry out regular Site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked– *Highly Recommended*.
- Monitoring: 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 – *Highly Recommended*.
- Monitoring: Agree on dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on-site or, if it a large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction. – *Highly Recommended.* Preparing and maintaining the Site: Plan Site layout so that machinery and dust causing activities are located away from receptors, as far as is possible – *Highly Recommended*.
- Preparing and maintaining the Site: Erect solid screens or barriers around dusty activities (or the Site boundary) that are at least as high as any stockpiles on-site – *Highly Recommended*.
- Preparing and maintaining the Site: Fully enclose Site or specific operations where there is a high potential for dust production and the Site is active for an extensive period– *Highly Recommended*.
- Preparing and maintaining the Site: Avoid Site runoff of water or mud– *Highly Recommended*..
- Preparing and maintaining the Site: Keep Site fencing, barriers and scaffolding clean using wet methods – *Highly Recommended*.
- Preparing and maintaining the Site: 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 – *Highly Recommended*.
- Preparing and maintaining the Site: Cover, seed or fence stockpiles to prevent wind whipping – *Highly Recommended*.
- Operating vehicle/machinery and sustainable travel: Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable– *Highly Recommended*.
- Operating vehicle/machinery and sustainable travel: Ensure all vehicles switch off engines when stationary - no idling vehicles – *Highly Recommended*.
- Operating vehicle/machinery and sustainable travel: Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable – *Highly Recommended*.
- Operating vehicle / machinery and sustainable travel: Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long-haul routes are

required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate) - *Highly Recommended.*

- Operating vehicle/machinery and sustainable travel: Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials – *Highly Recommended.*
- Operating vehicle/machinery and sustainable travel: Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) –*Highly Recommended*.
- Operations: Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation system – *Highly Recommended*.
- Operations: Ensure an adequate water supply on the Site for effective dust / particulate matter suppression/mitigation, using non-potable water where possible and appropriate – *Highly Recommended*.
- Operations: Use enclosed chutes and conveyors and covered skips – *Highly Recommended*.
- Operations: Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate – *Highly Recommended*.
- Operations: Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods – *Highly Recommended.*
- Waste management: Avoid bonfires and burning of waste materials – *Highly Recommended*.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all High risk sites in relation to earthworks:.

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable – *Highly Recommended.*
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable - *Highly Recommended.*
- Only remove the cover in small areas during work and not all at once - *Highly Recommended.*

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all Medium risk sites in relation to construction:

- Avoid scabbing (roughening of concrete surfaces) if possible - Desirable. 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 – *Highly Recommended.*

- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent the escape of material and overfilling during delivery – *Desirable.*
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust - *Desirable*.

The IAQM's Guidance states that the following measures are highly recommended or desirable as mitigation for all Medium risk sites in relation to trackout:

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

Step 3 Summary:

The site is considered a "High Risk Site" overall and a Dust Management Plan is recommended incorporating a number of specific mitigation measures based on the site-specific risks.

8.5. Step 4 – Determining Significant Effects

The site is considered a *"High Risk Site"* overall and if appropriate mitigation measures are put in place, as identified in Step 3, significant effects on receptors are unlikely to occur. Considering both the construction details and the specific characteristics of the site, it is anticipated that effective mitigation will be possible and residual effects will not be considered significant.

Step 4 Summary:

With risk appropriate mitigation, residual effects will not be considered significant.

8.6. Step 5 – Dust Assessment Report

Step 5 Summary:

Dust and other pollutant emissions from the construction, demolition, earthworks and trackout phases of the construction of the proposed development will see the site designated a "High Risk Site". However, with risk-appropriate mitigation, residual effects will not be considered significant.

9. MITIGATION

As a consequence of the proposed development, there will not be a significant increase in pollutant concentrations and therefore mitigation is not seen to be necessary, other than those routinely used to control construction dust, as detailed in the previous section. Similarly, concentrations of all pollutants are below the National Air Quality Objectives at the development site and therefore it is not necessary to implement mitigation to reduce the exposure from NO_2 or any other pollutant to future occupiers of the proposed development.

10. CONCLUSIONS & SUMMARY

An air quality assessment has been undertaken in accordance with the Department of Environment, Food and Rural Affairs' (Defra) current *Technical Guidance on Local Air Quality Management (LAQM) (TG22)* and addresses the effects of air pollutant emissions from traffic using the adjacent roads, and emissions associated with the development of the site. In addition, a risk-based assessment of the likely impact of construction on the air quality of the local environment has been conducted in accordance with the Institute of Air Quality Management's 2014 edition of the *Guidance on the assessment of dust from demolition and construction.*

Baseline pollutant concentrations on site have been investigated using both existing monitoring data and through predictions using the ADMS-Roads Detailed Dispersion Model methodology. At present, and in the opening year of the proposed development (2027), concentrations of all pollutants are below the Air Quality Objectives.

In order to assess the impact of the proposed development on local air quality, the IAQM/EPUK Guidance *Land-Use Planning & Development Control: Planning for Air Quality* has been utilised. The assessment has shown that due to limited traffic generation onto already highly trafficked roads, the impact of new vehicle emissions from the proposed development is considered to be *"negligible*".

With regards to the impacts of construction on air quality, dust and other pollutant emissions from the construction and demolition phases of the construction of the proposed development, the site is designated as a "*High Risk Site"*. However, with risk-appropriate mitigation, residual effects will not be considered significant.

Since it has been shown that the proposed development meets the guidance contained within *Technical Guidance on Local Air Quality Management (LAQM) (TG22),* IAQM/EPUK's *Land-Use Planning & Development Control: Planning for Air Quality* and IAQM's *Guidance on the assessment of dust from demolition and construction*, it is considered that the proposed development adheres to the principles of the National Planning Policy Framework since the new development will not be *"put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution".* Since it has been shown that in terms of air quality, the proposals adhere to local and national planning policy, it is considered that the air pollution should not be a constraint on the proposed residential development.

Appendix 1
Glossary of Terms

Appendix 1: Glossary of Terms

National Air Quality Standard/National Air Quality Objective (NAQO): 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 an assessment of the effects of each pollutant on human health including the effects on sensitive subgroups.

Annual mean: The average of the concentrations measured for each pollutant for one year. In the case of the Air Quality Objectives, this is for a calendar year.

Air Quality Management Area (AQMA): An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.

Concentration: The amount of a (polluting) substance in a volume (of air), typically expressed as a mass of pollutant per unit volume of air (for example, microgrammes per cubic metre, $\mu g/m^3$) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).

Exceedance: A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.

Nitrogen Oxides: Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. NO is not considered to be harmful to health. However, once released into the atmosphere, NO is usually very rapidly oxidised to nitrogen dioxide (NO_2), which is harmful to health. NO_2 and NO are both oxides of nitrogen and together are referred to as nitrogen oxides (NO_x).

Particulate Matter: Fine Particles are composed of a wide range of materials arising from a variety of sources including combustion sources (mainly road traffic), and coarse particles, suspended soils and dust from construction work. Particles are measured in a number of different size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM_{10} (less than 10 microns in diameter), but the finer fractions such as $PM_{2.5}$ (less than 2.5 microns in diameter) is becoming of increasing interest in terms of health effects.

$\mu g/m^3$ microgrammes per cubic metre of air: 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 2
Air Quality Model

Appendix 2: Air Quality Model

ADMS-Roads

In the UK, the Department for Environment, Food & Rural Affairs (Defra) provides guidance on the most appropriate methods to estimate pollutant concentrations for use in Local Air Quality Management (LAQM). Defra regularly updates its Technical Guidance, with the latest LAQM Technical Guidance TG22 published in 2016.

The methodology in TG22 directs air quality professionals to a number of tools published by Defra to predict and manage air quality. One of the main tools for modelling air pollutants is ADMS-Roads, which is a refined air dispersion model produced by Cambridge Environmental Research Consultants. ADMS-Roads has been specifically developed for use with UK roads and as such is considered to be one of the most appropriate tools for use in UK air quality modelling and therefore is widely used in the UK.

ADMS-Roads is an air dispersion modelling suite that predicts the air quality impacts of nitrogen dioxide, particulate matter and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roads and junctions.

The methodology utilised by ADMS-Roads is significantly more advanced than that of most other air dispersion models, such as CALINE, which Breeze Roads is based upon, which is the other commonly used detailed air dispersion model in the UK. ADMS-Roads incorporates the latest understanding of the boundary layer structure and goes beyond the simplistic Pasquill-Gifford stability categories method used in other dispersion models and utilises the Monin-Obukhov length for greater accuracy. The model also uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

Unlike the 'DMRB Screening Method', ADMS-Roads can take into account annualised meteorological data; it can take into account source, receiver and terrain heights; canyon effects can be modelled, and the model can calculate hourly concentrations.

TG22 provides detailed guidance on the modelling of air pollutants and in particular highlights a procedure to validate models. The procedure discusses the comparison of modelled results against measured levels, either from diffusion tubes (for NO_2) or continuous monitors (for NO_2 or PM_{10}).

Model verification and subsequent adjustment for oxides of nitrogen is undertaken based upon NO_X as most models (including ADMS-Roads) predict NO_2 based upon its relationship to NO_x. Consequently, the verification process requires conversion to NO_x of any measurements of NO_2 in order to compare against modelled levels of NO_x.

Defra has published in 2009 a methodology to calculate NO_x from NO_2 and as part of its LAQM toolkit[2]. The calculation method allows local authorities and air quality consultants to derive NO_2 and NO_x wherever NO_x is predicted by modelling emissions from roads. The calculation method incorporates the impact of expected changes in the fraction of NO_x emitted as NO_2 (f – NO_2) and changes in regional concentrations of NO_x, NO_2 and O_3.

[2] http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html

Background concentrations for various pollutants are published and updated regularly by Defra, so it is possible to calculate the contribution of NO_x from road traffic at a particular location. If the ratio of the monitored road traffic contribution to the modelled road traffic contribution of NO_x is calculated, this factor can be applied to the component derived from road traffic emissions for any predictions of NO_x in the area. Therefore, it is possible to validate the model such that predictions should be within 10% of air quality measurements.

Appendix 3
Modelling Procedure and Input Data

Appendix 3: Modelling Procedure and Input Data

The following Appendix summarises the input data and assumptions used in the modelling of air pollutants.

Appendix 3.1 - Traffic Data

Traffic flows in the vicinity of the site have been obtained from the Department for Transport's traffic database for the year 2019, and from traffic surveys conducted by TPA where this was not available. High traffic growth factors have been applied to this data to predict traffic flows for the proposed opening year (2027).

Since lower traffic speeds increase emissions from vehicles, it is necessary to take into account the reduction in traffic speeds around junctions. TG22 suggests that *"there is no simple factor that can be applied to the average speed to calculate a speed applicable to congested periods"* and that one should exercise professional judgement when taking into account congestion and decreasing speeds around junctions. However, in the absence of any more detailed site-specific information, TG22 does suggest that that *"For a busy junction, assume that traffic approaching the junction slows to an average of 20kph …(for) approach distances of approximately 25m"*. This is the approach adopted at this site.

All road links within 200m of a receptor have been included in the model. Road widths have been modelled in accordance with OS mapping data. However, based on observations, road widths are adjusted to take into account any restrictions to flow, such as parked cars.

Since road-traffic emissions on roads with significant gradients (>2.5%) can increase significantly, especially in relation to HGVs, significant gradients are taken into account in the modelling. At this site, road gradient effects were not considered to be significant.

The wake effects of traffic induced turbulence have been included in the modelling as standard. This takes into account the fact that increased traffic volumes and speeds produce more turbulence, which has effects on dispersion.

Input road links, traffic flows, the percentage of Heavy Goods Vehicles (HGVs) and traffic speeds are shown below.

Model Input Data

Road	AADT 2019	AADT 2027	AADT 2027 with Development	% HGV	Speed km/h
Bicester Rd 1	7779	8718	8997	5.5	64
Bicester Rd 2	7798	8738	8839	5.4	64
Bicester Rd 3	7798	8738	8839	5.4	20
Bicester Rd 4	10943	12263	12297	4.3	20
Bicester Rd 5	10943	12263	12297	4.3	64
A34	79325	88892	89029	9.7	112

Appendix 3.2 - Meteorological Data

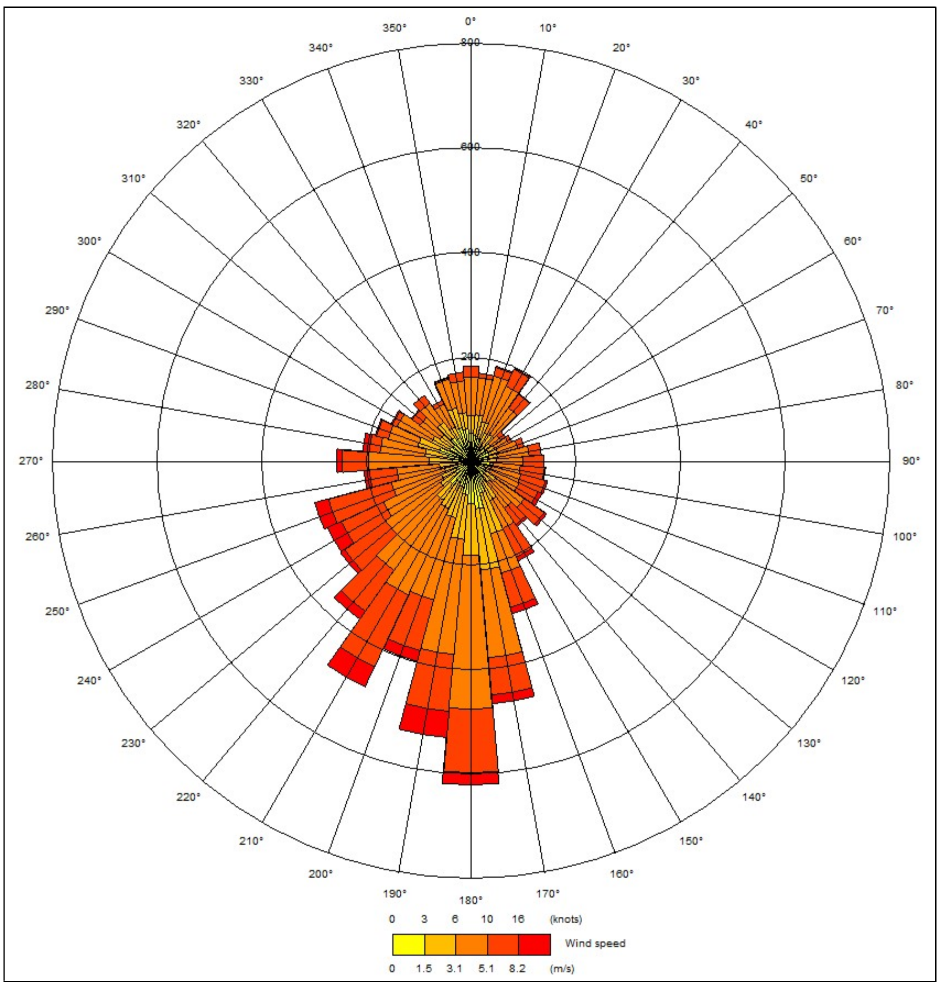
TG22 suggests that a single year's meteorological data will be sufficient to predict air pollution concentrations.

Meteorological data was obtained from RAF Benson for 2019. It is considered that this weather station is likely to be representative of conditions within the area local to the development site.

Data was collected in accordance with internationally accepted weather observation techniques, specifically the METAR weather format, which is an internationally recognised standardised weather format commonly used in the aviation industry. The meteorological data consists of hourly sequential data of wind speed, wind direction, surface temperature, precipitation rate and cloud cover data. In line with the standards, all data is passed through numerous quality control checks. At this site, the data was over 98% complete, with very little missing data.

The Meteorological data was used for both model verification and future year scenarios. The figure below shows the wind rose data used in the modelling.

Wind Rose – RAF Benson 2019



Appendix 3.3 - Emission Factors

The model utilises emission factors contained within EFT v11.0, published in November 2021. This represents the most up to date emissions factors available. The Emissions Factors Toolkit (EFT) is published by Defra and the Devolved Administrations to assist local authorities in carrying out Review and Assessment of local air quality as part of their duties under the Environmental Act 1995. It can be used by anyone to predict pollution concentrations at a given point, in conjunction with a detailed dispersion model.

The EFT provides emission rates for 2018 through to 2030 and takes into consideration data from the National Atmospheric Emissions Inventory (NAEI) such as fleet composition based on European emission standards from pre-Euro I to Euro 6/VI (including Euro 6 subcategories) and scaling factors reflecting improvements in the quality of fuel and some degree of retrofitting.

The EFT allows users to calculate road vehicle pollutant emission rates for NO_x, PM_{10}, $PM_{2.5}$ and CO_2 for a specified year, road type, vehicle speed and vehicle fleet composition. EFT v11.0 uses the latest COPERT 5.3 NO_x and PM emissions factors, updated from COPERT 5.0. The EFT is updated regularly to reflect changes in vehicle fleet composition and emissions factors.

It should be noted that the fleet projections in EFT v11.0 are based on fleet growth assumptions which were current prior to the Covid-19 pandemic and subsequent restrictions and lockdowns. Outputs from the EFT do not reflect short or longer-term impacts on emissions resulting from behavioural change during the national or local lockdowns. Consequently, it is probable that emission factors from EFT v11.0 represents a worst-case scenario when considering future pollutant concentrations.

Appendix 3.4 – Street Canyons

ADMS-Roads is designed to be used to model concentrations at different locations assuming that there are no obstacles to air flow. Dispersion modelling in urban areas is difficult due to the presence of buildings, trees, walls, etc. that modify the wind flow and alter the dispersion of traffic emissions. This is especially the case in so called 'street canyons', where buildings, or other obstacles, can trap pollutants and restrict dispersion. ADMS-Roads includes additional modules to account for the restricted dispersion.

Although street canyons have been defined as narrow streets where the height of buildings on both sides of the road are greater than the road width, there are numerous examples whereby broader streets may be considered as street canyons. It also does not require buildings on both sides of a road to restrict dispersion. A wall or a bank with trees will also affect dispersion, as will overhanging trees.

Background concentrations influence pollutant levels within street canyons when the air mass at rooftop level moves into the canyon, leading to increased ventilation and flushing of the polluted air from the traffic. Similarly, gaps between buildings allow increased wind flows to enter the canyon and can re-circulate pollutants away from the junctions but causing increased concentrations further away. The opposite effect may occur if the gap is at a junction, where road traffic emissions are carried into the canyon, resulting in higher concentrations.

The concentrations depend of the wind direction with respect to the orientation of the street canyon; when the wind is perpendicular to the road higher concentrations occur on the leeward side. Wind blowing along a road will reduce concentrations as it ventilates the canyon. In reality, street canyons in are generally not regular in shape, the buildings on opposite sides of the road are of different heights, the width varies along the street and there are gaps between buildings.

LAQM.TG22 states *"Where a street can be partially classified as a street canyon, for example, where there are gaps in between buildings, monitoring in such locations may indicated elevated concentrations. It is therefore recommended that local authorities consider these links as street canyons; otherwise predicted concentrations are likely to be under-estimated"* (paragraph 7.413).

At this site, street canyon effects were not considered to be significant.

Appendix 3.5 - Advanced Modelling Parameters

The following modelling parameters have been used in the ADMS-Roads Model:

Parameter	Value	Justification
Latitude	51.81˚	Latitude of site
Surface Roughness Note 1	0.5 m	Recommended for suburban areas
Minimum Monin-Obukhov Length	30 m	Recommended for towns and cities
Surface Albedo	0.23	The default for non-snow-covered ground
Priestley-Taylor Parameter	1.0	Model default

Note 1: A surface roughness of 0.2 has been applied to the meteorological measurement site, as it is considered to be a less built up area than the proposed development site.

Appendix 3.6 - Background Concentration of Air Pollutants

Background concentrations of air pollutants for the modelling were obtained from the UK National Air Quality Information Archive, in accordance with Local Air Quality Management Technical Guidance TG22. Background concentrations of **13.60 µg/m^3**, **16.79 µg/m^3**, and **10.89 µg/m^3** of NO_2, PM_{10} and $PM_{2.5}$ respectively were determined for the 1 km^2 grid square centred at 450500 213500. In order to avoid 'double counting', major road sources within the grid square identified were removed from the total background as they have been explicitly modelled as part of the assessment.

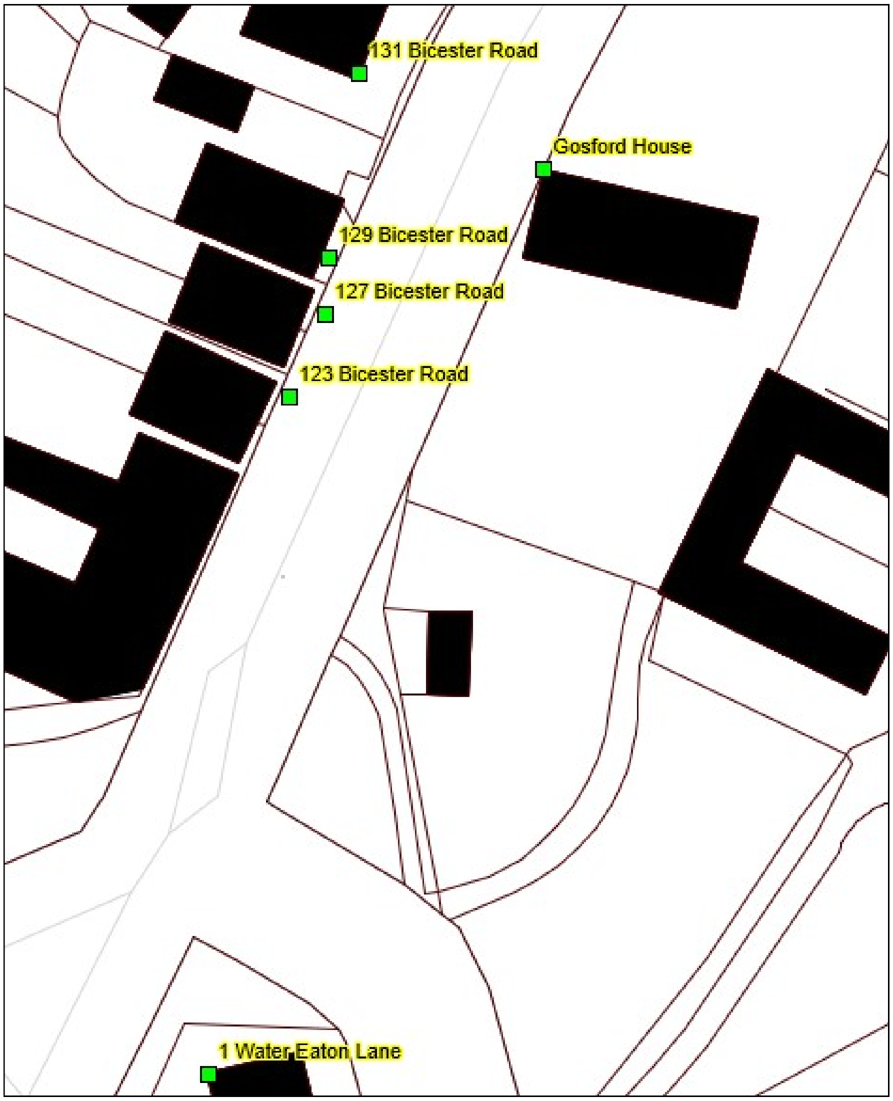
The estimated background concentration of NO_2 (13.60 µg/m^3) closely matches that of the nearest background monitoring location in Cherwell (diffusion tube at Benmead Road) which measured an annual average NO_2 concentration of 13.8 µg/m^3 in 2019.

The above background concentrations have been used in all modelling scenarios (current and future) in order to show a worst-case scenario, i.e., future concentrations assuming that background levels stay constant and do not decrease as expected.

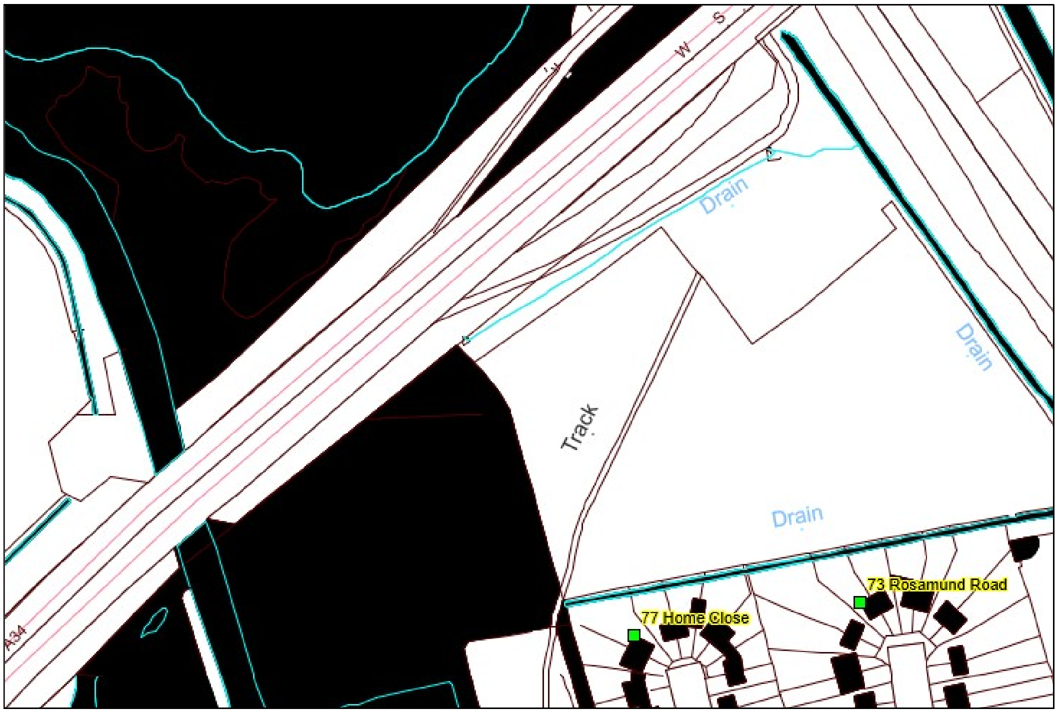
Appendix 3.7 - Receptor Locations

The plans below show the locations of the sample sensitive receptor locations used within the modelling.

It is good practice to include receptors in the model that represent those locations where concentrations are likely to highest. Consequently, the receptors include those locations closest to the kerbside, nearest to junctions or locations where traffic is stationary, slowed or congested and where appropriate include receptors on both sides of a road to take into account the fact the wind directions are predominately in one direction and the greatest annual mean impacts are generally downwind.


131 Bicester Road
Gosford House
129 Bicester Road
127 Bicester Road
123 Bicester Road
1 Water Eaton Lane

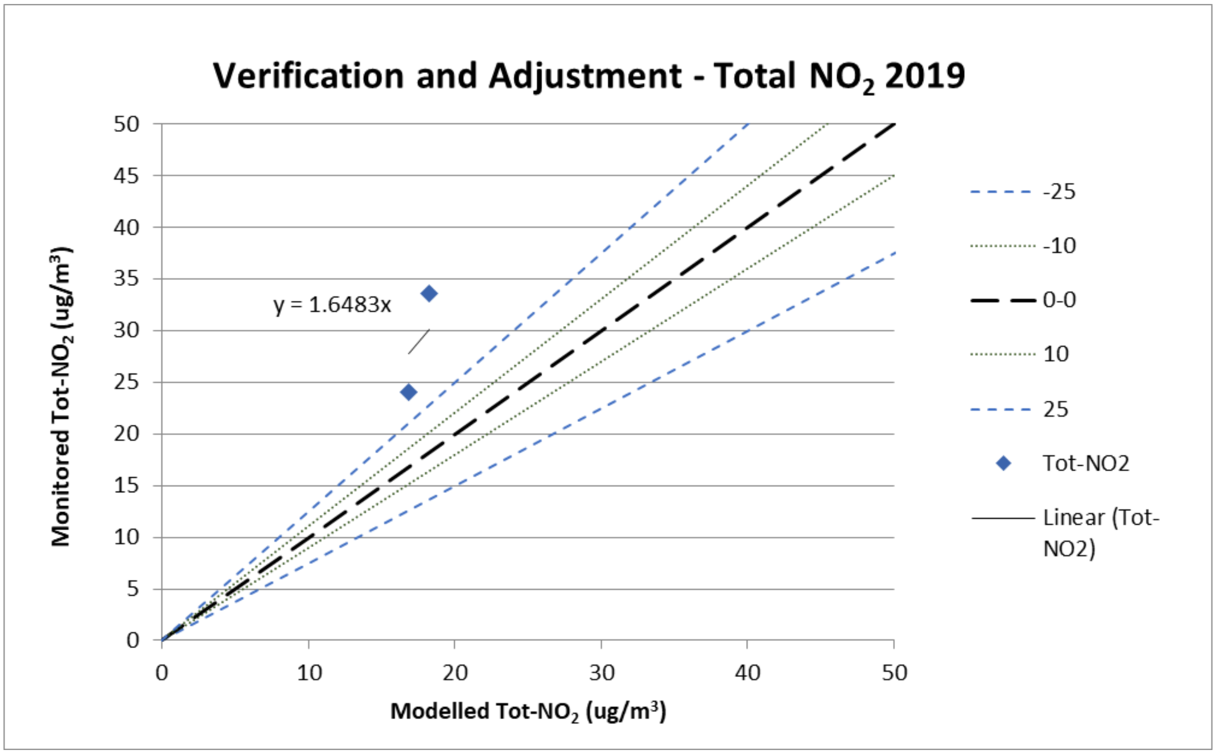

16 Beagles Close
CROMWELL WAY
Gosfo
65m
Cemy
38 Cromwell Way

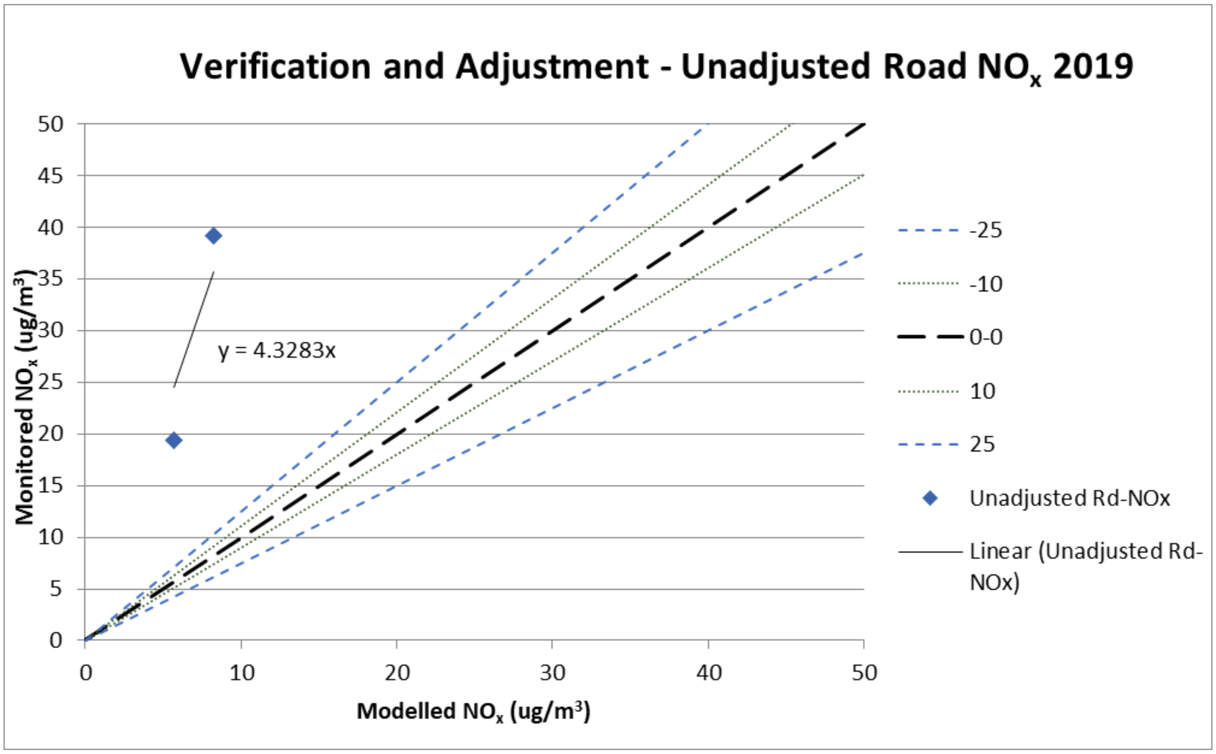

Drain
Drain
Track
Drain
73 Rosamund Road
77 Home Close
A34

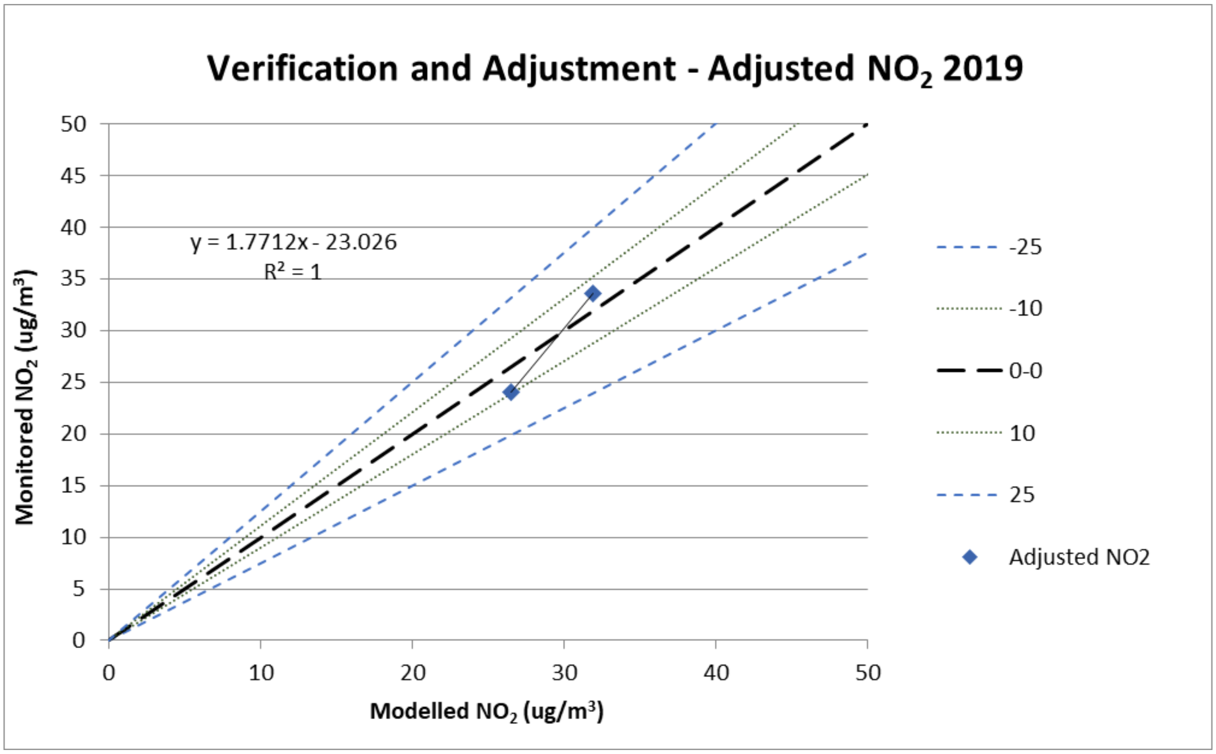
Appendix 3.8 - Verification and Adjustment

Verification of the air pollutant model was carried out in accordance with LAQM Technical Guidance TG22 using the data from the diffusion tube located in the vicinity of the site for 2019. The exercise required the modelling of the diffusion tube location for 2019 and comparing the modelled results with the monitoring results. The verification data is summarised below and shows that pollutant concentrations where underpredicted using the model; therefore, an adjustment factor of 4.3283 was applied to the model contribution of NO_x.

	Modelled Rds NO_x	Modelled Tot-NO_2	Monitored Tot-NO_2	%Diff Mod/Mon Tot-NO_2	Modelled Rd-NO_x	Monitored Rd-NO_x	NO_x ADJ Corr1	Adj Mod Rd-NO_x	Adj Mod Tot-NO_2	Monitored Tot-NO_2	%Diff Mod/Mon Adj Tot-NO_2
Bicester Road 2	8.25	18.25	33.6	-45.68	8.25	39.2	4.75	35.70	31.97	33.60	-4.85
Bramley Close	5.65	16.87	24.0	-29.71	5.65	19.36	3.42	24.47	26.55	24.00	10.63


Verification and Adjustment - Total NO2 2019
Monitored Tot-NO2 (ug/m3)
Modelled Tot-NO2 (ug/m3)
y = 1.6483x
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
-25
-10
0-0
10
25
Tot-NO2
Linear (Tot-NO2)


Verification and Adjustment - Unadjusted Road NOx 2019
Monitored NOx (ug/m3)
Modelled NOx (ug/m3)
y = 4.3283x
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
-25
-10
0-0
10
25
Unadjusted Rd-NOx
Linear (Unadjusted Rd-NOx)


Verification and Adjustment - Adjusted NO2 2019
Monitored NO2 (ug/m3)
Modelled NO2 (ug/m3)
y = 1.7712x - 23.026
R² = 1
0
5
10
15
20
25
30
35
40
45
50
0
10
20
30
40
50
-25
-10
0-0
10
25
Adjusted NO2

Appendix 3.9 - Model Uncertainty

TG22 recommends the use of statistical parameters to assess uncertainty in the verified model. The table below describes the three parameters it recommends and the corresponding value for the verified model at this site.

Parameter	Value	Description
Correlation Coefficient	N/A	Used to measure the linear relationship between predicted an observed data. The ideal value (an absolute relationship) is 1.
Root Mean Square Coefficient	2.1	RMSE defines the average error/uncertainty of the model verification and is in the same units as the model outputs (μg/m^3). Values should be <10μg/m^3 or ideally <4μg/m^3 where concentrations are near the AQO. The ideal value is 0μg/m^3.
Fractional Bias	-0.02	Identifies if the model shows a systematic tendency to over/under predict concentrations. The ideal value is 0 and range between +/- 2. Negative values suggest an over prediction whilst positive values suggest under prediction.

TG22 notes that the Correlation Coefficient is a less reliable indicator when validating with a small dataset; therefore, for sites such as this validated with smaller datasets, the Root Mean Square Coefficient is the main parameter used. The table above notes that the Root Mean Square Coefficient is 2.1, i.e. less than 4 and therefore the model can be used with a high level of confidence. The Fractional Bias is just less than 0, indicating that on average, the validated model is likely to overpredict very marginally, but overall should be highly accurate.

Appendix 3.10 - PM_{10} Exceedances

The number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration has been calculated from the modelled total annual mean concentration following the relationship advised by Defra:

$A = -18.5 + 0.00145\ B^3 + 206/B$

where A is the number of exceedances of 50 µg/m^3 as a 24-hour mean PM_{10} concentration and B is the annual mean PM_{10} concentration.