BRISLINGTON MEADOWS BRISLINGTON MEADOWS BRISLINGTON

Air Quality Impact Assessment

Homes England

ENVIRONMENTAL CONSULTANTS

Report for:

Homes England

Brislington Meadows

Air Quality Assessment

Status: Final **Date: 07.04.2022**

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Report For	Homes England
Date	07.04.2022
Version Number	A3949/AQ/04
Status	Final

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1. INTRODUCTION

ACCON UK Limited (ACCON) has been commissioned by CampbellReith on behalf of Homes England to carry out an Air Quality Assessment for the proposed development at: Brislington Meadows, Broomhill Road, Bristol, BS4 4UD.

The 'proposed development' comprises an outline planning application for the development of up to 260 dwellings with pedestrian, cycle and vehicular access, cycle and car parking, public open space and associated infrastructure. All matters except access are reserved.

The Applicant is committed to delivering affordable housing in line with policy requirements and will deliver a 10% net gain in biodiversity through on-site and off-site measures.

The proposed development is located within the administrative boundary of Bristol City Council (BCC).

The proposed development is expected to be fully completed and occupied by 2028, which for air quality purposes will be utilise as a worst-case scenario.

This assessment has been completed in order to determine whether the proposed development achieves compliance against the National Air Quality Objectives (NAQOs), along with National and Local Planning Policy. The assessment has been undertaken in accordance with the Department for Environment, Food and Rural Affairs' (DEFRA) current Technical Guidance on Local Air Quality Management (LAQM.TG16.)[1] and covers the effects of local air quality on the development.

The report assesses the overall pollutant concentrations of nitrogen dioxide (NO_2) and particulates (PM_{10} and $PM_{2.5}$) at nearby existing sensitive receptors. A glossary of terms is detailed in **Appendix 1** and the location of the site is shown in **Section 3.1**. **Appendix 4** identifies nearby sensitive receptor locations, modelled to assess the impacts of additional traffic emissions associated with the operation of the development. The development plan for the site with development receptor locations is identified in **Appendix 5**.

The potential air quality impacts of the development have been assessed on the basis of the findings of detailed dispersion modelling using Breeze Roads GIS Pro Version 5.1.8, which has been undertaken in the context of relevant NAQOs, emission limit values and relevant guidance.

[1] DEFRA, Local Air Quality Management Technical Guidance 2021.

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2. AIR POLLUTION POLICY CONTEXT

2.1. Legislation

2.1.1. Air Quality Strategy and Local Air Quality Management (LAQM)

Part IV of the Environment Act 1995 requires the Secretary of State to publish an air quality strategy and local authorities to review and assess the quality of air within their boundaries.[2] The latter has become known as Local Air Quality Management (LAQM), an instrument by which the Government's air quality objectives are to be achieved over a determined period of time.

The Air Quality Strategy provides the policy framework for local air quality management and assessment in the UK. It sets out air quality standards and objectives for key air pollutants which are designed to improve air quality and protect human health and the environment from the effects of pollution. These terms are defined below:

- The 'standards' are set at concentrations below which health effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of a particular pollutant.
- The 'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of the costs, benefits, feasibility and practicality of achieving the standards. The air quality standards and objectives are outlined in **Appendix 2**.

As part of this LAQM role, Local Authorities are required to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. Where a local authority identifies areas of non-compliance with the Air Quality Objectives[3] of pollutants of concern, and there is relevant public exposure, there remains a statutory need to declare the geographic extent of non-compliance as an Air Quality Management Area (AQMA) and to draw up an action plan detailing appropriate measures and policies that can be introduced in order to work towards achieving the objective(s).

The objectives for use by Local Authorities are prescribed within the Air Quality (England) Regulations 2000[4], and the Air Quality (England) (Amendment) Regulations 2002[5]. The AQOs for pollutants included within the Air Quality Strategy and assessed as part of the scope of this report are summarised in **Table 2.1**. The objectives for NO_2 and PM_{10} were to have been achieved by 2005 and

[2] In 1997, the United Kingdom National Air Quality Strategy (NAQS) was published in response to the Environment Act of 1995, setting out a framework of standards and objectives for the air pollutants of most concern (SO_2, PM_{10}, NOx, CO, lead, benzene, 1,3-butadiene and tropospheric ozone), to be achieved by local authorities through a system of Local Air Quality Management (LAQM) by 2005. The aim of the strategy was to reduce the air pollutant impact on human health by reducing airborne concentrations. A review of the NAQS led to the publication of Air Quality Strategy for England, Scotland, Wales and Northern Ireland in January 2000, whilst in July 2007 was further reviewed with various amendments to the Air Quality Objectives for local authorities.
[3] Defra, 2018, Local Air Quality Management Technical Guidance (TG16)
[4] The Stationary Office (2000) Statutory Instrument 2000, The Air Quality (England) Regulations 2000, London
[5] The Stationary Office (2002) Statutory Instrument 2002, The Air Quality (England) (Amendment) Regulations 2002, London

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2004 respectively and continue to apply in all future years thereafter. The $PM_{2.5}$ objective is to be achieved by 2020. It should be noted that Local Authorities in England have a flexible role in working towards reducing emissions and concentrations of $PM_{2.5}$.

Table 2.1: UK Air Quality Objectives for NO_2, PM_{10} and $PM_{2.5}$

Pollutant	Objectives	Averaging Period
Nitrogen dioxide (NO_2)	200µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40µg/m^3	Annual mean
Particulate Matter (PM_{10})	50µg/m^3 not to be exceeded more than 35 times a year	24-hour mean
	40µg/m^3	Annual mean
Particulate Matter ($PM_{2.5}$)*	Work towards reducing emissions/ concentrations of fine particulate matter ($PM_{2.5}$)	Annual mean

*The $PM_{2.5}$ objective, which is to be met by 2020, is not in (Air Quality England) Regulations and there is no requirement for local authorities to assess it, although they are encouraged to do so.

The AQS objectives apply at locations where members of the public are likely to be regularly present and exposed over the averaging period of the objective. **Table 2.2** identifies examples of where the annual mean objectives should apply as provided in LAQM.TG16[6], and include: building facades of residential properties[7], schools, hospitals, etc. The annual mean objectives are not relevant for the building facades of offices or other places of work where members of the public do not have regular access, kerbsides or gardens. The 24-hour mean objective applies to all locations where the annual mean objective would apply, together with hotels and gardens of residential properties. The 1-hour mean objective also applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1-hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

[6] Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.
[7] Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality. v1.2. Institute of Air Quality Management, London.

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Table 2.2 Examples of where AQS should be applied

Averaging Period	AQS Should Apply	AQS Should Not Apply
Annual Mean	All locations where members of the public might be regularly exposed. Building facades of: • Residential properties* • Schools • Hospitals • Care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. • Hotels, unless people live there as their permanent residence. • Residential gardens • Kerbside sites or any other location where public exposure is expected to be short term.
24-hour and 8-hour mean	All locations where the annual mean objective would apply. • Hotels • Residential gardens	Kerbside sites or any other location where public exposure is expected to be short term.
1-hour mean	All locations where the annual mean and 24 and 8-hour mean objectives apply. • Kerbside sites (e.g. pavements of busy shopping streets) • Those parts of car parks, bus stations and railway stations etc which are not fully enclosed, where members of the public might spend one hour or more. • Any outdoor locations where members of the public might spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

*Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local adjustment should always be applied.

2.2. Clean Air Strategy

The Clean Air Strategy 2019[8] was released in January 2019 and supersedes the policies featured in The National Air Quality Strategy. The strategy mainly deals with how to improve air quality in England but also discusses air quality policy in the devolved administrations. In comparison with the previous strategies it has a more joined-up approach, incorporating transport, domestic, industrial and agricultural emission reduction policies with a combined focus on both ambient and indoor air quality. The plan also has an emphasis on the proposal to use Clean Air Zones (CAZs) and the ULEZ

[8] DEFRA, 2019, The Clean Air Strategy 2019

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(in London) to quickly bring highly polluted urban centres below the legal limits. Some of the key policies in the plan are a renewed consideration of under-used Smoke Control Areas due to the growth of highly polluting domestic wood burning stoves, new best practices being incorporated into the agricultural sector to reduce ammonia emissions (and their associated secondary particulates) and with a policy to prohibit the sale of new petrol and diesel cars by 2040. However, air quality objective limits outlined in the document are largely unchanged from the previous strategy.

2.3. National Planning Policy

The National Planning Policy Framework (NPPF) was first published on 27th March 2012 and updated on 24th July 2018, 19th February 2019, and 20th July 2021. The policy sets out the government's planning policies for England and how these are expected to be applied.

The NPPF[9] "sets out the Government's planning policies for England and how these should be applied and provides a framework within which locally-prepared plans for housing and other development can be produced." It includes advice on when air quality should be a material consideration in development control decisions. Relevant sections are set out below:

Section 9 - Promoting sustainable transport:

Paragraph 105

> *"The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making.."*

Section 15 - Conserving and enhancing the natural environment:

Paragraph 174 Bullet point 'e':

> *"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; and*

Paragraph 186:

> *"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*

[9] Ministry of Housing, Communities and Local Government, 2019, National Planning Policy Framework

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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."

The NPPF is accompanied by relevant planning practice guidance (PPG)[10], a web-based resource which brings together planning guidance on various topics into one place. Specific guidance in respect to air quality is provided where the guiding principles on how planning can take account of the impact of new development on air quality is included. The PPG states 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). Air quality may also be a material consideration if the proposed development would be particularly sensitive to poor air quality in its vicinity."

The PPG sets out the information that has to be considered when deciding whether an air quality assessment may be required for a planning application, stating that:

Where air quality is a relevant consideration the local planning authority may need to establish:

- *the 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.*

It also provides guidance on options for mitigating air quality impacts, and makes clear that:

"Mitigation options will need to be locationally specific, will depend on the proposed development and need to be proportionate to the likely impact. It is important that local planning authorities work with applicants to consider appropriate mitigation so as to ensure new development is appropriate for its location and unacceptable risks are prevented. Planning conditions and obligations can be used to secure mitigation where the relevant tests are met."

[10] GOV.UK. (2014). Air quality. [online] Available at: https://www.gov.uk/guidance/air-quality--3 [Accessed 07 October 2020].

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Examples of mitigation include:

- *Where air quality is a relevant consideration the local planning authority may need to establish:*
- *the 'baseline' local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.*

2.4. Local Planning Policy

The Bristol Development Framework - Core Strategy (2011)

"The City Council is preparing the Bristol Development Framework (BDF). The BDF is a series of documents which will eventually replace the Bristol Local Plan that was adopted in 1997.

The BDF will consider how the city will develop over the next 15 to 20 years. The BDF documents will form part of the statutory Development Plan for the city. The Development Plan is used to help direct a range of implementation plans and decisions on planning applications.

The new development plan making process means that not all documents of the BDF need to be prepared simultaneously. The series of documents that make up the BDF will be prepared over time. The Local Development Scheme sets out the details of the documents the council will prepare in the next few years and when each will be prepared."

> *"Bristol collects around 180,000 tonnes of municipal waste each year. Between 2006 and 2009 the amount of household rubbish recycled has increased from 18.5% to 37%. Air Quality Management Areas have been established covering central Bristol and major arterial roads to monitor air quality in these locations where air quality objectives are not consistently met.*
>
> *Green infrastructure is the term used to describe the network of green assets that can work together to support sustainability and quality of life within and around Bristol. These networks bring many social, economic and environmental benefits, including:*
>
> - *Improved mental and physical health of local communities: Green infrastructure ensures access to good quality recreational places and spaces, encourages active travel along cycle and walking routes, provides space for community activities and interaction, reduces noise and water pollution, improves air quality and also allows access to natural areas of space and wildlife.*
>
> *Pollution from development to land, air or water can occur in a number of forms including smoke, fumes, dust, smell, vibration, noise and an increase in levels of artificial light. These*

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can have adverse impacts upon health both directly, for example a reduction in air quality can affect respiratory health, and indirectly through degradation of the natural environment and local amenity which can affect the quality of life and wellbeing of citizens. Certain types of development also pose risks to ground and surface water quality

Air Quality Management Areas are defined where local concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10}) exceed national targets. There is currently one designated Air Quality Management Area within the city, which covers the central area and major roads into the city centre. It would not be appropriate to resist all new development in such areas as they are often in the most sustainable locations. However, regard should be had to opportunities to minimise the contribution of development to airborne pollution and the impact on new development of existing airborne pollution in these areas. Diffuse pollution from development close to watercourses can be reduced through filtration and interception.

Policy BCS23

Development should be sited and designed in a way as to avoid adversely impacting upon: n Environmental amenity or biodiversity of the surrounding area by reason of fumes, dust, noise, vibration, smell, light or other forms of air, land, water pollution, or creating exposure to contaminated land."

Bristol Local Plan – Site Allocations and Development Management Policies – Adopted July 2014

Policy DM33: Pollution Control, Air Quality and Water Quality

As set out in policy BCS23 of the Core Strategy, excessive levels of air, land and water pollution have the potential to impact adversely on environmental amenity, biodiversity and, both directly and indirectly, on health and wellbeing.

Air Quality Management Areas are designated where concentrations of key pollutants exceed national targets. While much of Bristol's existing Air Quality Management Area covers otherwise sustainable locations where new development and regeneration are to be encouraged, major development within Air Quality Management Areas will require mitigation. Meanwhile, development outside Air Quality Management Areas should not cause new Air Quality Management Areas to be designated.

Water quality is also a key issue. Under the Water Framework Directive, the council has a statutory duty to improve the condition of water bodies within the Bristol area, working towards the target of 'Good Ecological Status'. New development adjacent to underground or surface water bodies is expected to contribute towards this objective. The scope of the Water Framework Directive within the Bristol area is defined by the Severn River Basin Management Plan.

This policy seeks to ensure that any proposal for potentially polluting development is accompanied by an appropriate scheme of mitigation, and to resist potentially polluting

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development that cannot be satisfactorily mitigated. It also sets out the approach to air and water quality to meet the council's statutory duties

Potentially Polluting Development

Development which has the potential, either individually or cumulatively, for an unacceptable impact on environmental amenity, biodiversity or water quality by reason of pollution as set out in the Core Strategy but is considered desirable for reasons of economic or wider social need will be expected to provide an appropriate scheme of mitigation. In assessing a scheme of mitigation, account will be taken of:

i. The location, design and layout of the proposed development; and

ii. Measures to bring levels of emissions to an acceptable level; and

iii. Measures to control run-off and other diffuse pollution; and

iv. Hours of operation; and

v. Measures that reduce existing levels of pollution.

Development will not be permitted if mitigation cannot be provided to an appropriate standard with an acceptable design, particularly in proximity to sensitive existing uses or sites.

Development Sensitive to Pollution

In areas of existing noise or other types of pollution, new development sensitive to the effects of that pollution is unlikely to be permitted where the presence of that sensitive development could threaten the ongoing viability of existing uses that are considered desirable for reasons of economic or wider social need, such as safeguarded industrial uses, through the imposition of undue operational constraints.

Air Quality

Development that has the potential for significant emissions to the detriment of air quality, particularly in designated Air Quality Management Areas, should include an appropriate scheme of mitigation which may take the form of on-site measures or, where appropriate, a financial contribution to off-site measures.

Development in designated Air Quality Management Areas should take account of existing air pollution and include measures to mitigate its impact on future occupiers where possible and consistent with other policies of the development plan such as those on climate change and urban design.

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2.5. Relevant Guidance

2.5.1. Local Air Quality Management Technical Guidance (TG16)

DEFRA's Technical Guidance LAQM (TG16)[11] provides guidance in respect of the local air quality; whilst this primarily addresses LAQM activities, the guidance provides relevant methods concerning treatment and interpretation of data. The methodology in LAQM.TG16. directs air quality professionals to a number of tools published by DEFRA to predict and manage air quality. DEFRA regularly updates its Technical Guidance, with the latest LAQM Technical Guidance (TG16) published in April 2021.

2.5.2. Land-Use Planning & Development Control: Planning for Air Quality (IAQM, 2017)

This guidance[12] has been produced by Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) to ensure that air quality is adequately considered in the land-use planning and development control process. This guidance, of itself, can have no formal or legal status and is not intended to replace other guidance that does have this status. This document has been developed for professionals operating within the planning system. It provides them with a means of reaching sound decisions, having regard to the air quality implications of development proposals. It also is anticipated that developers will be better able to understand what will make a proposal more likely to succeed. This guidance is particularly applicable to assessing the impacts of traffic and energy centre emissions and provides advice how to describe air quality impacts and their significance.

[11] DEFRA, 2018, Local Air Quality Management Technical Guidance (TG16)
[12] Moorcroft and Barrowcliffe. et al. (2017) Land-use Planning & Development Control: Planning for Air Quality. v1.2. Institute of Air Quality Management, London.

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3. SITE DESCRIPTION AND BASELINE CONDITIONS

3.1. Site Description

The proposed development site is located within the administrative boundary of Bristol City Council (BCC).

The Site is located in Brislington in the southeast of Bristol within the administrative boundary of Bristol City Council and the Ward of Brislington East.

The Site comprises an irregular shaped parcel of land (9.6 hectares) known as Brislington Meadows, as identified in **Figure 3.1**.

To the northeast, the Site is bound by Broomhill Road and residential properties in Condover Road. To the north the Site is bound by residential dwellings on Belroyal Avenue and an associated rear access lane, Broomhill Junior School and Mama Bear's Day Nursery, and residences accessed off Allison Road. To the east the site is bound by Bonville Road and the protected employment area comprising the Bonville Trading Estate. To the west of the site is School Road and allotments. To the south lie Victory Park and paddocks which comprise protected open space and a Site of Nature Conservation Interest.

The Site currently comprises open fields crossed by two public rights of way and a network of informal trodden paths. The Site is not subject to specific environmental or landscape designations and has an allocation for housing development in the Council's Local Plan.

The Site is characterised by a steeply sloping topography from the northern boundary down to the southern boundary, with the gradient reducing towards the east. There are overhead electricity cables and a pylon on the lower slopes towards the southern boundary of the Site. A telecommunications mast towards the northeast of the Site will be relocated following the grant of planning consent for the proposed development.

The Site is well located to make use of existing services and facilities. Broomhill Infant School, Broomhill Junior School and Mama Bear's Day Nursery are all located adjacent to the Site's northern boundary. Broomhill local centre, including a small convenience store, public house, salons and takeaway shops, is located approximately 200m north of the Site.

There is no public vehicular access into the Site at present. There are two public rights of way across the Site, one running east-west along the southern boundary connecting Bonville Road and School Road, and one north-south between Belroyal Avenue and Bonville Road. In addition, a network of informal trodden paths crosses the Site. The Applicant is in the process of formalising public access rights and the proposed development will accommodate pedestrian and cycle access across and within the Site.

The Site has a direct informal connection to Victory Park to the south. Eastwood Farm Local Nature Reserve is located approximately 150m north of the Site on the northern side of Broomhill Road.

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Nightingale Valley Park is located approximately 600m west of the Site off Allison Road. The site location is presented in **Figure 3.1.**

Figure 3.1: Site Location Plan

3.2. Air Quality Review and Assessment

As previously indicated, 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 limit values. Where these objectives are unlikely to be achieved, local authorities must designate these areas as AQMA's and prepare a written action plan to achieve the AQS's. The site is located approximately 500m from the Bristol city centre AQMA.

The review of air quality takes on several prescribed stages, of which each stage is reported. BCC Air Quality Annual Status Report 2020[13] provides the most recent available air quality monitoring results for the BCC (2019). Details of the monitoring data used for pollutant concentration model verification purposes are provided in **Section 3.3.**

3.3. Local Air Quality Monitoring

BCC monitors local air quality through an automatic monitor and diffusion tube monitoring network. The monitoring sites chosen for verification of the air quality modelling were the diffusion tubes as there is publicly available traffic data.

The 2019 annual mean NO_2 concentrations for the monitoring sites are identified in **Table 3.1.** The annual mean NO_2 NAQO was exceeded at both of the monitoring sites.

[13] 2020 Air Quality Annual Status Report (ASR) for Bristol City Council

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Table 3.1: Local Monitoring Data Suitable for Model Verification

Monitor Site Number	Grid Reference		2019 Annual Mean NO_2 (µg/m³)	2019 Data Capture (%)
	X	Y		
10 - Bath Road	361217	171429	42.2	100
175 - Top of Brislington Hill	362147	170525	44.6	100

3.4. Background Concentration of Air Pollutants

Background concentrations of air pollutants for the modelling were obtained from the DEFRA pollutant concentration maps[14].

Table 3.2 identifies the background pollutant concentrations at the diffusion tube monitoring locations and the proposed development site. All of the estimated background concentrations for the annual mean NO_2 and PM_{10} used in the assessment are significantly below the annual mean objective limit of 40µg/m³ in 2019 and 2028.

Table 3.2: Background Concentrations of Pollutants

Location and Year	NO_x µg/m³	NO_2 µg/m³	PM_{10} µg/m³	$PM_{2.5}$ µg/m³
10 - Verification – 2019 361500, 171500	20.9	15.3	15.4	10.5
175 - Verification – 2019 362500, 170500	19.6	14.4	14.4	9.5
Site and Existing Receptors - Opening Year – 2028 362500, 171500	12.4	9.5	13.0	8.9

Note: In 2028 the ratio between PM_{10} and $PM_{2.5}$ at the proposed Development Receptors is 0.68.

[14] DEFRA, *Background Mapping Data for Local Authorities- 2018* [online] Available at: https://uk-air.defra.gov.uk/data/laqm-background-maps?year=2018

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4. METHODOLOGY OF ASSESSEMENT AND ASSESSMENT CRITERIA

4.1. Methodology

In the UK, 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 (TG16)[15] published in February 2021. The methodology in LAQM.TG16 directs air quality professionals to a number of tools published by DEFRA to predict and manage air quality. For example, it is necessary to use the updated NO_x to NO_2 calculator to derive NO_2 concentrations from the NO_x outputs from Breeze Roads modelling. This is because NO_2 concentrations within the model are otherwise predicted using the CALINE4 NO_x to NO_2 conversion methodology, which should not be used within the model as current evidence shows that the proportion of primary NO_2 in vehicle exhausts has increased since the model was developed, which would affect the relationship between NO_x and NO_2 at roadside locations.

In order to determine the extent to which air quality issues will affect the development of the site, the study has considered the following:

- Any air quality measurements carried out in the area near the proposed development; and
- The most recent Air Quality Review and Assessment Reports from BCC.

4.2. Breeze Roads Modelling of Pollutant Concentrations

Dispersion modelling has been undertaken using Breeze Roads to determine air quality concentrations across the site. Breeze Roads is an air dispersion modelling software suite that predicts air quality impacts of carbon monoxide (CO), nitrogen dioxide, particulate matter (PM), and other inert pollutant concentrations from moving and idling motor vehicles at or alongside roadways and roadway intersections.

Breeze Roads can be used in conjunction with the MOBILE5, EMFAC emission models or other emissions data, to demonstrate compliance with the UK's National Air Quality Strategy. Breeze Roads predicts air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles operating under free-flow conditions and idling vehicles. In addition, 1-hour and running 8-hour averages of CO or 24-hour and annual block averages of PM_{10} can be calculated.

4.3. Model Set-up Parameters

The most recent Emissions Factor Toolkit (EFT, version 11.0, November 2021) issued by DEFRA was used to derive emissions rates (in grams per kilometre) for vehicle movements along roads incorporated into the model.

Briefly, the changes between v10.1 and 11.0 are as follows:

- EFT 11.0 allows users to define Input Years up to 2050.
    - 2031 - 2050 outputs are limited to England (not London) only.

[15] DEFRA, 2021, Local Air quality Management Technical Guidance (TG16)

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- Emissions outputs for the years 2031-2050 are provided in support of climate assessments and appraisals only. Where emissions are to be used after 2030 to inform air quality assessments, the appropriate caveats around the limitations of the analysis must be included to accompany the assessment.

- Updated fleet splits for England (not London) to extend the fleet data for Motorway, Urban and Rural Road types out to 2050;
- Engine efficiency adjustment factors have been provided by DfT/NH and applied to exhaust CO_2 emission outputs up to 2050; and
- Engine efficiency adjustment factors have been provided by DfT/NH and applied to exhaust CO_2 emission outputs up to 2050; and
- When CO_2 pollutant output is selected, an additional output is now provided. The 'Output CO_2 Summary' sheet provides a summary of direct CO_2 emissions from tailpipe and indirect CO_2e emissions associated with the charging of the batteries of electric and plug-in hybrid cars and LGVs, in tonnes/annum. N.B. link length is now a mandatory input requirement when outputting CO_2 emissions.

It is noted that the default fleet projections in EFT v11.0 are based on fleet growth assumptions which were current before the Covid-19 outbreak in the UK. In consequence, default fleet outputs from the tool do not reflect short- or longer-term impacts on emissions in 2020 and beyond resulting from behavioural change during the national or local lockdowns.

Meteorological data from Bristol Airport (2019) has been utilised for the dispersion modelling, which is considered representative of the development area, and the wind rose is shown in **Appendix 3**.

4.4. Assessment Criteria

A detailed assessment was considered appropriate for this proposed development with model results being verified against local monitoring data previously obtained by ACCON. This was undertaken using the detailed dispersion model Breeze Roads.

For the purposes of this assessment, the limit values assigned to individual pollutants as set out in the Air Quality Standards Regulations 2010 form the basis of the air quality assessment. The limit values 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.

4.5. Operational Phase

The main pollutants of concern are generally considered to be NO_2 and PM_{10} for road traffic. The Breeze Roads methodology has been used for this assessment to predict the constraints on the Site.

For the assessment, the following scenarios were considered:

- 2019;
- 2028 without Development; and
- 2028 with Development.

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4.6. Traffic Data

The Breeze Roads prediction model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the number of heavy-duty vehicles (HDVs), the distance of the road centreline from the receptors and vehicle speeds. The traffic information is detailed in **Table 4.1** and **Table 4.2** below for the verification and assessment scenarios.

Table 4.1 identifies the traffic data for 2019 which was utilised for the verification. Traffic flow and vehicle split data were obtained from the DfT (2019). Vehicle speeds were based on speed estimations and were subsequently adjusted where it was deemed, they were not sufficiently accurate, e.g. at junctions, crossings, etc.

Table 4.1: 2019 Traffic Flow Data for Verification

Road Name	AADT	HDV%
A4 – Water Lane to A4174	26,320	4.7
A4 – A4174 to Emery Road	35,446	3.8
A4 – A4320 to Eagle Road	25,639	4.7

Note: This is a non-exhaustive summary of the road sections modelled and includes the sections that are likely to contribute the greatest emissions.

Table 4.2 identifies the estimated AADT traffic flows for roads near to the proposed development site, with the proposed development fully operational. This data was provided by the transport consultants, Key Transport Consultants Ltd.

Table 4.2: 2028 Opening Year Traffic Flow Data

Road Section		2028 Base AADT	HDV (%)	2028 Base + Development AADT	HDV (%)
Birchwood Road	Northbound	5,373	1.4	5,532	1.3
	Southbound	5,129	0.6	5,219	0.5
Broomhill Road (West)	Westbound	5,475	1.0	5,718	1.0
	Eastbound	6,867	0.6	7,468	0.5
Allison Road (East)	Westbound	1,534	1.2	1,534	1.2
School Road (South)	Northbound	3,084	1.3	3,177	1.3
	Southbound	2,482	0.7	2,604	0.7
Broomhill Road (East)	Westbound	6,257	2.3	6,379	2.3
	Eastbound	5,392	2.1	5,551	2.0

Note: This is a non-exhaustive summary of the road sections modelled and includes the sections that are likely to contribute the greatest emissions to the development receptors.

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4.7. Validation and Verification of the Model

Model validation undertaken by the software developer will not have been carried out in the vicinity of the site being considered in this assessment. As a result, it is necessary to perform a comparison of the modelled results with local monitoring data at suitable locations. This verification process aims to minimise model uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results. The verification was carried out in accordance with LAQM.TG16. Suitable monitoring data for the purpose of verification is available for concentrations of NO_2 at the monitoring positions detailed in **Section 3.3**.

When the monitored and modelled results are compared as recommended in LAQM.TG16 the road NO_X adjustment factor is **6.8323** (as identified in **Table 4.3**). This factor was applied to all modelled NO_x results prior to calculating modelled NO_2 using the NO_x to NO_2 calculator. In the absence of appropriate PM_{10} monitoring within close proximity to the site, the NO_x adjustment factor has also been applied to the PM_{10} modelled concentrations, in accordance with the guidance provided in LAQM.TG16.

Table 4.3: NO_2 Annual Mean Verification for 2019

Monitoring Position	Monitored		Modelled		% Difference (NO_2 Roads) Before Adjustment	% Difference (NO_2 Total) After Adjustment	Road NO_X Factor
	Road NO_2 µg/m³	Road NO_X[16] µg/m³	Road NO_2 µg/m³	Road NO_X µg/m³			
10 - Bath Road	26.90	55.68	3.38	6.29	-88.70	-13.22	**6.8323**
175 - Top of Brislington Hill	30.20	63.25	5.55	10.38	-83.58	7.09	

[16] Obtained from NO_X to NO_2 Calculator Spreadsheet available from www.laqm.Defra.gov.uk

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5. IMPACTS AND CONSTRAINTS OF AIR QUALITY

5.1. Air Quality Impact of Development Traffic - Acceptability Criteria

It is common in the UK to use the Environmental Protection UK's (EPUK) Guidance[17] on Air Quality Assessments for Planning Applications to assess the impact of a development. This advises that an air quality assessment will be required where the development is anticipated to give rise to significant changes in air quality. There will also be a need to assess air quality implications of a development where a significant change in relevant exposure is anticipated. A full air quality assessment should normally be undertaken where proposals give rise to significant changes in traffic flows, typically a change in annual average daily traffic (AADT) of 100 LDV flows in or adjacent to an AQMA or 500 LDV flows elsewhere. Other changes caused by a development such as a major new junction, significant road realignment or a substantial increase in HDV traffic may also warrant a full impact assessment.

5.2. Air Quality Impact – Assessment Guidance

In January 2017, Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) updated their guidance on "Land-Use Planning and Development Control: Planning for Air Quality". The guidance provides a methodology for determining the impacts of increased pollutant concentrations at sensitive receptor locations resulting from emission sources such as the generation of traffic from development sites.

To characterise the impacts of the proposed development on local air quality, predictions of air pollutant concentrations have been made for an operational year of 2024 using the Breeze Roads dispersion modelling software.

Table 5.1: Impacts of Pollutant Concentrations as a result of the Development

Long-Term Average Concentration in Assessment Year	% Change in Concentration relative to the 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
The AQAL is the Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level'				

5.3. Operational Impact Assessment

The proposals are for the provision of up to 260 residential dwellings together with pedestrian, cycle and vehicular access, cycle and car parking, public open space and associated infrastructure.

The development proposals will result in an additional 843 vehicle movements per day (0.7% HDV), on to Broomhill Road west of the development access and 281 vehicle movements per day (0.5%

[17] Environmental Protection UK and IAQM (2017, v1.2) – Land-Use Planning and Development Control: Planning for Air Quality

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HDV) on to Broomhill Road east of the development access (1,126 vehicle movements in total) as detailed in **Table 4.2**, on to the local road network.

The development receptor's locations can be identified in **Appendix 5** and the modelled predicted NO_2 and particulate matter pollution concentrations can be identified in **Tables 5.2 and 5.4.**

The existing sensitive receptor locations are identified in **Appendix 4** and the modelled predicted NO_2 and particulate matter pollutant concentrations at these existing receptors are identified in **Tables 5.3** and **5.5**.

5.4. Predicted Air Quality Constraints on the Development

As identified in **Table 2.2**, the AQS objectives apply at locations where members of the public are likely to be regularly present and exposed over the averaging period of the objectives. On the basis that the Proposed Development consists of residential dwellings, the annual mean objective is to be assessed.

5.4.1. Sensitive Receptors Identification

In order to characterise the air quality at the Proposed Development, predictions of air pollutant concentrations have been carried out for the earliest potential occupation year of 2028 using the Breeze Roads dispersion model and UK emission factors.

Existing sensitive receptors were identified on the roads with the greatest changes in traffic and were modelled at ground floor levels as identified in **Appendix 4**

Development receptors were modelled at ground floor levels of the Proposed Development as identified in **Appendix 5**.

Higher floors were not modelled as the general trend for pollutant concentrations is to reduce with increasing height, therefore it was only deemed necessary to model pollutant concentrations at the ground floor as a worst case.

5.4.2. 2028 Annual Mean NO_2 Concentrations – Constraints

Table 5.2 identifies the modelled NO_2 concentrations at the proposed sensitive receptors on the development site for the worst-case scenario for which there will be no exceedances of the AQO.

All of the pollutant concentrations will remain significantly below the annual NO_2 AQO. In respect of the NO_2 1-hour AQO, there is only a risk that the NO_2 1-hour objective (200µg/m^3) could be exceeded at local sensitive receptors if the annual mean NO_2 concentration is greater than 60µg/m^3. Therefore, exceedances of NO_2 1-hour AQO would not be expected as the worst-case annual mean predicted concentration is 10.5µg/m^3 (DR1).

Table 5.2: Modelled 2028 NO_2 Concentrations – Development Receptors

Receptor	Floor	Air Quality Objective (µg/m^3)	Annual NO_2 Road (µg/m^3)	Annual Total NO_2 (µg/m^3)
DR1	Ground	40	1.0	10.5
DR2			0.4	9.9

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Receptor	Floor	Air Quality Objective (µg/m³)	Annual NO_2 Road (µg/m³)	Annual Total NO_2 (µg/m³)
DR3			0.3	9.8
DR4			0.2	9.7
DR5			0.1	9.6
DR6			0.1	9.6
DR7			0.1	9.6
DR8			0.4	9.9
DR9			0.3	9.8

5.4.3. 2028 Annual Mean NO_2 Concentrations - Impacts

Table 5.3 identifies the modelled NO_2 concentrations at representative existing sensitive receptors for the worst-case scenario for which there will be no exceedances of the AQO. All impacts are classified based on the criteria found in **Table 5.1**.

All of the receptors have pollutant concentrations which are significantly below "75% or less of the AQAL" and therefore all the modelled changes in pollutant concentrations are classified as "negligible" (**Table 5.1**).

All of the pollutant concentrations will remain significantly below the annual NO_2 AQO. In respect of the NO_2 1-hour AQO, there is only a risk that the NO_2 1-hour objective (200µg/m³) could be exceeded at local sensitive receptors if the annual mean NO_2 concentration is greater than 60µg/m³. Therefore, exceedances of NO_2 1-hour AQO would not be expected as the worst-case annual mean predicted concentration is 11.6µg/m³ (ER8). The worst-case increase in annual mean NO_2 concentrations is predicted to be 0.1µg/m³ (ER1, ER5, and ER7 to ER11), with the development completed and operational.

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Table 5.3: Predicted Annual NO_2 Concentration impacts in 2028 at Existing Receptors

Receptor	Floor	Annual Air Quality Objective (µg/m³)	Existing Annual NO_2 (µg/m³)	Proposed Annual NO_2 (µg/m³)	Total Change NO_2 (µg/m³)
ER1	Ground	40	10.9	11.0	0.1
ER2			9.7	9.7	0.0
ER3			9.8	9.8	0.0
ER4			9.9	9.9	0.0
ER5			10.0	10.1	0.1
ER6			10.2	10.2	0.0
ER7			10.8	10.9	0.1
ER8			11.5	11.6	0.1
ER9			10.0	10.1	0.1
ER10			10.2	10.3	0.1
ER11			11.0	11.1	0.1

5.4.4. 2028 Annual Mean Particulate Matter Concentrations - Constraints

Table 5.4 identifies the modelled PM_{10} and $PM_{2.5}$ concentrations in 2028. Modelled PM_{10} concentrations are predicted to be a worst case of 13.4µg/m³ (DR1). Modelled $PM_{2.5}$ concentrations are predicted to be a worst case of 9.2µg /m³ (DR1), which are significantly below the AQO's.

Table 5.4: Modelled 2028 PM_{10} and $PM_{2.5}$ Concentrations – Development Receptors

Receptor	Floor	PM_{10} Air Quality Objective (µg/m³)	Total PM_{10} µg/m³ (Days >50 µg/m³) [18]	$PM_{2.5}$ Air Quality Objective (µg/m³)	Total $PM_{2.5}$ µg/m³
DR1	Ground	40	13.4 (0)	25	9.2
DR2			13.2 (0)		9.0
DR3			13.1 (0)		9.0
DR4			13.1 (1)		8.9
DR5			13.1 (1)		8.9
DR6			13.0 (1)		8.9
DR7			13.0 (1)		8.9
DR8			13.2 (0)		9.0
DR9			13.1 (0)		9.0

[18] Not to be exceeded more than 35 times a year.

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5.4.5. 2028 Annual Mean Particulate Matter Concentrations - Impacts

Table 5.5 identifies the modelled PM_{10} and $PM_{2.5}$ concentrations in 2028 both with and without the development completed and fully occupied at existing receptor locations.

The highest predicted annual mean PM_{10} concentration with the development is 13.7µg/m^3 (ER11). There is not predicted to be any change in PM_{10} concentrations, with the development completed and operational, as a result of the proposed development. According to the EPUK & IAQM Guidance in **Table 5.1**, this would be a "less than 1% change in concentration relative to the AQAL". At this receptor the annual predicted PM_{10} pollutant concentration would be less than "75% of the AQAL and therefore the impact of the generated traffic on the closest sensitive receptor would be classified as "negligible".

The highest predicted annual mean $PM_{2.5}$ concentration with the development is 9.4µg/m^3 (ER11). There is not predicted to be any change in $PM_{2.5}$ concentrations, with the development completed and operational, as a result of the proposed development.

Table 5.5: Modelled 2028 PM_{10} and $PM_{2.5}$ Concentrations – Existing Receptors

Receptor	Total PM_{10} Without Development µg/m^3 (Days >50 µg/m^3)	Total PM_{10} With Development µg/m^3 (Days >50 µg/m^3) [19]	Change in PM_{10} relative to AQAL	Total $PM_{2.5}$ Without Development µg/m^3	Total $PM_{2.5}$ With Development µg/m^3	Change in $PM_{2.5}$ relative to AQAL
ER1	13.5 (0)	13.5 (0)	0.0 (0)	9.2	9.2	0.0
ER2	13.1 (0)	13.1 (0)	0.0 (0)	9.0	9.0	0.0
ER3	13.1 (0)	13.1 (0)	0.0 (0)	9.0	9.0	0.0
ER4	13.2 (0)	13.2 (0)	0.0 (0)	9.0	9.0	0.0
ER5	13.2 (0)	13.2 (0)	0.0 (0)	9.0	9.0	0.0
ER6	13.3 (0)	13.3 (0)	0.0 (0)	9.1	9.1	0.0
ER7	13.6 (0)	13.6 (0)	0.0 (0)	9.3	9.3	0.0
ER8	13.6 (0)	13.6 (0)	0.0 (0)	9.3	9.3	0.0
ER9	13.2 (0)	13.2 (0)	0.0 (0)	9.1	9.1	0.0
ER10	13.3 (0)	13.3 (0)	0.0 (0)	9.1	9.1	0.0
ER11	13.7 (0)	13.7 (0)	0.0 (0)	9.4	9.4	0.0

Note: All existing receptors are on ground floor elevations. The impact of the change in particulates relative to the AQAL is negligible based on criteria identified in **Table 5.1**.

[19] Not to be exceeded more than 35 times a year.

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6. MITIGATION

6.1. Operation Phase

As identified by the constraints assessment, there will be no exceedances of the NAQO's for NO_2, PM_{10} and $PM_{2.5}$ at any of the Proposed Development receptors for the projected fully completed and occupied year of 2028.

As identified by the impact assessment, there are no exceedances of the NAQO's for PM_{10} or $PM_{2.5}$ at any of the existing sensitive receptors.

There are negligible expected increases in NO_2, and no increases of PM_{10} and $PM_{2.5}$ concentrations at the existing receptors with the development in place.

Of the existing receptors, the highest resultant annual mean NO_2 pollutant concentration is at ER8 with a concentration of 11.6µg/m^3, which has a negligible increase as a result of the development scheme.

The highest modelled NO_2 and PM_{10} concentrations at existing sensitive receptors are 11.6µg/m^3 and 9.4µg/m^3 respectively, which are significantly below the annual mean NO_2 and PM_{10} objective values of 40µg/m^3. Therefore, it is not deemed necessary to include any mitigation measures as a result of the Proposed Development.

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7. CONCLUSIONS

During the operation phase, the modelling predicts that there will be no exceedances of the nitrogen dioxide or particulate matter objectives at the sensitive development receptors on the proposed development site.

There are no existing sensitive locations which will exceed the AQAL, as a result of the proposed development. Accordingly, air quality impacts of the proposed development scheme are considered to be acceptable, and mitigation is not required.

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APPENDICES

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Appendix 1: Glossary of Terms

AADT	Annual Average Daily Traffic
AAHT	Annual Average Hourly Traffic
AQMA	Air Quality Management Area -An area that a local authority has designated for action, based upon predicted exceedances of Air Quality Objectives.
AQS/ NAQOs	Air Quality Standard/ National Air Quality Objectives - 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 assessment of the effects of each pollutant on human health including the effects on sensitive sub groups.
AURN	Automatic Urban and Rural Network Air Quality Monitoring Site.
Calendar Year	The average of the concentrations measured for each pollutant for one year. In the case of the AQS this is for a calendar year.
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, micrograms per cubic metre, µg/m^3) or a volume of gaseous pollutant per unit volume of air (parts per million, ppm).
DEFRA	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emissions Factor Toolkit
Exceedance	A period of time where the concentration of a pollutant is greater than the appropriate Air Quality Objective.
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
LAQM	Local Air Quality Management
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 to 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).
PM_{10}/$PM_{2.5}$	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 aero-dynamic diameter), but the finer fractions such as $PM_{2.5}$ (less than 2.5 microns in aero-dynamic diameter) is becoming of increasing interest in terms of health effects.
TEMPro	TEMPro is software produced by the DfT to calculate the expected growth of traffic by year on roads throughout the country. The factor varies depending on the region and type of road.
µg/m^3	Micrograms per cubic metre of air - A measure of concentration in terms of mass per unit volume. A concentration of 1µg/m^3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollution.

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Appendix 2: Air Quality Standards

Pollutant	Averaging Period	Limit Value	Margin of Tolerance
Benzene	Calendar Year	5µg/m^3	
Carbon Monoxide	Maximum daily running 8 Hour Mean	10mg/m^3	
Lead	Calendar Year	0.5µg/m^3	100%
Nitrogen Dioxide	One Hour	200µg/m^3 Not to be exceeded more than 18 times per year	
	Calendar Year	40µg/m^3	
Particulates (PM_{10})	One day	50µg/m^3 Not to be exceeded more than 35 times per year	50%
	Calendar Year	40µg/m^3	20%
Particulates ($PM_{2.5}$)	Calendar Year	25µg/m^3	20%
Sulphur Dioxide	One Hour	350µg/m^3 Not to be exceeded more than 24 times per calendar year	150µg/m^3
	One Day	150µg/m^3 Not to be exceeded more than 3 times per calendar year	

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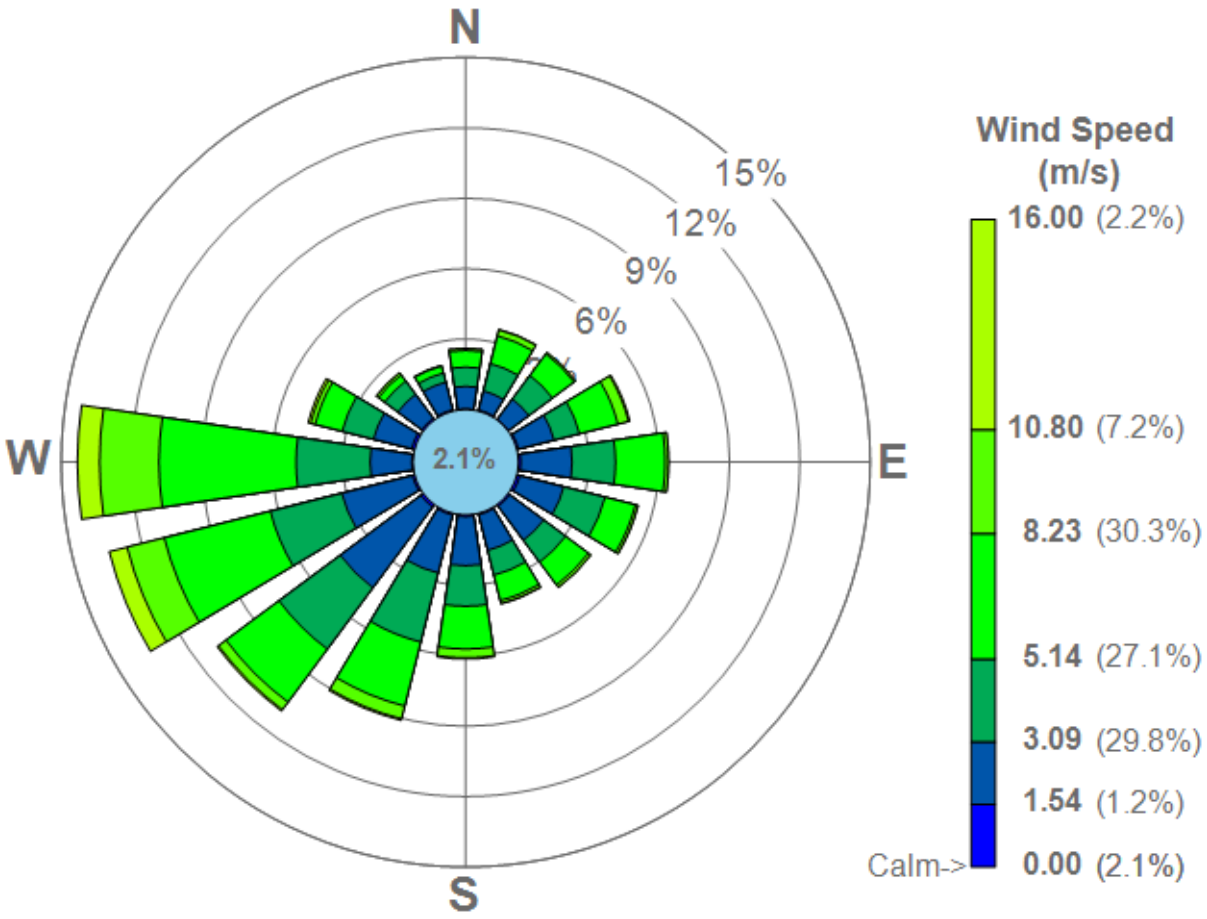
Appendix 3: 2019 Bristol Airport Meteorological Station Wind Rose



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Appendix 4: Proposed Development – Representative Existing Sensitive Receptor Locations

LEGEND

- Existing Receptor Location and Number
- Application Site Boundary

Client: Homes England		Description: Proposed Development – Existing Sensitive Receptor Locations		Design:	CP
				Drawn:	CP
Rev: A	Description: FINAL	Project: Brislington Meadows		Checked:	GP
				Approved:	GP

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Appendix 4

Scale: On Plan

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Appendix 5: Proposed Development – Ground Floor Receptor Locations

LEGEND

- Development Receptor Location
- DR1 Development Receptor Number

Client: Homes England		Description: Proposed Development – Ground Floor Receptor Locations		Design:	CP
				Drawn:	CP
Rev: A	Description: FINAL	Project: Brislington Meadows		Checked:	GP
				Approved:	GP

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Appendix 5

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