8. Air Quality

8.1 Introduction

8.1.1 This chapter of the Environmental Statement (ES) assesses the likely significant effects of the Proposed Development with reference to Air Quality. This chapter also sets out an assessment of the effects from dust due to construction activity. The chapter should be read in conjunction with **Chapter 2: Description of the Proposed Development** and with reference to relevant parts of other chapters including **Chapter 7: Noise and Vibration** and **Chapter 11: Biodiversity**, where common receptors have been considered and where there is an overlap or relationship between the assessment of effects.

8.2 Limitations of this assessment

8.2.1 It is common practice in Air Quality assessments (except assessments solely focusing on emissions from road traffic) to use five years of meteorological (met) data in order to ensure that the worst-case weather conditions are modelled. However, the nature of airport operations means that emissions are strongly tied to weather conditions, since aircraft normally land and take off into the wind. Given the modelling effort required to consider implications of inter-annual variation in met data, it is not considered to be practical to model emissions with more than a single meteorological year for this assessment.

8.2.2 To address this limitation, a sensitivity study has been carried out using five met years of data, but with a simplified model of the application site. The results of this sensitivity study are reported in **Section 8.10**, but the key conclusions are that:

- The 2017 met year produces consistently the highest predicted concentrations at most relevant receptors. This is consistent with monitoring data, which also found higher concentrations in 2017 than in other recent years (refer to **Section 8.5**); and
- An adjustment can be made at other receptors where 2017 is not worst-case to ensure that the results are conservative and do not risk underestimating the impacts of the Proposed Development.

8.2.3 Therefore, it is considered appropriate to carry out the full modelling for the assessment using 2017 met data only, as a worst-case, with an adjustment for selected receptors. This ensures that the assessment meets the usual standards of conservatism and robustness with regard to meteorological variation.

8.2.4 Because of the large number of sources modelled, it has not been possible to calculate short-term concentrations directly using the Atmospheric Dispersion Modelling System (ADMS) software, which is the usual approach for less complex emissions sources. Instead, the Department for Environment, Food and Rural Affairs (Defra) recommended empirical relationships between short-term and annual mean concentrations have been used to estimate short-term concentrations (see **Appendix 8D**).

8.3 Relevant legislation, planning policy and technical guidance

Legislative context

8.3.1 The following legislation is relevant to the assessment of Air Quality effects on receptors:

- *Directive 2008/50/EC* on ambient air quality and cleaner air for Europe: *Directive 2008/50/EC*[1] (the 'Ambient Air Directive'), which came into force in June 2008, consolidates previously existing European Union (EU)-wide air quality legislation (with the exception of *Directive 2004/107/EC*[2] relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons) and provides a new regulatory framework for particulate matter (PM) smaller than 2.5µm ($PM_{2.5}$).

  The Ambient Air Directive sets limit values (for the protection of human health) and critical levels (for the protection of vegetation and ecosystems) for selected pollutants that are to be achieved by specific dates, and details procedures EU Member States should take in assessing ambient air quality. Regulated pollutants include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), particulate matter smaller than 10µm (PM_{10}), particulate matter smaller than 2.5µm ($PM_{2.5}$), lead (Pb), benzene (C_6H_6) and carbon monoxide (CO).

  The limit values and critical levels are legally binding limits on concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The values are based on the assessment of the effects of each pollutant on human health, taking into account the effects on sensitive groups such as children, the elderly and those with health conditions, or on vegetation and ecosystems.

  The limit values and critical levels relate to concentrations in ambient air. The *Ambient Air Directive* defines ambient air as outdoor air, and explicitly excludes workplaces and other places to which members of the public do not have regular access;

- *Directive 92/43/EEC* on the conservation of natural habitats and of wild fauna and flora, and *Directive 79/409/EEC* on the conservation of wild birds: *Directive 92/43/EEC*[3] (the 'Habitats Directive'), which originally came into force in 1994, provides for the designation and protection of 'European sites' of high nature value, the protection of 'European protected species' and the adaptation of planning and other controls for the protection of European sites. It is transposed into English law as the *Conservation of Habitats and Species Regulations 2017*[4] (the 'Habitats Regulations'). Sites which are important for habitats or species are designated as Special Areas of Conservation (SACs).

[1] Official Journal (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, [online]. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0050 [Checked 22/03/2018].

[2] Official Journal (2004). Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32004L0107 [Checked 22/03/2018].

[3] Official Journal (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, 1992, [online]. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043 [Checked 22/03/2018].

[4] The Conservation of Habitats and Species Regulations 2017, [online]. Available at: https://www.legislation.gov.uk/uksi/2017/1012/contents/made [Checked 22/03/2018].

The *Habitats Regulations* also regulate Special Protection Areas (SPAs) classified under *Directive 79/409/EEC*[5] (superseded by *Directive 2009/147/EC*[6]; the 'Birds Directives'). These sites, SACs and SPAs, form a network termed 'Natura 2000'.

The *Habitats Regulations* also provide for the control of potentially damaging operations, whereby consent may only be granted once it has been shown through 'appropriate assessment' that the proposed operation will not adversely affect the integrity of the protected site. When considering potentially damaging operations, the 'precautionary principle' must be applied; that is, consent cannot be given unless it is ascertained that there will be no adverse effect on the integrity of the site;

- Ramsar Convention: *The Convention on Wetlands*[7], called the Ramsar Convention after the city where it was signed, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Sites designated under the Ramsar Convention are commonly known as Ramsar sites. In the UK, many Ramsar sites are also SPAs classified under the Birds Directive;
- *Wildlife and Countryside Act 1981*[8]: This provides the basis for the regulatory framework for the designation of Sites of Special Scientific Interest (SSSIs). Sites in England are designated by Natural England (NE) if they have special interest by reason of any of their flora, fauna, or geological or physiographical features;
- The *Environment Act 1995*[9]: Requires that Local Authorities periodically review air quality within their individual areas. This process of Local Air Quality Management (LAQM) is an integral part of delivering the *Government's Air Quality Strategy*[10] and the Air Quality Objectives (AQOs) contained in the Strategy.

  To carry out an air quality review and assessment under the LAQM process, local authorities produce an Annual Status Report which describes areas identified to be at potential risk of exceeding the objectives in the regulations, and progress towards meeting the objectives. Review and assessments of local air quality aim to identify areas where national policies to reduce vehicle and industrial emissions are unlikely to result in air quality meeting the Government's AQOs by the required dates.

  For the purposes of determining the focus of review and assessment, local authorities should have regard to those locations where members of the public are likely to be regularly present and are likely to be exposed over the averaging period of the objective.

  Where the assessment indicates that some or all of the objectives may be potentially exceeded, the local authority has a duty to declare an Air Quality Management Area (AQMA). The declaration of an AQMA requires the local authority to implement an Air Quality Action Plan, to reduce air pollution concentrations so that the required AQOs are met; and

---

[5] Official Journal (1979). Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds, 1979. Available online https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:31979L0409 [Checked 22/03/2018].

[6] Official Journal (2009). Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, 2009, [online]. Available at: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32009L0147 [Checked 22/03/2018].

[7] UNESCO (1971). Convention on wetlands of international importance especially as waterfowl habitat, [online]. Available at: https://www.ramsar.org/ [Checked 22/03/2018].

[8] Wildlife and Countryside Act 1981, [online]. Available at: http://www.legislation.gov.uk/ukpga/1981/69 [Checked 22/03/2018].

[9] Environment Act 1995, [online]. Available at: http://www.legislation.gov.uk/ukpga/1995/25/contents [Checked 22/03/2018].

[10] Department for Environment, Food & Rural Affairs (2007). The air quality strategy for England, Scotland, Wales and Northern Ireland: Volume 1, [online]. Available at: https://www.gov.uk/government/publications/the-air-quality-strategy-for-england-scotland-wales-and-northern-ireland-volume-1 [Checked 22/03/2018].

- The *Air Quality Standards Regulations 2010*[11]: This came into force on 11 June 2010 and transpose Directive 2008/50/EC[1], including the limit values, into UK legislation. The limit values in the *Air Quality Standards Regulations 2010* are generally referred to as Air Quality Standards (AQS).

  Similarly to *Directive 2008/50/EC*, the *Air Quality Standards Regulations* define ambient air as outdoor air, and explicitly exclude workplaces and other places to which members of the public do not have regular access.

Planning policy context

8.3.2 There are a number of policies and guidance documents at the national and local level that are relevant to the Environmental Impact Assessment (EIA) for the Proposed Development. In addition to policy referenced in **Chapter 5: Legislative and Policy Overview**, **Table 8.1** lists policy documents which are relevant to the baseline data collection and assessment of the effects on Air Quality receptors. Further details are given in **Appendix 8A**.

Table 8.1 Policy documents relevant to Air Quality

Policy	Relevance
The Air Quality Strategy for England, Scotland, Wales and Northern Ireland[10]	Provides a framework for improving air quality at a national and local level and supersedes the previous strategy published in 2000. It imposes a number of obligations on local authorities to manage air quality but does not directly impose obligations on developers.
Clean Air Strategy 2018[12]	Describes the government's approach to tackling air pollution in England.
National Planning Policy Framework (NPPF)[13]	A key part of the government's reforms to make the planning system less complex and more accessible. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.
North Somerset Council's Core Strategy[14]	The main planning document which guides development choices and decisions in North Somerset.

Technical guidance

8.3.3 In the absence of statutory standards for the other prescribed substances that may be found in the emissions arising from the Proposed Development, there are several sources of applicable air quality guidelines which offer levels to assess impacts against.

8.3.4 **Table 8.2** lists technical guidance documents which are relevant to the baseline data collection and assessment of the effects on Air Quality receptors. Further details are given in **Appendix 8A**.

[11] The Air Quality Standards Regulations 2010. Statutory Instrument 2010 No. 1001, [online]. Available at: http://www.legislation.gov.uk/uksi/2010/1001/contents/made [Checked 22/03/2018].
[12] Department for Environment, Food & Rural Affairs (2018). Air quality: draft Clean Air Strategy 2018, [online]. Available at: https://consult.defra.gov.uk/environmental-quality/clean-air-strategy-consultation/ [Checked 22/08/2018].
[13] Ministry of Housing, Communities & Local Government (2018). National Planning Policy Framework, [online]. Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2 [Checked 22/08/2018].
[14] North Somerset Council (2017). Core Strategy, [online]. Available at: http://www.n-somerset.gov.uk/wp-content/uploads/2015/11/Core-Strategy-adopted-version.pdf [Checked 22/03/2018].

Table 8.2 Technical guidance relevant to Air Quality

Guidance	Relevance
World Health Organization (WHO), Air Quality Guidelines for Europe[15]	Aims to provide a basis for protecting public health from adverse effects of air pollutants and to eliminate or reduce exposure to those pollutants that are known or likely to be hazardous to human health or well-being. These guidelines are intended to provide guidance and information to international, national and local authorities making risk management decisions, particularly in setting air quality standards.
Environment Agency (EA), ***Air emissions risk assessment for your environmental permit***[16]	Contains long- and short-term assessment levels for releases to air derived from a number of published UK and international sources. Gives criteria for screening outsource contributions in the context of environmental permit applications. Although intended for use in evaluating permit applications, it is often used for planning applications where no better guidance is available (particularly for ecological receptors). This guidance also introduces the terms 'process contribution' (PC), meaning the concentration or deposition rate resulting from the development activities only, excluding other sources, and 'predicted environmental contribution' (PEC), meaning the total modelled concentration, equal to the PC plus the background contribution from all other sources. These terms are commonly used in air quality assessments, even where the term 'process' is not strictly accurate, and so are used in this assessment with 'process' referring to the Proposed Development.
Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK), ***Land-use Planning and Development Control: Planning for Air Quality***[17]	Suggests how to classify the magnitude and significance of air quality effects from a new development for planning purposes. This guidance also promulgates the term air quality assessment level (AQAL) as a generic term for the various standards, objectives, limit values etc. against which impacts need to be assessed.
IAQM, ***Use of a Criterion for The Determination of an Insignificant Effect of Air Quality Impacts on Sensitive Habitats***[18]	Gives criteria for screening-out source contributions at designated nature conservation sites.
IAQM, ***Guidance on the assessment of dust from demolition and construction***[19]	Gives guidance on the assessment of dust from construction activities.

[15] World Health Organization (2000). Air Quality Guidelines for Europe, Second Edition, [online]. Available at: http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf [Checked 22/03/2018].
[16] Environment Agency (2016). Air emissions risk assessment for your environmental permit, [online]. Available at: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Checked 22/03/2018].
[17] EPUK and IAQM (2017). Land-use Planning and Development Control: Planning for Air Quality, v1.2, [online]. Available at: http://www.iaqm.co.uk/text/guidance/air-quality-planning-guidance.pdf [Checked 22/03/2018].
[18] IAQM (2016). Use of a criterion for the determination of an insignificant effect of air quality impacts on sensitive habitats, [online]. Available at: http://www.iaqm.co.uk/text/position_statements/aq_impacts_sensitive_habitats.pdf [Checked 22/03/2018].
[19] IAQM (2016). Guidance on the assessment of dust from demolition and construction. Version 1.1, [online]. Available at: http://iaqm.co.uk/text/guidance/construction-dust-2014.pdf [Checked 22/03/2018].

8.4 Data gathering methodology

Study area

8.4.1 Assessments carried out for Bristol Airport Limited's (BAL) 10 million passengers per annum (mppa) planning application[20], as well as those carried out for other airports, show that total pollutant concentrations approach background levels on a distance scale of a few kilometres (km) or less from key airport sources. This sets the spatial scale of the area over which airport-related effects on local air quality have been assessed. Aircraft in the air have a limited impact on ground-level pollutant concentrations, with off-airport concentrations being dominated by emissions on the ground being blown horizontally rather than dispersing downwards from aircraft overhead.

8.4.2 Road traffic generated by Bristol Airport travels over a larger area, potentially covering hundreds of kilometres from the airport. The greatest proportion of airport-related traffic, and therefore impacts, is on roads that directly connect with Bristol Airport. It is not necessary to assess impacts on the entire road network used by airport-related traffic as a result of the Proposed Development as the dispersion of this traffic means that impacts on the majority of the network would be negligible. Consideration of the principal routes used by airport-related traffic suggests that for Air Quality purposes, it is sufficient to consider traffic on the A38 and selected minor roads (principally Downside Road) within a few kilometres of the application site. These roads have relevant receptors close to them, so they are expected to be the most sensitive to changes in airport-related traffic flows.

Desk study

8.4.3 A summary of the organisations that have supplied data, together with the nature of that data is as follows:

- Air Pollution Information Service (APIS):
  - Mapped background deposition rates; and
  - Critical load information for nitrogen and acidity;
- Defra:
  - Mapped background air pollutant concentrations; and
  - Air Quality monitoring data;
- MAGIC:
  - Locations of sensitive ecological receptors;
- North Somerset Council (NSC):
  - Air Quality monitoring data;
- Bath and North East Somerset Council (BNES):
  - Air Quality monitoring data;
- BAL:
  - Forecast and historical airport operational data; and

[20] Entec (2009). Development and enhancement of Bristol International Airport. Environmental Statement Volume 3 Air quality.

- Air Quality monitoring data; and
- NATS:
  - Airport operational data.

Survey work

8.4.4 In view of the extensive monitoring data available from BAL and NSC (refer to **Section 8.5**), it was not considered that any additional monitoring was required to determine baseline concentrations.

8.5 Overall baseline

Current baseline

Setting of Bristol Airport

8.5.1 A description of the location of Bristol Airport and the surrounding area is given in **Chapter 2: description of the Proposed Development**, specifically **Section 2.2**. Some additional points of relevance to the Air Quality assessment are noted here.

8.5.2 Although Bristol Airport is located within the administrative area of NSC, the unitary authority BNES lies approximately 300m from the application site, and significant fractions of airport-related traffic pass through the City of Bristol and Sedgemoor district, using the A38 which passes just east of Bristol Airport.

8.5.3 The area around the application site is predominantly rural. Sources of pollution that influence air quality include the ambient background (pollutants transported from elsewhere, including the wider United Kingdom (UK) and mainland Europe), road traffic (both airport-related and non-airport) and domestic, commercial and industrial heating, as well as Bristol Airport itself.

8.5.4 The settlements of Lulsgate Bottom and Downside lie immediately to the north of the application site, with houses close to airport facilities, especially car parks. The larger village of Felton lies about 1km to the east. Land to the south and west is rural with isolated residential properties.

Local air quality management

8.5.5 As part of their responsibilities under the *Environment Act 1995*[9], local authorities prepare annual reports on the air quality within their administrative areas and declare AQMAs in locations where there is a risk of an AQO being exceeded. NSC has not declared any AQMAs. BNES has declared four AQMAs for annual mean NO_2 or hourly mean NO_2, covering parts of Bath, Keynsham and Saltford; the nearest of these is approximately 15km from the application site. Bristol City Council (BCC) has declared three AQMAs for annual mean NO_2, hourly mean NO_2 or daily mean PM_{10}, covering much of the city; at the nearest point these AQMAs are approximately 8km from the application site.

Air quality monitoring

8.5.6 In 2012, BAL installed a continuous air quality monitoring station in the long-stay car park, measuring NO_x, NO_2 and PM_{10}. BAL has also installed diffusion tubes at nine locations, one of which is collocated with the continuous monitor.

8.5.7 NSC does not undertake any continuous monitoring. NSC undertook passive monitoring of NO_2 with diffusion tubes at 26 sites during 2017[21]. Of these, four are close to the application site, with two of them adjacent to the A38 and two along Downside Road. Of the remainder, 18 are classified as roadside or kerbside sites; since measurements at these sites are very strongly influenced by local road traffic, they are of little value in understanding the air quality around Bristol Airport. The final four diffusion tube sites are classified as background, so provide an indication of the background concentrations within 20km of the application site.

8.5.8 BNES undertook continuous monitoring at four stations in 2017[22], all located in urban Bath. Alongside this, passive monitoring of NO_2 with diffusion tubes at 92 sites was undertaken during 2016. Most of these are roadside, kerbside or urban background sites, so are of little value in understanding the baseline air quality around the application site. Two are urban background sites outside Bath, in Keynsham and Radstock, so are helpful for understanding air quality around the application site.

8.5.9 There is a continuous monitor at a rural location at Charlton Mackrell, approximately 35km south of the application site. This is part of the Defra Automatic Urban and Rural Network (AURN) and measures NO_x, NO_2 and ozone. Although distant, it is potentially useful for understanding background air quality around the application site.

8.5.10 The nearest monitoring of $PM_{2.5}$ is at Bristol St. Pauls. As an urban location, this is not suitable for understanding air quality around the application site.

8.5.11 The locations of the monitoring stations used to inform the assessment are summarised in **Table 8.3**, **Figure 8.12** and **Figure 8.13**.

Table 8.3 Monitoring stations

ID and name	Type	Pollutants monitored	Classification	Coordinates	Distance from Bristol Airport (km)
BAL Continuous	Continuous	NO_x, NO_2, PM_{10}	Airport	351101, 165538	0
BAL 1 Airside OTB Lamppost A2	Diffusion tube	NO_2	Airport	351042, 165317	0
BAL 2 Airside Fuel Farm Fence	Diffusion tube	NO_2	Airport	350557, 165385	0
BAL 3 Airside 09 Approach Light	Diffusion tube	NO_2	Airport	348837, 165029	0
BAL 4 Landside Bat Box Stone Farm	Diffusion tube	NO_2	Airport	350390, 165780	0
BAL 5 Landside New Terminal Light	Diffusion tube	NO_2	Airport	350622, 165550	0
BAL 6 Landside Long Stay Car Park (Lamppost 112)	Diffusion tube	NO_2	Airport	350780, 165700	0
BAL 7 Landside Long Stay Car Park (Lamppost 13)	Diffusion tube	NO_2	Airport	351101, 165538	0

[21] NSC (2018). 2018 Air Quality Annual Status Report (ASR).
[22] BNES (2018). 2018 Air Quality Annual Status Report (ASR), [online]. Available at: http://www.bathnes.gov.uk/sites/default/files/sitedocuments/Environment/Pollution/bnes_asr_2018.pdf [Checked 29/08/2018].

ID and name	Type	Pollutants monitored	Classification	Coordinates	Distance from Bristol Airport (km)
BAL 8 Landside Information Sign Main Access Road	Diffusion tube	NO_2	Airport	351138, 165463	0
BAL 9 Landside A38 Field	Diffusion tube	NO_2	Airport	351410, 165470	0
NSC 1 Long Ashton Park & Ride (A370)	Diffusion tube	NO_2	Background	356021, 171009	8
NSC 3 Pill (Railway Line)	Diffusion tube	NO_2	Background	352084, 176273	11
NSC 5 Bristol Airport (A38)	Diffusion tube	NO_2	Roadside	350890, 164688	1
NSC 6 Felton Primary School*	Diffusion tube	NO_2	Roadside	351289, 165479	1
NSC 7 Downside Road (Holmlea)	Diffusion tube	NO_2	Background	350920, 165745	1
NSC 8 Downside Road (Top 8)	Diffusion tube	NO_2	Kerbside	351054, 165665	1
NSC 20 Weston-Super-Mare, Bedford Road	Diffusion tube	NO_2	Background	332402, 159840	19
NSC 26 Banwell, Bowling Green	Diffusion tube	NO_2	Background	339838, 159166	12
DT33 Keynsham	Diffusion tube	NO_2	Urban Background	364803, 168237	15
DT30 MSN Westfield Primary Sch	Diffusion tube	NO_2	Urban Background	367280, 153840	20
UKA00537 AURN Charlton Mackrell	Continuous	NO_x, NO_2, ozone	Rural background	352196, 128768	35

* The school closed several years ago but the name of the monitoring site has been retained.

8.5.12 Monitored annual mean NO_2 concentrations are summarised in **Table 8.4**. Inter-annual variations are generally of the magnitude expected from monitoring of this kind.

8.5.13 Over the period 2012 to 2017, monitored annual mean NO_2 concentrations upwind of the application site and away from roads (e.g. BAL 3, BAL 4, UKA00537) were typical of rural locations in England, at around 9–12μg m^{-3}. At kerbside locations on the A38 (NSC 5), they were about 30μg m^{-3} and immediately downwind of Bristol Airport they were generally in the range 10-30μg m^{-3} depending on exact location, with concentrations dropping rapidly with distance from the airfield. The Felton Primary School monitor, NSC6, is located downwind of Bristol Airport and close to the A38, which carries both airport-related and non-airport traffic. This monitor has recorded annual average concentrations close to or above 40μg m^{-3} in the last three years, although concentrations in some earlier years were much lower; the reasons for the variation are unclear.

8.5.14 Concentrations at most receptors were noticeably higher in 2017 than in previous years; this appears to have been due to unusual weather conditions in 2017, as demonstrated by the meteorological sensitivity study (refer to **Section 8.10**). Regression analysis suggests that there was a slight decreasing trend in concentrations at most of the monitoring stations up to 2016, averaging a decrease of about 0.2μg m^{-3} per year, but the higher concentrations in 2017 reversed the downward trend. Nationally, the long-term trend is for concentrations of NO_2 to decrease.

8.5.15 In the period 2014 to 2017, the number of hours where the hourly NO_2 concentration at the BAL Continuous monitor was over 200μg m^{-3} was zero, compared with a legal limit of 18 hours over 200μg m^{-3} per year. Hourly concentrations are not available from diffusion tubes.

Table 8.4 Monitored annual mean NO_2 concentrations (μg m^{-3})

Station	2011	2012	2013	2014	2015	2016	2017	Average
BAL Continuous	N/A	19	20	19.6	18.2	19.8	19	19.3
BAL 1	N/A	27	25	21	25	26	37	26.8
BAL 2	N/A	29	29	24	27	29	35	28.8
BAL 3	N/A	11	11	10	9	10	10	10.2
BAL 4	N/A	12	13	12	11	12	14	12.3
BAL 5	N/A	29	28	30	29	28	34	29.7
BAL 6	N/A	17	18	17	17	17	21	17.8
BAL 7	N/A	21	20	19	19	20	24	20.5
BAL 8	N/A	29	29	25	27	31	38	29.8
BAL 9	N/A	21	16	15	17	18	24	18.5
NSC 1	20.3	21.9	21.2	18.9	18.4	22.9	Discontinued	20.6
NSC 3	19.2	20.5	19.4	16.8	15.5	17.9	16.1	17.9
NSC 5	17.9	21.8	21.0	23.8	21.9	23.5	20.8	21.5
NSC 6	25.3	36.2	31.3	26.4	38.9	40.7	40.7	34.2
NSC 7	14.8	15.0	13.6	13.8	12.3	13.2	12.1	13.5
NSC 8	24.2	30.4	27.2	25.8	25.7	29.1	23.9	26.6
NSC 20	17.1	21.8	19.0	17.3	16.9	18.4	16.1	18.1
NSC 26	16.3	16.6	14.7	12.9	12.6	13.8	11.9	14.1
DT33	14	19	18	17	16	16	16	16.7
DT30	15	15	17	17	14	15	14	15.5
UKA00537	8	9	9	7	6	7	6	7.4

N/A: Not available.
Data for some sites is only available to the nearest whole number.

8.5.16 Monitored annual mean NO_x concentrations are summarised in **Table 8.5**. NO_x measurements are only available from continuous monitors, so comparatively there is less data than for NO_2.

Measurements at the BAL continuous monitor suggests that the annual mean NO_2 concentration is approximately two-thirds of the annual mean NO_x concentration.

Table 8.5 Monitored annual mean NO_x concentrations (µg m^{-3})

Station	2011	2012	2013	2014	2015	2016	2017	Average
BAL Continuous	N/A	N/A	N/A	31	29	33	29	31
UKA00537	9	11	11	8	8	9	7	9

N/A: Not available

8.5.17 Monitored annual mean PM_{10} concentrations are summarised in **Table 8.6**. Only one station in proximity to the application site measures PM_{10}. Over the period 2012 to 2017, monitored annual mean PM_{10} concentrations at the BAL Continuous monitor, downwind of Bristol Airport, were 18–21µg m^{-3}, well below the legal limit of 40µg m^{-3}. The number of days per year where the daily average PM_{10} concentration was over 50µg m^{-3} was between zero and four, well within the legal limit of 35 days over 50µg m^{-3} per year.

Table 8.6 Monitored annual mean PM_{10} concentrations (µg m^{-3})

Station	2011	2012	2013	2014	2015	2016	2017	Average
BAL Continuous	N/A	18	20	19	21	19	19	19

Defra's background concentration modelling

8.5.18 Defra maintains a nationwide model (the Pollution Climate Mapping (PCM) model) of current and future background air quality concentrations at a 1km grid square resolution. The data sets include annual average concentration estimates for NO_x, NO_2, PM_{10} and $PM_{2.5}$, as well as other pollutants. The PCM model is semi-empirical in nature: it uses data from the National Atmospheric Emissions Inventory (NAEI) to model the concentrations of pollutants at the centroid of each 1km grid square but then calibrates these concentrations in relation to actual monitoring data. Concentrations represent background locations, not roadside locations or those particularly influenced by point sources.

8.5.19 The dataset was updated in 2016. Data is available for years covering 2015 to 2030; with modelled concentrations generally decreasing over that time period.

8.5.20 The dataset for the area around Bristol Airport includes a contribution from current aircraft and other activity occurring on site. Defra provides a mechanism for subtracting out particular contributions, but the results presented below include this current contribution from the airport.

8.5.21 Concentrations of NO_2, NO_x, PM_{10} and $PM_{2.5}$ from the Defra data for 2017 are given in **Table 8.7** to **Table 8.10** for a selection of grid squares in the vicinity of the application site. These all fall well below corresponding legal limits and are typical of rural locations in England. The Defra NO_2 concentrations are generally comparable with the monitored locations where there is little airport or road contribution, such as BAL 3 and BAL 4, but are appreciably lower than monitored results near roads or close to and downwind of airport activity.

8.5.22 The concentration of PM_{10} (in the 166500, 351500 grid square) is anomalously high, and stands out in the contour plots (refer to **Figure 8.31** and **Figure 8.32**). There are no obvious sources of PM_{10} in this square, and there is not a corresponding feature for $PM_{2.5}$, so this may be an error in the Defra data.

Table 8.7 Annual mean NO_2 concentrations (µg m^{-3}) from Defra data

				Easting			
Northing	**347500**	**348500**	**349500**	**350500**	**351500**	**352500**	**353500**
167500	8.7	8.1	8.1	8.3	8.3	8.3	9.8
166500	8.0	7.8	8.4	9.1	9.8	8.9	8.2
165500	7.3	7.6	11.7	13.1	10.0	8.0	7.6
164500	7.1	7.3	8.0	12.2	8.7	7.2	6.9
163500	7.1	7.1	7.7	7.9	7.3	6.7	6.5

Table 8.8 Annual mean NO_x concentrations (µg m^{-3}) from Defra data

				Easting			
Northing	**347500**	**348500**	**349500**	**350500**	**351500**	**352500**	**353500**
167500	11.4	10.7	10.7	10.9	11.0	10.9	13.0
166500	10.5	10.3	11.1	12.0	13.1	11.7	10.8
165500	9.5	10.0	16.0	18.1	13.3	10.5	9.9
164500	9.2	9.5	10.5	16.7	11.5	9.4	9.0
163500	9.2	9.3	10.0	10.3	9.5	8.6	8.4

Table 8.9 Annual mean PM_{10} concentrations (µg m^{-3}) from Defra data

				Easting			
Northing	**347500**	**348500**	**349500**	**350500**	**351500**	**352500**	**353500**
167500	11.7	11.5	14.6	12.5	13.0	12.5	12.6
166500	11.0	11.3	11.8	12.3	15.4	12.8	11.9
165500	11.1	11.6	11.7	12.4	12.7	11.6	11.2
164500	11.4	11.3	11.6	12.3	12.1	11.8	11.6
163500	11.6	11.4	12.3	12.0	11.2	12.0	11.7

Table 8.10 Annual mean $PM_{2.5}$ concentrations (µg m^{-3}) from Defra data

	Easting						
Northing	**347500**	**348500**	**349500**	**350500**	**351500**	**352500**	**353500**
167500	7.6	7.4	7.8	7.5	7.9	7.7	8.0
166500	7.2	7.3	7.5	7.8	8.3	7.9	7.6
165500	7.3	7.5	7.7	8.0	8.0	7.5	7.3
164500	7.5	7.4	7.5	7.9	7.8	7.6	7.6
163500	7.6	7.5	7.8	7.7	7.3	7.7	7.4

Comparison of monitoring with Defra data

8.5.23 In **Table 8.11**, measured NO_2 concentrations at non-roadside monitors are compared with the Defra concentrations for the corresponding grid square (both for 2017). The measured concentrations are higher than the Defra concentrations at most monitoring locations. This is partly because the monitoring results for 2017 were unusually high, due to that year's particular meteorological conditions, something which cannot be taken into account in the forecasting models. The largest discrepancies are at airside monitors (BAL 1 and BAL 2), suggesting that Defra modelling underestimates Bristol Airport's contribution.

Table 8.11 Monitored concentrations vs Defra concentrations for NO_2 (µg m^{-3})

Station	Classification	Measured	Defra	Difference
BAL Continuous	Airport	19.0	10.0	9.0
BAL 1 Airside OTB Lamppost A2	Airport	37.0	10.0	27.0
BAL 2 Airside Fuel Farm Fence	Airport	35.0	13.1	21.9
BAL 3 Airside 09 Approach Light	Airport	10.0	7.6	2.4
BAL 4 Landside Bat Box Stone Farm	Airport	14.0	13.1	0.9
BAL 6 Landside Long Stay Car Park (Lamppost 112)	Airport	21.0	13.1	7.9
BAL 7 Landside Long Stay Car Park (Lamppost 13 (average)	Airport	24.0	10.0	14.0
BAL 9 Landside A38 Field	Airport	24.0	10.0	14.0
NSC 1 Long Ashton Park & Ride (A370)	Background	22.9	17.0	5.9
NSC 3 Pill (Railway Line)	Background	16.1	15.1	1.0

Station	Classification	Measured	Defra	Difference
NSC 7 Downside Road (Holmlea)	Background	12.1	13.1	-1.0
NSC 20 Weston-Super-Mare, Bedford Road	Background	16.1	10.3	5.8
NSC 26 Banwell, Bowling Green	Background	11.9	7.6	4.3
DT33 Keynsham	Urban Background	16.0	10.4	5.6
DT30 MSN Westfield Primary Sch	Urban Background	14.0	9.7	4.3
UKA00537 AURN Charlton Mackrell	Rural background	6.0	5.7	0.3

8.5.24 In **Table 8.12**, measured NO_x concentrations at non-roadside monitors are compared with the Defra concentrations (both for 2017) for the corresponding grid square. Again, the contributions from Bristol Airport seem to be underestimated in the Defra modelling.

Table 8.12 Monitored concentrations vs Defra concentrations for NO_x ($\mu g\ m^{-3}$)

Station	Classification	Measured	Defra	Difference
BAL Continuous	Airport	29.0	13.3	15.7
UKA00537 AURN Charlton Mackrell	Rural background	7.0	7.4	-0.4

8.5.25 In **Table 8.13**, measured PM_{10} concentrations at non-roadside monitors are compared with the Defra concentrations (both for 2017) for the corresponding grid square. Again, contributions from Bristol Airport appear to be underestimated in the Defra modelling.

Table 8.13 Monitored concentrations vs Defra concentrations for PM_{10} ($\mu g\ m^{-3}$)

Station	Classification	Measured	Defra	Difference
BAL Continuous	Airport	19.0	12.7	6.3

APIS background mapped deposition rates

8.5.26 The APIS website provides information on background deposition of nitrogen and sulphur at sensitive ecological sites in the UK (refer to **Appendix 8B**). APIS is widely recognised as the primary source of this information and has been used for the Air Quality assessment.

Dust deposition

8.5.27 Ambient dust deposition rates are not monitored extensively in the UK. Monitoring that is undertaken is usually connected with specific activities such as mining and mineral extraction operations or specific large-scale construction programmes. Dust monitoring may also be undertaken to investigate specific complaints received by local authorities, who are then empowered to investigate dust nuisance under the *Environmental Protection Act 1990*[23].

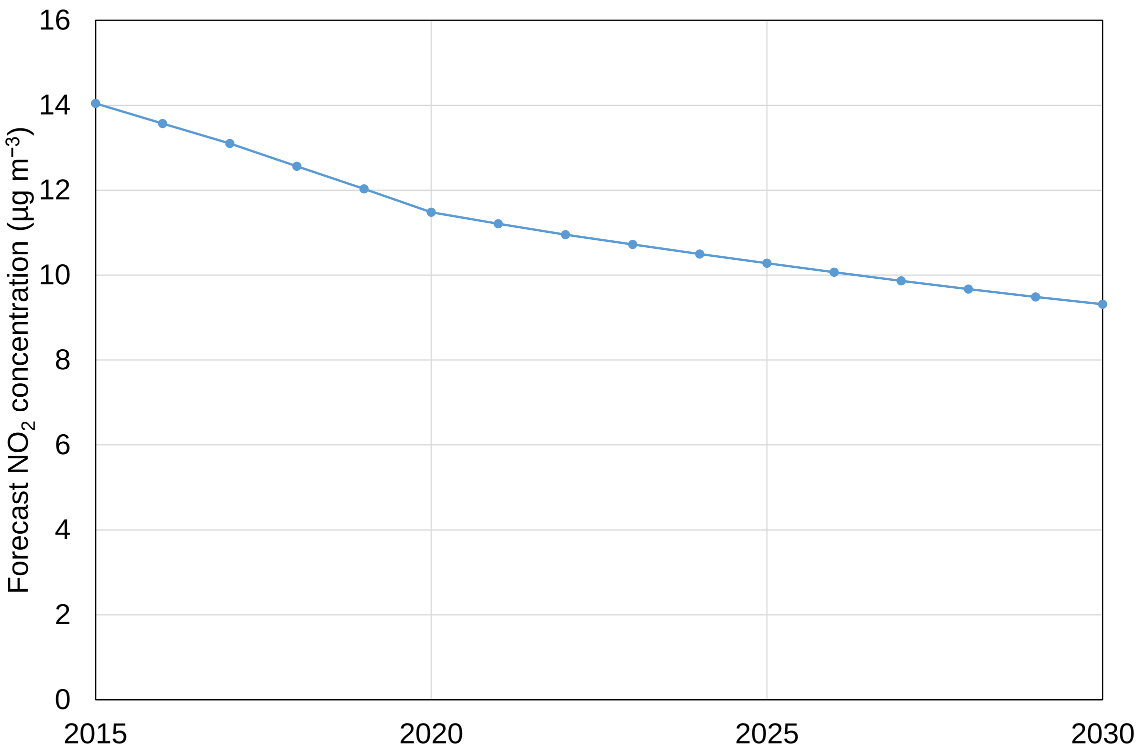
8.5.28 Dust deposition rates are not currently monitored in the area of the application site.

Future baseline

8.5.29 In the absence of the Proposed Development, the baseline is likely to change in future for a number of reasons.

8.5.30 Air quality in the UK is generally improving as a result of controls on emissions sources. Defra issues projections of background (non-roadside) concentrations on a 1km square basis, out to 2030. For a typical grid square covering the application site, the total projected concentrations of NO_2 are shown in **Figure 8.1**. Concentrations are expected to fall by about 30% between 2015 and 2030, or about 0.25μg m^{-3} per year.

Figure 8.1 Trend in modelled NO_2 concentrations



8.5.31 Concentrations near roads are also expected to decline as a result of emissions controls, though this may be partly offset by an increase in traffic levels. Projections of emission factors for road vehicles are provided by Defra up to 2030. Projections of changes in traffic are provided by the Department for Transport (DfT); these have been taken into account in **Chapter 6: Traffic and transport** and are considered in the Air Quality assessment.

8.5.32 Most monitoring locations near the application site have a significant road or airport contribution, with relatively few reflecting true background conditions. The best monitors for these purposes are BAL 3, which is west of the application site and therefore upwind of all airport sources, and BAL 4, which although north of the application site, is sufficiently far west that prevailing winds do not carry much airport-related pollution to it. At these locations, monitored NO_2 concentrations (in the

[23] Environmental Protection Act 1990, [online]. Available at: https://www.legislation.gov.uk/ukpga/1990/43 [Checked 22/03/2018].

range 9–14μg m^{-3} in recent years) are similar to Defra concentrations (9μg m^{-3} and 14μg m^{-3} in 2017).

8.5.33 Therefore, the Defra concentration in the relevant grid square has been used as the best estimate of the background concentration of annual mean NO_2 at all receptors. For the model evaluation (which models 2017 emissions for comparison against monitoring data for the same year), concentrations for 2017 have been used. For the 10 mppa and 12 mppa scenario assessments (which model emissions in 2026, when 12 mppa is forecast to be reached), 2026 concentrations have been used. The airport and in-square[24] major road contributions have been removed.

8.5.34 For NO_x, PM_{10} and $PM_{2.5}$, there is no suitable monitoring data without an airport contribution, so the same approach of using the modelled Defra concentrations for 2017 and 2026, with airport and in-square major road contributions removed, has been used.

8.5.35 Background deposition rates of all pollutants have been taken from the APIS website[25], based on the most sensitive habitat feature at each designated site. No information is available on future deposition rates, so these have conservatively been assumed to be the same as the current baseline despite there being a predicted downward trend in emissions of pollutants.

8.5.36 Committed developments have been reviewed to identify additional sources of emissions that are likely to arise in future. The main new developments of relevance are residential, which may generate additional road traffic. These have been included in the traffic model (**Chapter 6: Traffic and Transport**). No other developments have been identified which are likely to have a significant effect on air pollutant concentrations at receptors close to the application site. No developments have been identified that would add receptors that are likely to be affected by the Proposed Development.

8.5.37 The background concentrations in air in 2026 at each of the specific receptors, as assumed in the modelling for this assessment, are given in **Appendix 8B**. The background deposition rates at each of the specific ecological receptors, as assumed in the modelling for this assessment, are given in **Appendix 8B**. Details of the receptor locations are given in **Section 8.7** and **Appendix 8C**.

Baseline dust deposition

8.5.38 Ambient dust deposition rates are not monitored extensively in the UK as noted in paragraph 8.5.27. While dust deposition rates are not currently monitored in the vicinity of the application site, no records of dust complaints at Bristol Airport have been identified. It is assumed therefore that current dust levels in the areas potentially affected by the Proposed Development are below annoyance levels and in the absence of the Proposed Development, it is anticipated that this situation would continue.

8.6 Consultation

8.6.1 Organisations that have been consulted through the EIA Scoping process, include:

- NSC;
- Public Health England (PHE); and
- NE.

---

[24] That is, the contribution from major roads within the 1km grid square. The contribution from major roads outside the grid square are not removed, which results in a small degree of double-counting but removes the risk of underestimating the concentration.
[25] Air Pollution Information System (APIS), [online]. Available at: www.apis.ac.uk [Checked: 12/02/2018].

8.6.2 No substantive issues have been raised in regard to air quality, dust or odour.

8.7 Scope of the assessment

Spatial scope

8.7.1 The spatial scope of the assessment of Air Quality covers the area of the Proposed Development, together with the Zones of Influence (ZoIs) that have formed the basis of the study area described in **Section 8.4**.

Temporal scope

8.7.2 The temporal scope of the assessment of Air Quality is consistent with the period over which the Proposed Development would be carried out and therefore covers the construction and operational periods.

8.7.3 The following three operational scenarios have been assessed:

- Calendar year 2017, for model evaluation (that is, to see how well the model performs by comparing its outputs for a historic case with monitored data, and to determine if any model adjustment is necessary);
- Calendar year 2026, with airport activity constrained to its current cap of 10 mppa (a "without development" case); and
- Calendar year 2026, with airport activity allowed to grow to 12 mppa (a "with development" case).

8.7.4 The year 2026 was chosen as this is the year in which Bristol Airport is forecast to reach 12 mppa.

Potential receptors

8.7.5 The modelled domain covers both a set of gridded receptors (to enable contour plots to be generated and interpolation to intermediate locations if required) and sets of specific receptors representing individual sensitive human and ecological locations, plus monitoring locations (for the model evaluation).

Gridded receptors

8.7.6 A 5km × 3km Cartesian grid centred on the application site was modelled, with the south-west corner at National Grid Reference (NGR) (348000, 164000) and the north-west corner at NGR (353000, 167000). This region is shown in **Figure 8.14**. Concentrations due to traffic on roads (including queues) were modelled with a grid resolution of 10m, since these concentrations fall away over a scale of tens of metres from the road. Concentrations due to aircraft and car parks were modelled with a grid resolution of 50m since these sources are spread over an area of several square kilometres in extent, and then interpolated onto a 10m grid for combining with the roads contribution.

8.7.7 In addition, a larger but coarser grid was modelled, covering a 20km × 20km region with the south-west corner at NGR (340000, 155000) and the north-west corner at NGR (360000, 175000). Roads were not explicitly modelled over this larger area but are included through the Defra mapped background. Aircraft and car parks were modelled with a grid resolution of 500m.

Human receptors

8.7.8 As well as grid points, concentrations have been assessed at a selection of specific receptor points. The purpose of the specific receptor points is to allow a more detailed assessment at particular locations where Air Quality assessment levels apply, for example residential properties.

8.7.9 Specific receptors were selected to represent locations where there is the greatest possibility of a significant effect on human health or on vegetation or ecosystems. Specific receptors are chosen, in general, as the nearest relevant location in any given direction from sources of emissions, to ensure that the worst-case impacts are picked up.

8.7.10 In addition, a receptor has been specified for each property in Lulsgate Bottom, as this is the location with the greatest risk of potential significant effects occurring as a result of the Proposed Development. Because this results in a large number of receptors being modelled, detailed results are only presented in **Section 8.10** for those receptors where the changes in emission concentrations are greatest, with results for other receptors being presented more briefly in **Appendix 8E**.

8.7.11 Receptors for assessment of human health effects were chosen based on guidance regarding relevant exposure, judged in terms of the likely duration of exposure to pollutants and proximity to the Proposed Development, as described in **Section 8.3** and **Appendix 8A**. They were chosen to ensure that sufficient receptor coverage is available for **Chapter 16: Human Health** to determine population health effects. Not every location of relevant exposure within the study area has been included as a specific receptor, but a selection has been made that covers the locations most likely to be affected by the Proposed Development and is representative of wider locations.

8.7.12 While most human receptors are likely to have both long-term (annual mean) and short-term (typically hourly mean) exposure, a number of receptors are only relevant for short-term exposure since members of the public are only likely to be present for short periods of time (e.g. the Forge Motel and St Katharine's Church).

8.7.13 In addition, a receptor (H138) has been selected to represent the nearest edge of the Bristol AQMA.

8.7.14 A review was also undertaken to determine if any new locations (e.g. new residential developments) that may potentially be subject to significant effects as a result of the Proposed Development may be created in future. No additional specific receptors were identified.

8.7.15 For the purposes of assessing Air Quality impacts, workplace locations have been excluded from the assessment in accordance with Schedule 1, Part 1, and Paragraph 2 of the *Air Quality Standards Regulations 2010*[11]. These Regulations are detailed in **Appendix 8A** and do not differentiate between whether this is a workplace location under the control of the operator, or an off-site workplace location.

8.7.16 Details of the locations of human receptors are given in **Appendix 8C** and **Figure 8.14**.

Ecological receptors

8.7.17 The EA guidance note '*Air emissions risk assessment for your environmental permit*'[16] indicates that the impact of a development should be evaluated at protected conservation areas that meet the following criteria:

- SPAs, SACs or Ramsar sites within 10km of the development (or within 15km of coal or oil-fired power stations); and
- SSSIs or local nature sites (ancient woods, local wildlife sites, National Nature Reserves (NNR) and Local Nature Reserves (LNR)) within 2km of the development.

8.7.18 This guidance was developed for environmental permitting purposes but is commonly used for other types of environmental assessment. Based on this EA guidance, the ecological sites that have been assessed are:

- Avon Gorge Woodlands SAC;
- North Somerset and Mendip Bats SAC;
- Mendip Woodlands SAC;
- Chew Valley Lake SPA;
- Goblin Combe SSSI;
- King's Wood and Urchin Wood SSSI: This coincides with part of the North Somerset and Mendip Bats SAC;
- Brockley Hall Stables SSSI: This coincides with part of the North Somerset and Mendip Bats SAC;
- Felton Common LNR; and
- Ancient woodland at Brockley Combe, Garleys Wood, Hyatts Wood, Oatfield Wood, Lye Wood, Scars Wood, High Wood, Horts Wood, Little Horts Wood, Tuckers Grove and Whitley Coppice, Shippenhays Wood, Prestow Wood and Corporation Woods.

8.7.19 SSSIs which are cited for their geological interest only, with no particular features of ecological interest, have not been assessed as air pollutants will not affect these sites. This applies to the Lulsgate Quarry and Hartcliff Rocks Quarry SSSIs.

8.7.20 Details of the locations of ecological receptors are given in **Appendix 8C** and **Figure 8.15** and **Figure 8.16.**

Pollutants assessed

8.7.21 The Air Quality assessment focuses on the local air pollutants which present a risk of actual or potential exceedances of AQALs, including AQOs, EU limit values, targets, critical levels or critical loads at locations in the UK (not necessarily in the vicinity of the application site). These are NO_x, NO_2, PM_{10} and $PM_{2.5}$ in relation to concentrations in air, and nutrient nitrogen and acidity in relation to deposition. PM_{10} and $PM_{2.5}$ are collectively referred to as PM in this document. A brief description of these pollutants is provided in **Table 8.14**. Other potential pollutants have been scoped out, as described in the Scoping Report **(Appendix 1A)** and agreed in the Scoping Opinion (**Appendix 1B**)

Table 8.14 Descriptions of the pollutants assessed

Pollutant	Description and effect on human health and the environment	Principal Sources
Oxides of nitrogen (NO_x)	NO_2 and nitric oxide (NO) are collectively referred to as oxides of nitrogen (NO_x). It is NO_2 that is associated with adverse effects on human health. Most atmospheric emissions are in the form of NO which is converted to NO_2 in the atmosphere through reactions with ozone. The oxidising properties of NO_2 theoretically could damage lung tissue, and exposure to very high concentrations of NO_2 can lead to inflammation of lung tissue and affect the ability to fight infection. The greatest impact of NO_2 is on individuals with asthma or other respiratory conditions, but consistent impacts on these individuals is at levels of greater than 564μg m^{-3}, much higher than typical UK ambient concentrations.	All combustion processes produce NO_x emissions. The principal sources of NO_x in the UK are road transport and power stations, each of which accounted for about a third of total UK emissions in 2013.
Particulate matter (PM_{10} and $PM_{2.5}$)	PM is the term used to describe all suspended solid matter. PM with an aerodynamic diameter of less than 10μm (PM_{10}) is the subject of health concerns because of its ability to penetrate and remain deep within the lungs. The health effects of particles are difficult to assess, and evidence is mainly based on epidemiological studies. Evidence suggests that there may be associations between increased PM_{10} concentrations and increased mortality and morbidity rates, changes in symptoms or lung function, episodes of hospitalisation or doctor's consultations. Recent reviews by the WHO and Committee on the Medical Effects of Air Pollutants (COMEAP) have suggested exposure to a finer fraction of particles ($PM_{2.5}$) gives a stronger association with the observed health effects. $PM_{2.5}$ typically makes up around two-thirds of PM_{10} emissions and concentrations.	Road transport, industrial processes and electricity generation. Other pollutants, including NO_2 and SO_2, have the potential to form secondary particulates which are often smaller than PM_{10}.

8.7.22 NO and NO_2 are emitted as a result of combustion processes (from aircraft, equipment, heating plant and vehicles for example). Chemical reactions in the atmosphere convert NO to NO_2 (mostly through reaction with ozone) and vice versa (through photolysis during daylight hours). The sum of NO and NO_2 is referred to as NO_x. It is usual practice to treat NO_x and NO_2 as distinct pollutants, with the modelling process keeping track of the relationship between them. For example, some regulations and air quality assessment levels relate to NO_2 while others relate to NO_x.

8.7.23 Emissions of dust, which can affect amenity, are also considered within this assessment.

Likely significant effects

8.7.24 The potentially significant effects on Air Quality from the Proposed Development, which are subject to further discussion in this chapter, are summarised below.

Sources of emissions

8.7.25 The following aspects of the Proposed Development have potential to affect air quality, dust emissions and/or odour:

- Increased aircraft movements, on the ground and in the air;
- Increased ground support equipment (GSE) use;
- Increased landside road activity, including car park usage;
- Construction activity, including traffic; and
- Changes to road layouts and consequent changes to road traffic (e.g. reduced queuing).

Potentially significant effects on human health

8.7.26 It is unlikely that the Proposed Development will result in Air Quality impacts which are likely to have significant effects (in EIA terms) on human health. Of the potential Air Quality impacts on human health, the greatest risk of significant effects is from annual mean NO_2. Given that BAL will operate at a steady level of activity over time (except for daytime/night-time differences), it is much less likely that short-term (i.e. hourly mean) NO_2 concentrations will cause significant effects. Concentrations of other pollutants such as PM_{10} or $PM_{2.5}$ are also less likely to cause significant effects. However, they have been included in the assessment to provide confidence in this conclusion.

Potentially significant effects on ecological sites

8.7.27 Concentrations of NO_x in air are associated with adverse effects on plant growth and are included in this assessment.

8.7.28 In addition, emissions of NO_x and sulphur oxides to the air may result in deposition onto ecological sites, which may be sensitive to both nutrifying nitrogen and acid deposition. As discussed above, emissions of sulphur oxides are negligible, but the impacts of NO_x on nitrifying and acid deposition are included in the assessment.

Potentially significant effects on amenity

8.7.29 Emissions of dust can cause a reduction in amenity to nearby receptors. Emissions of dust from normal airport operation are unlikely to result in significant effects and have been scoped out (noting that no evidence of complaints about dust from Bristol Airport have been identified). However, emissions of dust from construction activity (including construction or demolition of structures, earth-moving, and trackout of dust due to vehicles leaving dusty sites) are potentially significant and have been included in the assessment.

Summary of effects that have been assessed

8.7.30 The effects that have been included in this assessment are summarised in **Table 8.15**.

Table 8.15 Effects that have been assessed for Air Quality

Activity	Impact	Potential effect
	Construction	
Construction site (including laydown areas, staff facilities etc.), airfield expansion (including earthworks), campus development and changes to road infrastructure	Emission of dust.	Amenity at sensitive receptors (residential properties, schools, medical facilities, ecological receptors) near to work sites and haul routes.
	Operation	
Airport operational activity (including aircraft movements, GSE)	Increased combustion emissions as a result of increased aircraft movements and handling.	Increased concentrations of air pollutants that could affect human health (NO_2 and PM) at sensitive receptors (residential properties, schools, medical facilities), or could affect ecological sites.

Activity	Impact	Potential effect
Landside road traffic	Increased combustion emissions as a result of increased road traffic.	Increased concentrations of air pollutants that could affect human health (NO_2 and PM) at sensitive receptors (residential properties, schools, medical facilities), or could affect ecological sites.

Potential effects not requiring assessment

8.7.31 Most of the potential effects not requiring assessment were described in the Scoping Report (**Appendix 1A)** and agreed in the Scoping Opinion (**Appendix 1B**). The Scoping Report left two issues open pending further information, and these are discussed here.

8.7.32 Estimates of traffic associated with construction activity are well below the IAQM/EPUK screening criterion, which is annual average daily traffic of 100 heavy good vehicle movements[17]. Impacts from construction traffic have therefore not been assessed further.

8.7.33 Airport operation can be a source of odour which causes loss of amenity to nearby receptors. However, no records of odour complaints have been received by either BAL or NSC. Therefore, impacts from odour have not been assessed further.

8.8 Environmental measures embedded into the development proposals

8.8.1 A range of environmental measures have been embedded into the Proposed Development proposals as outlined in **Section 3.3**. **Table 8.16** outlines how these embedded measures influence the Air Quality assessment.

Table 8.16 Summary of the embedded environmental measures

Receptor	Changes and effects	Embedded measures
Construction phase measures		
Local road network	Dust soiling of the local road network as a result of trackout of dust and mud from vehicles entering and leaving the application site during the construction phase.	As part of the Construction Environmental Management Plan (CEMP) (**Appendix 2B**) the contractor will produce and implement a Dust Management Plan (DMP); this will include details of measures to identify and reduce the risk, monitoring any dust and identify appropriate clean-up measures.
Local road network	Congestion on the local road network.	As part of the CEMP (**Appendix 2B**), agree and enforce a strict routeing agreement for incoming and outgoing heavy goods vehicles (HGV), avoiding, peak traffic flow hours in order to reduce congestion and queuing.

Receptor	Changes and effects	Embedded measures
Human health and ecological receptors	Potential effect on human health and ecological receptors from dust during the construction phase.	As part of the CEMP (**Appendix 2B**) the contractor will produce and implement a DMP; this will include details of measures to identify and reduce the risk, monitoring any dust and identify appropriate clean-up measures. Measures will include locating stockpiles away from the application site boundary or receptors, covering or damping down stockpiles, stockpile maintenance or management, and removal of materials from the application site.
Human health and ecological receptors	Potential effects upon human health and ecological resources from vehicle emissions.	As part of the CEMP (**Appendix 2B**), agree and enforce delivery and dispatch schedules for HGVs, that avoid, causing congestion on the local road network and excessive emissions to atmosphere. Also, enforce a "no unnecessary idling" policy for all vehicles on the application site.
Operational phase measures		
Human health and ecological receptors	Potential effects upon human health and ecological resources as a result of emissions from aircraft movements on the ground and during the landing and take-off (LTO) cycle.	As part of normal operational practice, planning of aircraft arrival and departure scheduling to avoid, over-long idling, taxiing and hold times. The airfield layout has been designed to minimise times for taxiing and holding. Encourage use of reduced-engine taxiing. Use of Fixed Electrical Ground Power, where available, to minimise engine or auxiliary power unit (APU) use.
Human health and ecological receptors	Potential effects upon human health and ecological resources as a result of emissions from aircraft GSE.	As part of normal operational practice, planning of aircraft arrival and departure scheduling to avoid, over-long operation of liquid fossil-fuelled GSE.

8.9 Assessment methodology

8.9.1 The generic project-wide approach to the assessment methodology is set out in **Chapter 4: Approach to Preparing the Environmental Statement**, and specifically in **Sections 4.5** to **4.7**. However, whilst this has informed the approach that has been used in this Air Quality assessment, it is necessary to set out how this methodology has been applied and adapted as appropriate, to address the specific needs of this Air Quality assessment.

8.9.2 The assessment methodology is summarised here, with full details given in **Appendix 8D**. The methodology is based on best practice and published guidance.

Construction dust

8.9.3 The IAQM has developed guidance for assessing the impacts of construction on dust and determining their significance[19]. This guidance has been used to assess impacts from construction dust.

8.9.4 The IAQM guidance provides a method to assess the significance of construction effects by considering the annoyance due to dust soiling as well as harm to ecological receptors and the risk of health effects due to any significant increases to PM_{10} or $PM_{2.5}$.

8.9.5 The IAQM approach begins with a counterfactual assessment of the risk of dust impacts in the absence of any dust control measures. This is then used to determine what control measures are recommended. In practice, these control measures, or equally effective measures, are normally implemented in the construction phase through a CEMP as part of standard good practice, and as such can be considered as embedded mitigation. The IAQM method is therefore somewhat inconsistent with the normal EIA approach, in which effects with embedded mitigation are assessed first to determine if additional mitigation is required.

8.9.6 Individual construction working sites are classified according to the risk of effects (based upon the scale and nature of the works, plus the proximity of sensitive receptors) in the absence of dust control measures. The significance of the dust effects is assigned after applying the site-specific embedded mitigation. The overall significance of the effects arising from the entire construction phase of the Proposed Development is based upon professional judgement, taking into account the significance of the effects of each of the four activity types and any remaining effect after the embedded mitigation is applied.

Operation

8.9.7 The Air Quality assessment predicts concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$. The Air Quality assessment leads directly to forecasts of annual mean concentrations of the identified pollutants. Shorter-period concentrations, which feature in some AQALs, have been derived from annual mean values, using relationships that have been recommended in technical guidance for local authority LAQM Review and Assessment.[28] This is necessary because the very large number of sources associated with an airport cannot practically be included in a single ADMS model run.

Aircraft emissions

8.9.8 Emissions from the following sources have been calculated:

- Aircraft on the ground, including landing roll, taxi-in, pushback, taxi-out, hold, take-off-roll, APU usage, brake wear and tyre wear;
- Aircraft in the air up to 3,000ft (914m), including approach, initial climb and climb-out; and
- GSE.

8.9.9 Emissions have been calculated using a bottom-up approach, based on multiplying activity levels by appropriate emission factors. Data on activity levels has been provided by BAL, supplemented by data from comparable airports. Emission factors have been taken from standard published sources (refer to **Appendix 8D** for details).

8.9.10 Emissions have been assigned to spatial elements based on layout drawings provided by BAL and standard aviation operational practice (for example for taxiing routes). The spatially-defined emissions were then entered into the dispersion modelling tool ADMS, which calculates concentrations of pollutants at receptors. Deposition rates at ecological receptors have been calculated from concentrations in air using standard deposition velocities.

8.9.11 Throughout the modelling process, care has been taken not to risk underpredicting impacts. Where data is not available, conservative assumptions have been made if necessary.

Road traffic emissions

8.9.12 The contribution from road traffic on roads around the application site has been assessed using data generated as part of the transport assessment within **Chapter 6: Traffic and Transport**. Contributions from airport-related and non-airport traffic have been included on key road links around the application site. Emissions of NO_x have been calculated using the Calculator Using Realistic Emissions for Diesels (CURED) v3A, created by Air Quality Consultants[26], and emissions of other pollutants have been calculated using Defra's Emission Factors Toolkit (EFT) v8. ADMS-Roads was used to perform the dispersion modelling and calculate concentrations at receptors. The roads model was verified and adjusted using the procedure recommended by Defra in their TG(16) guidance.[28]

Impact significance

8.9.13 The significance of effects on NO_2 and PM concentrations in air at human receptors have been assessed in accordance with guidance developed by the IAQM and EPUK[17]. The IAQM/EPUK significance criteria take account of both the incremental change in air quality at relevant receptors and the absolute concentration in relation to AQALs and defines descriptors for the level of impact.

8.9.14 The overall significance of the effect has then been determined using professional judgement. One of the relevant factors to consider is the potential for cumulative effects, e.g. in cases where several 'slight' impacts (in IAQM/EPUK terms) on receptors individually could, taken together, be regarded as having a significant effect for the purposes of air quality management in an area. Conversely, a 'moderate' or 'substantial' impact may not have a significant effect if it is confined to a very small area and where it is not obviously the cause of harm to human health.

8.9.15 For ecological receptors, the criteria recommended in EA guidance[16] and IAQM commentary[18] have been used to provide an initial screening of significance. Where impacts cannot be screened out as insignificant, they will be assessed further by specialist ecologists.

8.10 Assessment of Air Quality effects

Predicted effects and their significance: construction dust and decommissioning

Construction phase effects

8.10.1 *Summary: With embedded mitigation, there will be **no significant effects** as a result of dust generated during construction.*

8.10.2 An assessment of dust from the construction phase has been carried out using the risk-based approach recommended by the IAQM[19], supported by expert judgement.

8.10.3 The IAQM approach divides construction sources of dust into:

- Demolition of existing buildings and structures;
- Earthworks, including soil-stripping, ground-levelling, excavation and landscaping;
- Construction of new buildings and structures; and

[26] Air Quality Consultants (2018). Updated CURED to V3A, [online]. Available at: http://www.aqconsultants.co.uk/News/January-2018/UPDATED-CURED-TO-V3A.aspx [Checked: 22/03/2018].

- Trackout, i.e. the transport of dust and dirt onto public roads, where it may be resuspended by vehicles using the roads.

8.10.4 These four sources are assessed separately, since for any project the relative impacts are likely to be different, and the mitigation measures are also different.

8.10.5 The risk-based approach then assesses the potential dust emission magnitude (whether the activity is likely to generate dust or not — rated as large, medium or small), the sensitivity of receptors in the area to dust (rated as high, medium or low), and the consequent risk of dust impacts in the absence of mitigation (rated as high, medium, low or negligible). The guidance gives advice on assigning the various elements of a construction project to suitable categories of dust emission magnitude and sensitivity, and a procedure for determining the final risk in the absence of mitigation. Full details are not reproduced here but are given in the IAQM document[19].

8.10.6 As noted in paragraph 8.9.5, the IAQM approach to dust assessment differs from the approach taken for other technical disciplines of this EIA in that it begins with a counterfactual assessment of the risk of dust impacts in the absence of any dust control measures, as opposed to undertaking assessments with embedded mitigation incorporated.

8.10.7 The Proposed Development components within the scope of this application which may produce dust impacts are:

- Terminal extensions: Four storey extension to the existing terminal building on the western side (total floorspace of 10,385m^2); two storey extension to the southern side of the existing terminal building (total floorspace 4,600m^2); and an optional extension to the east of the terminal building, which would be brought forward instead of the south terminal extension;
- New multi-storey car park (MSCP) to be constructed in the northern area of the application site, adjacent to the existing MSCP. To provide approximately 2,150 spaces over five levels (total footprint of 11,200m^2);
- New, two lane (one way) gyratory road within the northern area of the application site;
- Widening of the A38 to create an additional lane northbound. Addition of a dedicated right turn from the A38 northbound at the junction with West Lane. Signalised left turn from the West Lane junction onto the A38;
- Extension to the existing Silver Zone Car Park to accommodate 2,700 spaces;
- A new service yard, north of the western walkway and east of the current airside access security;
- A new pier connected to the eastern walkway for passenger access to the eastern stands. It will have vertical circulation cores and five pre-board zones. The footprint is approximately 1,900m^2 for each of the two floors;
- A new eastern taxiway link at the far eastern end of the runway to allow improved and efficient access to the runway for aircraft. This will be a continuation of the current surfacing; and
- Taxiway widening to the southern edge of the northernmost taxiway (Taxiway Golf) to provide a parallel taxiway system for improved access and movement of aircraft.

8.10.8 None of these elements will entail significant amounts of demolition or earthworks, so the only activities that will lead to dust emissions are construction of structures and trackout.

Potential dust emission magnitude

8.10.9 The likely amount of dust produced by the various construction activities has been assessed against IAQM criteria[19] and is given in **Table 8.17**.

Table 8.17 Potential dust emission magnitude

Development component	Activity	Potential dust emission magnitude	Justification
Terminal extensions	Construction	Medium	Total building volume approx. 40,000m^3.
Terminal extensions	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
New MSCP	Construction	Medium	Total building volume approx. 34,000m^3.
New MSCP	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
Gyratory	Construction	Medium	Approximately 800 m of road to be laid within 40,000m^2 car park area to be refurbished.
Gyratory	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
A38 configuration	Construction	Medium	Approximately 400m of road to be widened, two junctions to be altered.
A38 configuration	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
Extension to Silver Zone	Construction	Medium	Approximately 40,000m^2 to be surfaced.
Extension to Silver Zone	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
Service yard	Construction	Small	Approximately 4,000m^2 footprint.
Service yard	Trackout	Small	No data on vehicle movements, so assumed to be the same as construction activity.
Pier connected to the eastern walkway	Construction	Small	Total building volume less than 10,000m^3.
Pier connected to the eastern walkway	Trackout	Small	No data on vehicle movements, so assumed to be the same as construction activity.
Eastern taxiway link	Construction	Medium	Approximately 4,000m^2 to be paved.
Eastern taxiway link	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.
Taxiway Golf widening	Construction	Medium	Approximately 15,000m^2 to be paved.
Taxiway Golf widening	Trackout	Medium	No data on vehicle movements, so assumed to be the same as construction activity.

Sensitivity of the area

8.10.10 The principal human receptors likely to be affected by dust are the dwellings around the application site and near the A38. These are classed as **high** sensitivity in the IAQM guidance. There are also locations classed as **medium** sensitivity, including places of work, the golf course and Felton Common, and places of **low** sensitivity including agricultural land and footpaths.

8.10.11 Regarding ecological receptors, the only ecological site within 50m of a dust-generating activity is Felton Common LNR. It has not been determined if the site has dust-sensitive features, so it is conservatively assumed that it has. The site is therefore classed as **low** sensitivity in the IAQM guidance.

8.10.12 The IAQM guidance says that, without site-specific mitigation, trackout may occur on roads up to 500m from sites with large potential dust emission magnitude, 200m from medium sites and 50m from small sites. The sites here are classed as medium and small, so trackout distances along the roads are taken as 200m and 50m.

8.10.13 The number of receptors within various distance bands (defined in the IAQM guidance) from the construction sites, and the consequent sensitivity of the overall area around the construction sites to various dust effects, is given in **Table 8.18** to **Table 8.20**.

Table 8.18 Sensitivity of the overall area around the construction sites to dust soiling

Development component	Activity	Sensitivity to dust soiling	Justification
Terminal extensions	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
Terminal extensions	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from the site entrance).
New MSCP	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
New MSCP	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from the site entrance).
Gyratory	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
Gyratory	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from site entrance).
A38 configuration	Construction	Medium	Approximately 20 high-sensitivity receptors within 50m and approximately five high-sensitivity receptors within 20m.
A38 configuration	Trackout	Medium	Approximately 20 high-sensitivity receptors within 50 m and approximately five high-sensitivity receptors within 20m.
Extension to Silver Zone	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.

Development component	Activity	Sensitivity to dust soiling	Justification
Extension to Silver Zone	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from site entrance).
Service yard	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
Service yard	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (50m from site entrance).
Pier connected to the eastern walkway	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
Pier connected to the eastern walkway	Trackout	Low	No high-sensitivity receptors within 50m of trackout zone (50m from site entrance).
Eastern taxiway link	Construction	Low	No high-sensitivity receptors within 100 m or medium-sensitivity receptors within 20m.
Eastern taxiway link	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from site entrance).
Taxiway Golf widening	Construction	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m.
Taxiway Golf widening	Trackout	Low	No high-sensitivity receptors within 100m or medium-sensitivity receptors within 20m of trackout zone (200m from site entrance).

Table 8.19 Sensitivity of the overall area around the construction sites to health effects

Development component	Activity	Sensitivity to health effects	Justification
A38 configuration	Construction	Low	Approximately five high-sensitivity receptors within 20m. Annual mean PM_{10} concentration approx. 20µg m^{-3}.
A38 configuration	Trackout	Low	Approximately five high-sensitivity receptors within 20m of trackout zone (200m from site entrance). Annual mean PM_{10} concentration approx. 20µg m^{-3}.
All other development components	Construction	Low	No high-sensitivity receptors within 20m. Annual mean PM_{10} concentration approx. 20µg m^{-3}.
All other development components	Trackout	Low	No high-sensitivity receptors within 20m of trackout zone (200m from site entrance). Annual mean PM_{10} concentration approx. 20µg m^{-3}.

Table 8.20 Sensitivity of the overall area around the construction sites to ecological effects

Development component	Activity	Sensitivity to ecological effects	Justification
Gyratory	Construction	Low	Low-sensitivity receptor within 50m.
Gyratory	Trackout	Low	Low-sensitivity receptor within 50m.
A38 configuration	Construction	Low	Low-sensitivity receptor within 50m.
A38 configuration	Trackout	Low	Low-sensitivity receptor within 50m.
All other development components	Construction	Negligible	No receptors within 50m.
All other development components	Trackout	Negligible	No receptors within 50m.

Risk of impacts with no mitigation

8.10.14 Using the IAQM procedure to combine the results in **Table 8.17** to **Table 8.20**, the risk of impacts with no mitigation applied is given in **Table 8.21**. Without mitigation, there is a **medium** risk of dust soiling arising from the A38 construction activity. All other construction-related activities present a **low** or **negligible** risk of dust soiling, health effects and ecological effects.

Table 8.21 Summary dust risk table, without mitigation

Development component	Activity	Risk of dust soiling	Risk of health effects	Risk of ecological effects
Terminal extensions	Construction	Low risk	Low risk	Negligible risk
Terminal extensions	Trackout	Low risk	Low risk	Negligible risk
New MSCP	Construction	Low risk	Low risk	Negligible risk
New MSCP	Trackout	Low risk	Low risk	Negligible risk
Gyratory	Construction	Low risk	Low risk	Low risk
Gyratory	Trackout	Low risk	Low risk	Low risk
A38 configuration	Construction	Medium risk	Low risk	Low risk
A38 configuration	Trackout	Low risk	Low risk	Low risk
Extension to Silver Zone	Construction	Low risk	Low risk	Negligible risk
Extension to Silver Zone	Trackout	Low risk	Low risk	Negligible risk
Service yard	Construction	Negligible risk	Negligible risk	Negligible risk
Service yard	Trackout	Negligible risk	Negligible risk	Negligible risk
Pier connected to the eastern walkway	Construction	Negligible risk	Negligible risk	Negligible risk

Development component	Activity	Risk of dust soiling	Risk of health effects	Risk of ecological effects
Pier connected to the eastern walkway	Trackout	Negligible risk	Negligible risk	Negligible risk
Eastern taxiway link	Construction	Low risk	Low risk	Negligible risk
Eastern taxiway link	Trackout	Low risk	Low risk	Negligible risk
Taxiway Golf widening	Construction	Low risk	Low risk	Negligible risk
Taxiway Golf widening	Trackout	Low risk	Low risk	Negligible risk

Mitigation

8.10.15 Given the medium risk of impacts in the absence of mitigation determined above, a range of mitigation measures will be necessary to reduce the actual impact from the A38 construction activities. The IAQM guidance[19] suggests ten mitigation measures that are desirable for these impact risks, and 40 that are highly recommended. For the other, low-risk activities, the IAQM guidance suggests 16 mitigation measures that are desirable, and 21 that are highly recommended. They are not reproduced here. These measures, or equally effective measures, will be included in the CEMP (**Appendix 2B**) for each of the construction activities as part of general construction good practice. As such, these measures may be considered as embedded mitigation.

Significant effects

8.10.16 In accordance with best practice for construction, the embedded mitigation measures will be designed and implemented in the CEMP (**Appendix 2B**) to ensure that the potential significant adverse effects identified will not occur. Therefore, with embedded mitigation, there will be **no significant effects** as a result of dust generated during construction.

8.10.17 As the IAQM Guidance[19] states, *"with the implementation of effective site-specific mitigation measures the environmental effect will not be significant in most cases".*

Decommissioning phase effects

8.10.18 For the purposes of this assessment it is not envisaged that decommissioning of the Proposed Development would occur in the foreseeable future and in effect, the Proposed Development would operate in perpetuity.

8.10.19 Nonetheless, should it be necessary to decommission the Proposed Development, it is envisaged that decommissioning phase effects would be similar to construction phase effects, with similar potential for dust associated with the demolition activities. Therefore, with embedded mitigation, it is anticipated that there will be **no significant effects** as a result of dust generated during decommissioning (should this occur).

Met sensitivity study

8.10.20 In order to ascertain the effects of met data on model results, a sensitivity study was carried out using a simplified emissions model. For this study, emissions from the application site were calculated for the 12 mppa case and distributed uniformly over a single volume source covering the Proposed Development's runway and aprons. Emissions from roads were not included, since these were subject to a separate verification and adjustment procedure, in accordance with standard modelling recommendations. Five years of met data were used, from 2013 to 2017, from the Bristol Airport met station.

8.10.21 The wind roses for the five met years are shown in **Figure 8.2** to **Figure 8.6**. These show the frequency of winds from each direction, with different colours for different wind speeds. It can be seen that there is a strong preponderance of winds from the west and south-west in each year. However, there is some variation in the total number of winds from this direction: some years such as 2013 have a significant fraction of north-easterly winds, while in 2017 the wind is almost entirely from the west.

Figure 8.2 Wind rose for 2013

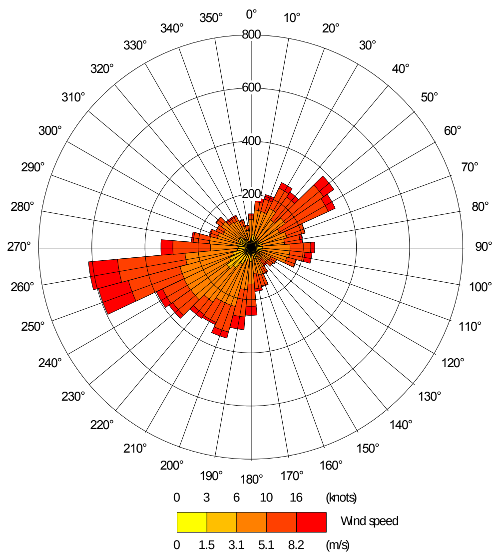


Figure 8.3 Wind rose for 2014

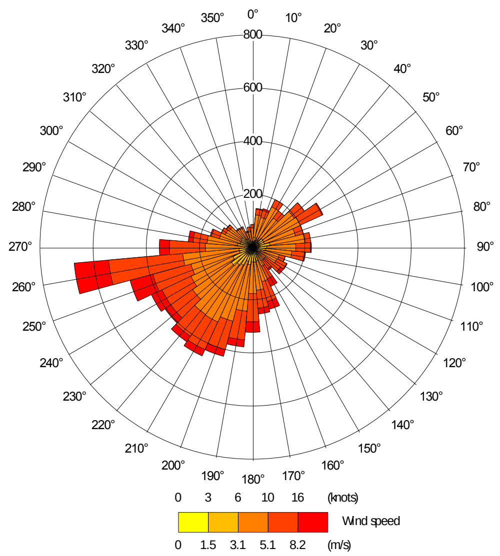


Figure 8.4 Wind rose for 2015

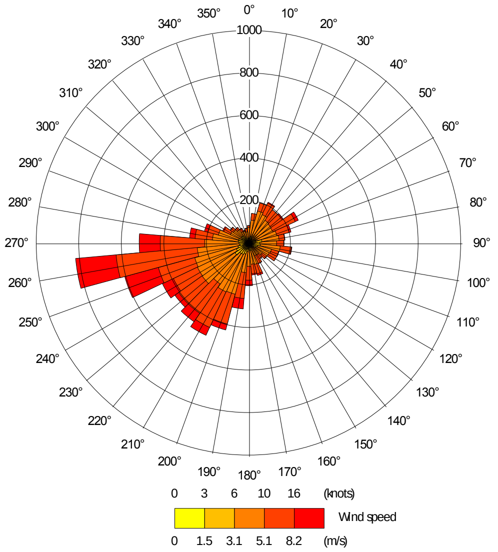


Figure 8.5 Wind rose for 2016

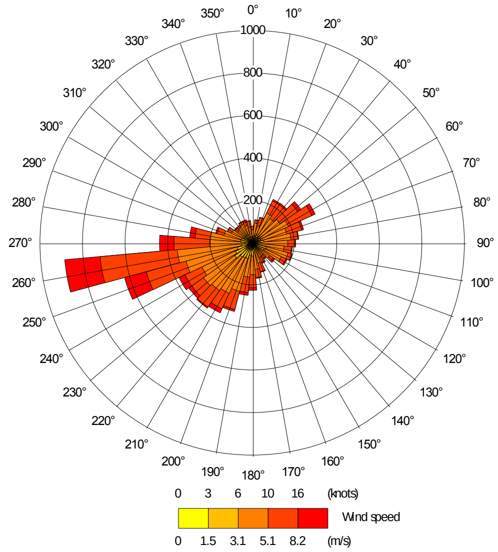
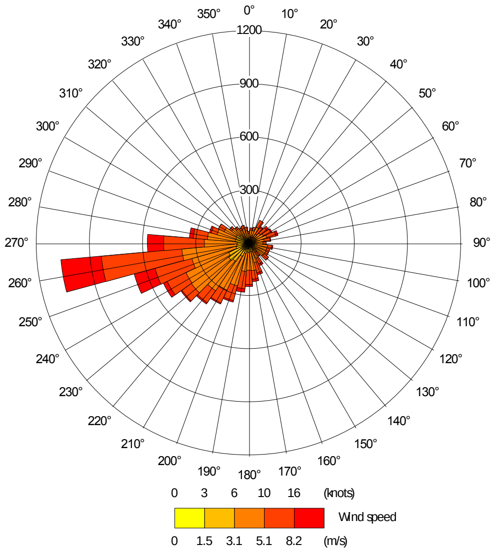
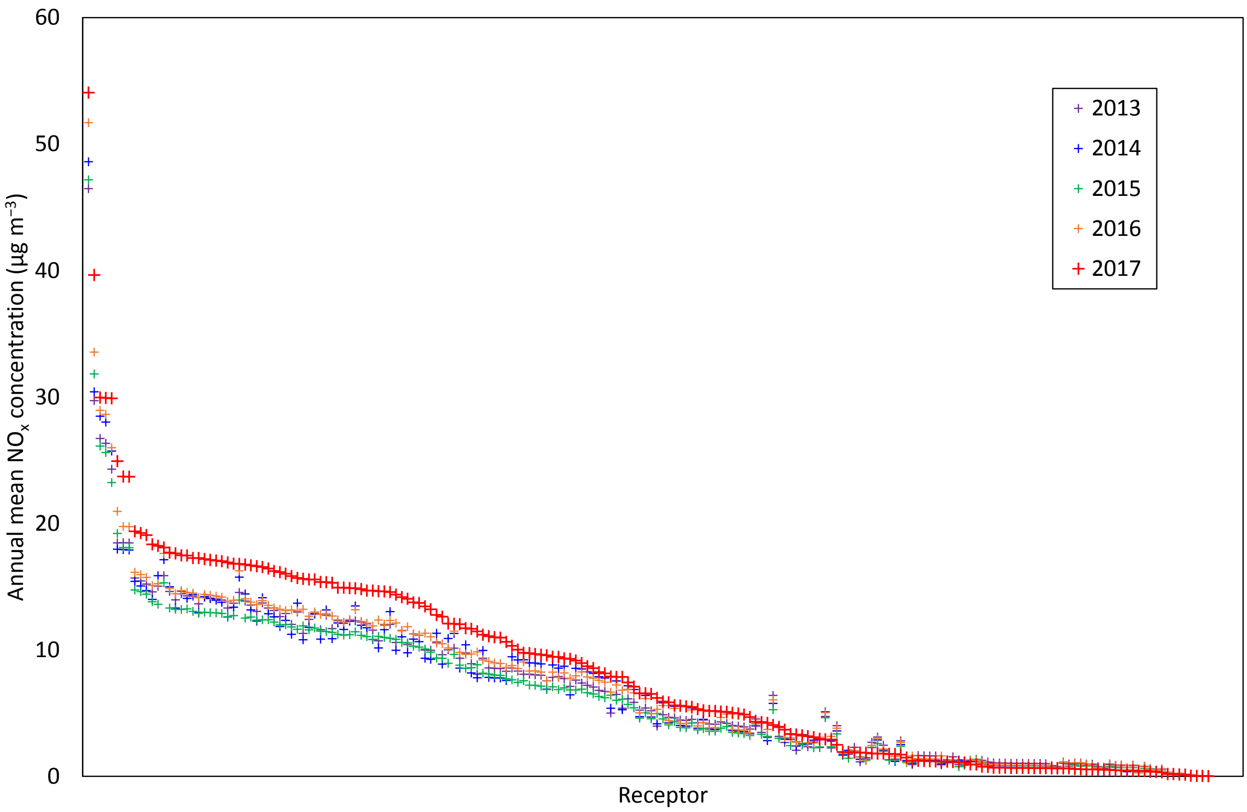


Figure 8.6 Wind rose for 2017



8.10.22 **Figure 8.7** shows the modelled NO_x concentrations at each of the specific receptors, for each of the five met years. It can be seen that at most receptors, the highest concentrations are given by the 2017 met data (red crosses). At the receptors with the highest concentrations (closest to the application site), this is very consistent, and the concentrations are markedly higher in 2017 than in other years. This tallies with the monitoring results from near the application site (**Section 8.5**), which showed a similar increase in concentrations in 2017 compared to preceding years.

Figure 8.7 Met sensitivity study: annual mean NO_x concentrations (μg m^{-3}) for different met years



8.10.23 At some of the ecological receptors, which are more distant from the application site and therefore affected by dispersion in different ways from nearer receptors, 2017 is not the worst met year. For some years and at some ecological receptors, concentrations are up to two times higher than with 2017 met. Therefore, at these receptors, an adjustment factor has been applied to the modelled results in the assessment to ensure that the assessment meets high standards of conservatism. The factors applied are given in **Table 8.22**.

Table 8.22 Met adjustment factors applied for ecological sites

Ecological site	Met adjustment factor
Avon Gorge Forests SAC	1
Chew Valley Lake SPA	1
North Somerset & Mendip Bats 1 SAC	2
Mendip Forests SAC	2
Goblin Combe SSSI	2
Felton Common LNR	1
Ancient woodland sites	2

8.10.24 The results of this sensitivity study demonstrate that using just 2017 met data for the dispersion modelling is a worst case at the most critical receptors and provides a robust basis for the assessment. The only exception is some of the ecological receptors, where 2017 may not be the worst case; for these, a factor of up to two (depending on location) has been applied to the modelled concentrations to ensure that the worst case has been captured and a suitable degree of conservatism exists in the assessment.

Predicted effects and their significance: 2017 model evaluation

8.10.25 This section sets out the results of the dispersion modelling for 2017 and compares predicted ground level concentrations against monitoring data. The purpose of this section is to evaluate the performance of the modelling, so only key results are presented.

8.10.26 Contour plots of modelled annual mean NO_2 concentrations are given in **Figure 8.24** and **Figure 8.25**. These show the contribution from the airfield and from the modelled roads clearly above the background, demonstrating that these contributions fall quickly with distance and reach background levels within a few kilometres of the airfield and within a few hundred metres of roads. They also show that concentrations above 40μg m^{-3} are confined to the airfield (where the limit value does not apply as there is no long-term public exposure), very close to the carriageway of the A38, and within the carriageways of Downside Road and Northside Road (where again the limit value does not apply).

8.10.27 Modelled annual mean NO_2 concentrations are shown in **Table 8.23** for those human receptors where the concentration is over 36μg m^{-3}. This threshold is commonly used as an indicator that there is a risk of exceeding the limit value. A full table of results is given in **Appendix 8E.**

Table 8.23 Modelled annual mean NO_2 where greater than 36μg m^{-3}, 2017

Receptor	AQAL (μg m^{-3})	PEC (μg m^{-3})	PEC (% of AQAL)
H078	40	37.6	93.9%
H080	40	40.0	100.0%
H081	40	37.7	94.2%
H092	40	45.8	114.5%
H093	40	40.4	100.9%
H096	40	50.0	124.9%
H097	40	49.8	124.4%
H099	40	41.7	104.2%
H100	40	41.0	102.6%
H101	40	41.5	103.7%

8.10.28 Modelled annual mean NO_2 concentrations at the monitors are compared with measurements in **Table 8.24** and in **Figure 8.8**. In the figure, points on the diagonal line are receptors where the modelled concentration exactly agrees with the monitored concentration; points above the line are over-predicted, and those below the line are under-predicted. It should be noted that the model has been adjusted to give the best fit at the four roadside monitors, but this will make little difference at the other ten monitors.

8.10.29 It should also be noted that the monitoring results, especially the diffusion tubes, are also subject to uncertainty. Uncertainty in annual mean NO_2 monitored by the continuous monitor is around 10–15%, and uncertainty in annual means from diffusion tubes is around 25%[27].

8.10.30 Overall there is good agreement between modelled and monitored concentrations, with slightly more overpredicted sites than underpredicted, although there are three receptors where the underprediction is relatively large. This is reflected by a regression line forced through the origin, which has a slope of 0.95, indicating a slight tendency to under predict, and a coefficient of determination (R^2) of 0.53.

8.10.31 The three most underpredicted receptors are BAL 8 (next to Northside Road), BAL 2 (airside on the fuel farm fence) and BAL 5 (landside outside the terminal building). The underprediction at BAL 5 may be because the monitor is located close to a roundabout, so there may be queuing or accelerating traffic here. The underprediction at BAL 2 suggests that apron emissions on the central stands may be underpredicted, or it may be associated with airside bus parking which takes place close to this diffusion tube. The underprediction at BAL 5 may be attributed to emissions from buses waiting and starting up, which have not been modelled (any emissions here will be small and only have a local impact — they will not have a material effect on relevant receptors).

8.10.32 At monitoring locations off the application site, the model gives good agreement with a tendency to overpredict, i.e. to be conservative.

8.10.33 It is therefore concluded that the model is suitable for forecasting the impacts from the Proposed Development and associated traffic at key receptors without further adjustment.

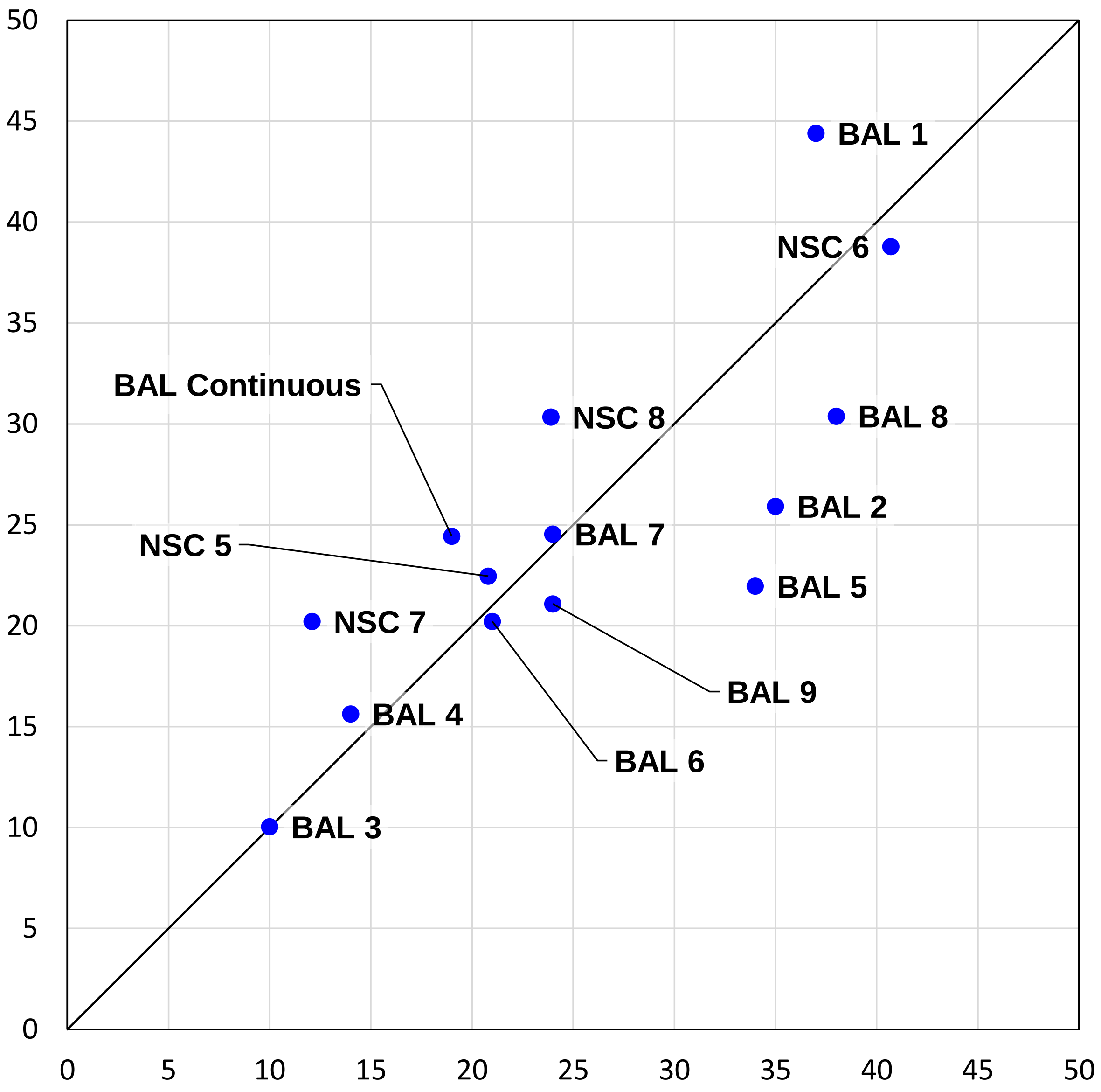
Table 8.24 Modelled versus monitored annual mean NO_2, 2017

Receptor	Monitored ($\mu g\ m^{-3}$)	Modelled ($\mu g\ m^{-3}$)	Ratio
BAL Continuous	19	24.4	1.29
BAL 1	37	44.4	1.20
BAL 2	35	25.9	0.74
BAL 3	10	10.0	1.00
BAL 4	14	15.6	1.12
BAL 5	34	22.0	0.65
BAL 6	21	20.2	0.96
BAL 7	24	24.6	1.02
BAL 8	38	30.4	0.80
BAL 9	24	21.1	0.88
NSC 5	20.8	22.5	1.08
NSC 6	40.7	38.8	0.95
NSC 7	12.1	20.2	1.67

[27] AEA Energy & Environment (2008). Diffusion Tubes for Ambient NO2 Monitoring: Practical Guidance, AEA/ENV/R/2504 Issue 1a.

Receptor	Monitored (µg m⁻³)	Modelled (µg m⁻³)	Ratio
NSC 8	23.9	30.3	1.27

Figure 8.8 Modelled versus monitored annual mean NO_2, 2017



Predicted effects and their significance: operational phase

8.10.34 This section sets out the results of the dispersion modelling for 2026 and compares predicted ground level concentrations against the assessment criteria detailed in **Section 8.9**. The predicted increase in concentrations resulting from the Proposed Development (known as the process contribution or PC) are presented; this is the increment of the concentrations in the 12 mppa scenario relative to the 10 mppa scenario. Also presented are the total predicted environmental concentrations (PEC) for the 12 mppa scenario, which include the background contribution from sources unrelated to the Proposed Development. These concentrations are then compared with the relevant air quality assessment level (AQAL: standard, objective, target or guideline value).

8.10.35 Modelled concentrations include the contributions from operational activity on the application site such as aircraft (including at height beyond the airport boundary), GSE and airport car parks, and road traffic on the modelled links (both airport-related and non-airport and including queues).

8.10.36 Results are given here for the receptors of greatest interest for each assessment criterion. Full results are available in **Appendix 8E**[28].

Human health effects: nitrogen dioxide (NO_2)

8.10.37 *Summary: **Moderate** adverse impacts on annual mean NO_2 concentrations are predicted at seven receptors close to the A38. Concentrations at all receptors remain below the limit value for annual mean NO_2. **No substantial** adverse impacts are predicted. **Slight** adverse impacts are modelled at 50 receptors, with all other receptors being modelled as experiencing **negligible** impacts. In addition, no new or existing exceedances of the hourly mean NO_2 limit value are likely.*

8.10.38 Predicted concentrations of annual mean NO_2 at selected receptors are given in **Table 8.25**. In view of the large number of modelled receptors, results are given in this table for only a selection of receptors (those with moderate impacts, and the five receptors with the highest PECs of those with slight impacts). Results for all receptors are given in **Appendix 8E**. Contour plots of total NO_2 for the 10 mppa and 12 mppa scenarios are shown in **Figure 8.26** to **Figure 8.29**.

Table 8.25 Maximum PCs and PECs for annual mean NO_2

Receptor	AQAL (μg m^{-3})	PC (μg m^{-3})	PEC (μg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Impact
H045	40	3.01	28.12	7.5%	70.3%	Slight
H058	40	2.84	27.65	7.1%	69.1%	Slight
H078	40	6.72	34.88	16.8%	87.2%	Moderate
H079	40	4.74	27.54	11.9%	68.9%	Moderate
H080	40	4.08	32.39	10.2%	81.0%	Moderate
H081	40	3.77	30.38	9.4%	76.0%	Moderate
H092	40	1.38	35.09	3.5%	87.7%	Slight
H093	40	1.85	31.93	4.6%	79.8%	Slight
H095	40	2.52	27.19	6.3%	68.0%	Slight
H098	40	2.82	30.44	7.1%	76.1%	Moderate
H099	40	2.56	35.77	6.4%	89.4%	Moderate
H103	40	4.40	28.32	11.0%	70.8%	Moderate

8.10.39 There are no receptors where the impact of annual mean NO_2 is modelled to be substantial under the IAQM/EPUK criteria, or where the annual mean NO_2 concentration is predicted to exceed the

[28] Please note that results are given to several decimal places. This is to enable comparison between receptors and between PC and PEC contributions. The number of decimal places should not be taken as providing any indication of the accuracy of the results.

limit value of 40 µg m^{-3}. There are seven receptors where the impact is modelled to be **moderate** under the IAQM/EPUK criteria. These are properties close to the A38 road north of the airport, namely the Airport Tavern, Oakwood House, unnamed house south of Yew Tree Cottage, Yew Tree Cottage, the former school (two receptors) and a property between Downside Road and the A38. These are shown in **Figure 8.30**.

8.10.40 The greatest PEC at any of the modelled receptors is 36.9µg m^{-3} or 92% of the AQAL at the H097 receptor representing the Forge Motel; the PC here is -0.7µg m^{-3}, indicating a **slight beneficial** impact as the widening of the road moves traffic slightly away from the facade of the property. Of the receptors experiencing adverse impacts, the greatest PEC is 35.8µg m^{-3} or 89% of the AQAL at the H099 (A38 21) receptor, representing the former school. However, it should be noted that this site has received planning permission for redevelopment as a hotel, and as such will not in future be relevant exposure for annual mean NO_2.

8.10.41 The greatest annual mean NO_2 PC is modelled to be 6.7µg m^{-3} at the H078 receptor representing the Airport Tavern. The PEC here is modelled as 34.9µg m^{-3} or 87% of the AQAL, and the impact is classified as **moderate** under the IAQM/EPUK criteria. This relatively large PC is due to the widening of the A38 bringing traffic closer to the facade of the building.

8.10.42 At all other receptors, the modelled impact is **slight** adverse (50 receptors) or **negligible** (78 receptors), indicating that the PEC in the 12 mppa scenario is below 36µg m^{-3} and the PC is below 4µg m^{-3}. This includes all the properties along Downside Road, as well as any properties more than a few metres from the A38.

8.10.43 Defra TG(16) guidance[28] suggests that where the annual mean NO_2 concentration is below 60µg m^{-3} it is unlikely that there which be a breach of the one-hour AQAL. Modelled annual mean NO_2 concentrations at all receptors, including those where there is only short-term exposure such as the Forge Motel and the former school (which has planning permission for a hotel), are comfortably below 60µg m^{-3}, so it is considered very unlikely that there is any risk of exceeding the one-hour mean NO_2 limit value.

Human health effects: PM_{10}

8.10.44 *Summary: No new or existing exceedances of the annual mean PM_{10} limit value or the daily mean PM_{10} limit value are predicted. Impacts are **negligible** everywhere.*

8.10.45 Predicted concentrations of annual mean PM_{10} at all the modelled receptors are classified as having a negligible impact under the IAQM/EPUK criteria. Concentrations for those receptors with the five greatest PECs and the five greatest PCs are given in **Table 8.26**. (Note that H081 and H87 are in the top five for both PEC and PC.) A full set of results is given in **Appendix 8E**. Contours of annual mean PM_{10} concentrations in the 10 mppa and 12 mppa scenarios are shown in **Figure 8.31** and **Figure 8.32**. The large bulge in the contours over Yewtree Farm is due to an unusually high background concentration in the Defra maps in that 1km grid square (refer to **Table 8.9**).

Table 8.26 Maximum PCs and PECs for annual mean PM_{10}

Receptor	AQAL (µg m^{-3})	PC (µg m^{-3})	PEC (µg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Impact
H081	40	0.49	19.47	1.2%	48.7%	Negligible
H082	40	0.37	18.50	0.9%	46.2%	Negligible
H083	40	0.29	17.78	0.7%	44.4%	Negligible

Receptor	AQAL ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PEC ($\mu g\ m^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)	Impact
H086	40	0.36	18.39	0.9%	46.0%	Negligible
H087	40	0.40	18.76	1.0%	46.9%	Negligible
H078	40	0.93	15.96	2.3%	39.9%	Negligible
H079	40	0.60	15.11	1.5%	37.8%	Negligible
H080	40	0.54	16.62	1.3%	41.5%	Negligible

8.10.46 The maximum annual mean PM_{10} PEC at any relevant human receptor location is predicted as 19µg m^{-3}, or 49% of the AQAL at the H081 (A38 3) receptor. The modelled increment from the Proposed Development here is just 0.5µg m^{-3}. The greatest PC is 0.9µg m^{-3} at the H078 (Airport Tavern) receptor, where the total PEC is 16µg m^{-3} or 40% of the AQAL.

8.10.47 The number of days per year with a daily mean PEC concentration over 50µg m^{-3} is estimated to be less than 3 at all receptors. This compares with a limit value of 35 days per year permitted to be over 50µg m^{-3}.

8.10.48 No existing or new exceedances are predicted, and the maximum concentrations are well below the AQALs and will have a **negligible** impact. It is concluded that there is no risk of an exceedance of either the annual mean or daily mean limit values for PM_{10}, so impacts are **not significant**.

Human health effects: $PM_{2.5}$

8.10.49 *Summary: No new or existing exceedances of the annual mean $PM_{2.5}$ objective are predicted. Impacts are **negligible** everywhere.*

8.10.50 Predicted concentrations of annual mean $PM_{2.5}$ at all the modelled receptors are classified as having a **negligible** impact under the IAQM/EPUK criteria. Concentrations for those receptors with the five greatest PECs and the five greatest PCs are given in **Table 8.27**. (Note that receptors H080 and H081 are in the top five for both PEC and PC.) A full set of results is given in **Appendix 8E**. Contours of annual mean $PM_{2.5}$ for the 10 mppa and 12 mppa scenarios are shown in **Figure 8.33** and **Figure 8.34**.

Table 8.27 Maximum PCs and PECs for annual mean $PM_{2.5}$

Receptor	AQAL ($\mu g\ m^{-3}$)	PC ($\mu g\ m^{-3}$)	PEC ($\mu g\ m^{-3}$)	PC (% of AQAL)	PEC (% of AQAL)	Impact
H080	25	0.32	10.17	1.3%	40.7%	Negligible
H081	25	0.29	10.22	1.2%	40.9%	Negligible
H096	25	-0.28	10.06	-1.1%	40.2%	Negligible
H097	25	-0.33	10.09	-1.3%	40.4%	Negligible
H101	25	0.04	9.98	0.1%	39.9%	Negligible
H078	25	0.55	9.89	2.2%	39.6%	Negligible
H079	25	0.35	9.35	1.4%	37.4%	Negligible

Receptor	AQAL (µg m^{-3})	PC (µg m^{-3})	PEC (µg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Impact
H087	25	0.24	9.80	0.9%	39.2%	Negligible

8.10.51 The maximum annual mean $PM_{2.5}$ PEC at any relevant human receptor location is predicted as 10µg m^{-3} or 41% of the AQAL at the H081 (A38 3) receptor. The modelled increment from the Proposed Development here is just 0.3µg m^{-3}. The greatest PC is 0.5µg m^{-3} at the H078 (Airport Tavern) receptor, where the total PEC is 10µg m^{-3} or 40% of the AQAL.

8.10.52 No existing or new exceedances are predicted, and the maximum concentrations are well below the AQALs with a **negligible** impact. It is concluded that there is no risk of an exceedance of the annual mean limit value for $PM_{2.5}$, so impacts are **not significant**.

Ecological effects: Annual mean nitrogen oxides (NO_x) concentrations in air

8.10.53 *Summary: Parts of Felton Common close to the A38 are predicted to exceed the limit value for annual mean NO_x, largely due to the existing baseline. At all other receptors, concentrations are well below the limit value. Under Environment Agency criteria, the impact at all ecological receptors, including Felton Common, is **not significant**.*

8.10.54 Predicted concentrations of annual mean NO_x at selected receptors are given in **Table 8.28**. In view of the large number of modelled receptors, results are given in this table for only a selection of receptors, namely the major environmental sites (SPAs, SACs, Ramsar sites and SSSIs) with the three highest PECs and PCs, and the local nature sites with the three highest PECs and PCs (note that of the major sites, E12 is in the top three for both PEC and PC, and of the local sites, E16 and E36 are in the top three for both PEC and PC). Results for all receptors are given in **Appendix 8E**. Contours of annual mean NO_x concentrations for the 10 mppa and 12 mppa scenarios are shown in **Figure 8.35** to **Figure 8.38** .

Table 8.28 Maximum PCs and PECs for annual mean NO_x, worst receptors

Receptor	AQAL (µg m^{-3})	PC (µg m^{-3})	PEC (µg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Site type
E08	30	0.11	15.68	0.4%	52.3%	Major
E09	30	0.33	16.27	1.1%	54.2%	Major
E11	30	0.49	15.11	1.6%	50.4%	Major
E11	30	0.49	15.11	1.6%	50.4%	Major
E13	30	0.38	15.10	1.3%	50.3%	Major
E15	30	-4.86	87.51	-16.2%	291.7%	Local
E16	30	4.23	28.61	14.1%	95.4%	Local
E36	30	1.72	23.09	5.7%	77.0%	Local
E17	30	1.60	14.86	5.3%	49.5%	Local

8.10.55 Considering first the major environmental receptors (Ramsar, SPAs, SACs and SSSIs), the maximum annual mean NO_x PEC is predicted as 16µg m^{-3}, or 55% of the AQAL at the E12 (Goblin Combe 2 SSSI) receptor. The modelled increment from the Proposed Development here is 0.7µg m^{-3}, which is the greatest PC at any of the modelled nationally- or internationally-designated ecological receptors. Since the PEC is less than 70% of the AQAL at all the major receptors, under EA guidance, this impact is **not significant**.

8.10.56 Turning to the local nature receptors (i.e. excluding Ramsar, SPA, SAC and SSSI sites), the maximum annual mean NO_x PEC is predicted as 88µg m^{-3} or 292% of the AQAL at the E15 (Felton Common 1 LNR) receptor. The PC here is -5µg m^{-3} — a reduction in concentration compared to the 10 mppa scenario because the widening of the A38 road moves emissions slightly further away from the receptor. The concentrations here are elevated because this receptor represents the corner of the LNR next to the pavement alongside the A38. Concentrations fall rapidly with distance from the road, and at E16, which is 140m from the road, the PEC is below the AQAL at just 29µg m^{-3}, and at E18 in the centre of the LNR, the PEC is close to background levels at 15µg m^{-3} or 50% of the AQAL. At all Felton Common receptors, the PC is less than 100% of the AQAL, so under EA guidance, the impact is **not significant**.

8.10.57 At all other local nature receptors, concentrations are well below the AQAL. The greatest PEC at a local receptor other than Felton Common is 23 µg m^{-3} or 77% of the AQAL. Under EA guidance, the impact at these receptors is not significant.

8.10.58 Except for parts of Felton Common, no existing or new exceedances are predicted at any of the modelled receptors. Under EA guidance, the impact at all receptors can be considered **not significant** and no further assessment is necessary.

Ecological effects: Maximum daily mean NO_x concentrations in air

8.10.59 *Summary: It is likely that parts of Felton Common close to the A38 will exceed the target for daily mean NO_x, largely due to the existing baseline. At all other receptors, concentrations are not expected to exceed the target.*

8.10.60 Because of the large number of emissions sources, it has not been possible to model daily mean NO_x concentrations. Instead, concentrations have been estimated using the guideline suggested by the EA[16] and Defra that short-term concentrations are approximately double the corresponding annual mean concentrations. Given that emissions from Bristol Airport are broadly uniform over the course of a year, apart from day and night variations, this is considered a reasonable approximation for airport-related emissions.

8.10.61 Predicted concentrations of annual mean NO_x at selected receptors are given in **Table 8.29**. In view of the large number of modelled receptors, results are given in this table for only a selection of receptors, namely the major environmental sites (SPAs, SACs, Ramsar sites and SSSIs) with the three highest PECs and PCs, and the local nature sites with the three highest PECs and PCs (note that of the major sites, E12 is in the top three for both PEC and PC, and of the local sites, E16 and E36 are in the top three for both PEC and PC). Results for all receptors are given in **Appendix 8E**.

Table 8.29 Maximum PCs and PECs for daily mean NO_x, worst receptors

Receptor	AQAL (µg m^{-3})	PC (µg m^{-3})	PEC (µg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Site type
E08	200	0.21	31.37	0.1%	15.7%	Major
E09	200	0.67	32.54	0.3%	16.3%	Major
E12	200	1.45	32.99	0.7%	16.5%	Major
E11	200	0.97	30.22	0.5%	15.1%	Major

Receptor	AQAL (μg m^{-3})	PC (μg m^{-3})	PEC (μg m^{-3})	PC (% of AQAL)	PEC (% of AQAL)	Site type
E13	200	0.77	30.20	0.4%	15.1%	Major
E15	200	-9.71	175.02	-4.9%	87.5%	Local
E16	200	8.47	57.23	4.2%	28.6%	Local
E36	200	3.45	46.18	1.7%	23.1%	Local
E17	200	3.20	29.72	1.6%	14.9%	Local

8.10.62 Considering first the major environmental receptors (Ramsar, SPAs, SACs and SSSIs), the maximum daily mean NO_x PEC is predicted as 33μg m^{-3}, or 16% of the AQAL at the E12 (Goblin Combe 2 SSSI) receptor. The modelled increment from the Proposed Development here is 1.5μg m^{-3}, which is the greatest PC at any of the modelled nationally- or internationally-designated ecological receptors. Since the PC is less than 10% of the AQAL, under EA guidance, this impact is **not significant**.

8.10.63 Turning to the local nature receptors (i.e. excluding Ramsar, SPA, SAC and SSSI sites), the maximum daily mean NO_x PEC is predicted as 175μg m^{-3} or 88% of the AQAL at the E15 (Felton Common 1 LNR) receptor. The PC here is -9μg m^{-3} — a reduction in concentration compared to the 10 mppa scenario because the widening of the A38 road moves emissions slightly further away from the receptor. The concentrations here are elevated because this receptor represents the corner of the LNR next to the pavement alongside the A38. Concentrations fall rapidly with distance from the road, and at E16, which is 140m from the road, the PEC is just 57μg m^{-3}, and at E18 in the centre of the LNR, the PEC is close to background levels at 30μg m^{-3} or 15% of the AQAL. At all Felton Common receptors, the PC is less than 100% of the AQAL, so under EA guidance, the impact is **not significant**.

8.10.64 At all other local nature receptors, concentrations are well below the AQAL. The greatest PEC at any of the receptors other than Felton Common is 46μg m^{-3} or 23% of the AQAL. Under EA guidance, the impact at these receptors is **not significant**.

8.10.65 No existing or new exceedances are predicted at any of the modelled receptors. Under EA guidance, the impact at all receptors can be considered **not significant**.

Ecological effects: nutrient nitrogen deposition

*8.10.66 Summary: While exceedances of the critical loads for nitrogen are predicted at all receptors, these are due to existing deposition rates and the additional contribution from the Proposed Development is **not significant** at any receptor.*

8.10.67 Modelled nutrient nitrogen deposition rates at selected receptors are given in **Table 8.30**, along with the receptor-specific critical loads. In view of the large number of modelled receptors, results are given in this table for only a selection of receptors, namely the major environmental sites (SPAs, SACs, Ramsar sites and SSSIs) with the three highest PECs and PCs (as a percentage of the receptor-specific critical load), and the local nature sites with the three highest PECs and PCs (note that of the major receptors, E06 is in the top three for both PEC and PC, and of the local receptors, E17 is in the top three for both PEC and PC). Results for all receptors are given in **Appendix 8E**.

Table 8.30 Maximum PCs and PECs for nitrogen deposition

Receptor	AQAL (kg N ha^{-1} y^{-1})	PC (kg N ha^{-1} y^{-1})	PEC (kg N ha^{-1} y^{-1})	PC (% of AQAL)	PEC (% of AQAL)	Site type
E03	10.00	0.00	36.96	0.0%	369.6%	Major
E06	10.00	0.04	32.66	0.4%	326.6%	Major
E07	10.00	0.02	32.64	0.2%	326.4%	Major
E11	15.00	0.07	32.69	0.5%	217.9%	Major
E12	15.00	0.11	27.27	0.7%	181.8%	Major
E17	5.00	0.12	23.36	2.5%	467.3%	Local
E19	5.00	0.06	23.30	1.2%	466.0%	Local
E28	10.00	0.18	37.84	1.8%	378.4%	Local
E16	5.00	0.32	18.52	6.4%	370.4%	Local
E36	10.00	0.25	30.21	2.5%	302.1%	Local

8.10.68 Nutrient nitrogen background deposition rates at all of the modelled receptors are modelled to be at exceedance already, based on background deposition rates from APIS and without any additional contribution from the Proposed Development; no account is taken of reductions in deposition rates in future years.

8.10.69 At the major environmental sites, the additional PC is less than 1% at all the modelled receptors. Under EA guidance, where the PC at a major site is less than 1% of the critical load, it can be considered **insignificant** and does not need to be assessed further.

8.10.70 At the local nature sites, the additional PC is less than 7% of the critical load. This is less than 100% of the assessment level, so under EA guidance for local nature sites, it can be considered **insignificant** and does not need to be assessed further.

8.10.71 It is therefore concluded that the impacts on nitrogen deposition are **not significant** at any receptor.

Ecological effects: acid deposition

*8.10.72 Summary: While exceedances of the critical loads for acidity are predicted at two receptors, these are due to existing deposition rates and the additional contribution from the Proposed Development is **insignificant** at all receptors.*

8.10.73 Modelled PC and background deposition rates are given in **Table 8.31**. A comparison with the critical load function is given in **Table 8.32**[29]. In view of the large number of modelled receptors, results are given in this table for only a selection of receptors, namely the major environmental sites (SPAs, SACs, Ramsar sites and SSSIs) with the three highest PECs and PCs (as a percentage of the receptor-specific critical load function), and the local nature sites with the three highest PECs and PCs (again as a percentage of the critical load function). Results for all receptors are given in **Appendix 8E**.

[29] These are calculated using the same formulas as the APIS critical load function tool, but without rounding of intermediate values, so results differ slightly from those generated by the website tool.

Table 8.31 Acid deposition rates

Receptor	Sulphur PC (keq ha^{-1} y^{-1})	Nitrogen PC (keq ha^{-1} y^{-1})	Sulphur background (keq ha^{-1} y^{-1})	Nitrogen background (keq ha^{-1} y^{-1})	Site type
E03	0	0.0001	0.20	2.64	Major
E04	0	0.0001	0.20	2.14	Major
E08	0	0.0012	0.19	2.25	Major
E11	0	0.0051	0.16	1.37	Major
E12	0	0.0078	0.17	1.17	Major
E13	0	0.0041	0.17	1.17	Major
E26	0	0.0058	0.24	2.69	Local
E28	0	0.0125	0.24	2.69	Local
E40	0	0.0058	0.24	2.69	Local
E16	0	0.0227	0.18	1.30	Local
E21	0	0.0136	0.20	1.94	Local
E28	0	0.0125	0.24	2.69	Local

Table 8.32 Acid deposition: comparison with critical loads

Receptor	Exceedance (keq ha^{-1} y^{-1})			Percent of critical load function			Site type
	PC	Background	PEC	PC	Background	PEC	
E03	No exceedance	0.77	0.77	0.0	136.9	136.9	Major
E04	No exceedance	0.26	0.26	0.0	112.5	112.5	Major
E08	No exceedance	No exceedance	No exceedance	0.0	92.8	92.8	Major
E11	No exceedance	No exceedance	No exceedance	0.1	31.5	31.6	Major
E12	No exceedance	No exceedance	No exceedance	0.2	27.6	27.8	Major
E13	No exceedance	No exceedance	No exceedance	0.1	27.6	27.7	Major
E26	No exceedance	No exceedance	No exceedance	0.1	48.0	48.1	Local
E28	No exceedance	No exceedance	No exceedance	0.2	48.0	48.2	Local

Receptor	Exceedance (keq ha^{-1} y^{-1})			Percent of critical load function			Site type
	PC	Background	PEC	PC	Background	PEC	
E40	No exceedance	No exceedance	No exceedance	0.1	48.0	48.1	Local
E16	No exceedance	No exceedance	No exceedance	0.5	34.2	34.7	Local
E21	No exceedance	No exceedance	No exceedance	0.2	35.7	35.9	Local
E28	No exceedance	No exceedance	No exceedance	0.2	48.0	48.2	Local

8.10.74 Background acid deposition rates at two of the modelled receptors, E03 (North Somerset & Mendip Bats 1 SAC) and E04 (North Somerset & Mendip Bats 2 SAC) are modelled to be at exceedance already, based on background deposition rates from APIS and without any additional contribution from the Proposed Development; no account is taken of reductions in deposition rates in future years. The PC at these receptors is less than 0.005% of the critical load function.

8.10.75 At the major environmental sites, the greatest PC is 0.2% of the critical load function at the E12 (Goblin Combe 2 SSSI) receptor, where the PEC is 28% of the critical load function. Since the PCs at all major receptors are less than 1% of the AQAL, under EA guidance the impacts at these receptors can be considered **not significant**.

8.10.76 At the local nature sites, the additional PC is at most 0.5% of the critical load function, at the E16 (Felton Common 2 LNR) receptor. The PEC here is modelled as 35% of the critical load function. The greatest PEC at a local nature site is 48% of the critical load function at the E28 (High Wood AW) receptor. Since the PCs at all local receptors are less than 100% of the AQAL, under EA guidance for local wildlife sites the impacts at these receptors can be considered **not significant**.

8.10.77 Under the EA criteria, the impacts at all modelled receptors, both major and local, can be considered **not significant** and do not need to be assessed further.

Summary of predicted effects and their significance

8.10.78 A summary of the results of the assessment of Air Quality is provided in **Table 8.33**.

Table 8.33 Summary of significance of effects

Receptor and summary of predicted effects	Significance[1]	Summary Rationale
Human health effects: Annual mean NO_2	Moderate	There are modelled to be moderate impacts, in terms of the IAQM/EPUK guidance, at seven receptors. All these receptors are close to the A38. At all other receptors, the impact is slight or negligible. There are no new or existing exceedances of the limit value, and no substantial impacts in terms of the IAQM/EPUK guidance. In view of the small number of receptors with moderate impacts, and in the wider context of the Proposed Development, these impacts are considered to be of at most moderate significance in EIA terms.
Human health effects: Hourly mean NO_2	Not significant	Given that the annual mean NO_2 concentrations are well below the 60µg m^{-3} value suggested by Defra as indicating that exceedances of the hourly mean limit are unlikely to occur, it is not considered credible that there is any risk of any exceedance of the hourly mean NO_2 AQAL.
Human health effects: Annual mean PM_{10}	Not significant	Annual mean PM_{10} concentrations are well below the AQAL and the impact of the Proposed Development is negligible at all receptors under the IAQM/EPUK criteria. This impact is therefore not considered significant.
Human health effects: Daily mean PM_{10}	Not significant	The daily mean PM_{10} is estimated to be greater than 50µg m^{-3} on no more than three days per year at any of the receptors. The AQAL specifies that there should be no more than 35 days per year greater than 50µg m^{-3}, so it is not considered that there is any risk of any exceedance of the daily mean PM_{10} AQAL.
Human health effects: Annual mean $PM_{2.5}$	Not significant	Annual mean $PM_{2.5}$ concentrations are well below the AQAL and the impact of the Proposed Development is negligible at all receptors under the IAQM/EPUK criteria. This impact is therefore not considered significant.
Ecological effects: Annual mean NO_x	Not significant	Some parts of Felton Common exceed the AQAL, largely due to the existing background. However, under EA criteria, the impacts at this site can be considered insignificant. At all other ecological sites, the PEC is well below the AQAL and again the impacts can be considered insignificant under EA criteria.
Ecological effects: Daily mean NO_x	Not significant	At all ecological sites, the PEC is well below the AQAL and under EA criteria the impacts can be considered insignificant.
Ecological effects: Nutrient nitrogen deposition	Not significant	All ecological sites modelled exceed the critical load for nutrient nitrogen deposition, due to existing background. However, the additional contribution from the Proposed Development is small, and under EA criteria, the impacts at all ecological sites can be considered insignificant.
Ecological effects: Acid deposition	Not significant	Two ecological receptors are modelled to exceed the critical load for acid deposition, due to existing background. However, the additional contribution from the Proposed Development is small, and under EA criteria, the impacts at all ecological sites can be considered insignificant.

Receptor and summary of predicted effects	Significance[1]	Summary Rationale
Air Quality effects: construction dust	Not significant	Embedded mitigation measures will be designed and implemented to ensure that the potential significant adverse effects will not occur, so the effect with embedded mitigation will be not significant.

1. The significance of the environmental effects is based on the combination of the sensitivity/importance/interest of a receptor and the magnitude of change and is expressed as major (significant), moderate (probably significant) or minor/negligible (not significant), subject to the evaluation methodology outlined in **Section 8.9**.

8.11 Consideration of optional additional mitigation or compensation

8.11.1 No additional mitigation measures are proposed to further reduce the Air Quality effects that are identified in this ES. This is because all relevant and implementable measures have been embedded into the development proposals and are assessed above in this chapter. These measures are considered to be effective and deliverable.

8.12 Conclusions of significance evaluation

8.12.1 Overall the Air Quality impacts are considered to be of **moderate significance**. Increases in annual mean NO_2 result in impacts which are classified as **moderate** adverse in terms of the IAQM/EPUK guidance at seven receptors, and **slight** adverse at a further 50 receptors, but there are no other significant Air Quality impacts at any human or ecological receptor.