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Bathampton Meadows Park & Ride

Air Quality Sensitivity Assessment

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Revision	Date	Notes	Author	Checked	Approved
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1 INTRODUCTION

1.1 Entran Limited has been commissioned to undertake an assessment of the potential air quality impacts associated with a proposed Park and Ride facility at Bathampton Meadows and specifically the air quality impacts this may have on Batheaston.

1.2 The proposal Park and Ride facility would accommodate up to 1,400 spaces. It is anticipated that this will also significantly increase traffic flows on London Road West and High Street, Batheaston, which already suffer from poor air quality that is marginally below the annual mean objective for nitrogen dioxide. This assessment therefore examines a sensitivity analysis to determine the potential impacts within this area.

1.3 Bath and North East Somerset Council (BANES) has declared a number of Air Quality Management Area's (AQMA's) due to exceedances of the nitrogen dioxide (NO_2) objectives, including an area incorporating the main road network within Bath. The potential Park & Ride site at Bathampton Meadows lies less than 500m to the east of the AQMA on London Road.

1.4 A glossary of common air quality terminology is provided in **Appendix A.**

2 LEGISLATION AND POLICY

Air Quality Strategy for England, Scotland, Wales & Northern Ireland

2.1 The Government's policy on air quality within the UK is set out in the Air Quality Strategy (AQS) for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[1], pursuant to the requirements of Part IV of the Environment Act 1995. The AQS sets out a framework for reducing hazards to health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.

2.2 The AQS sets standards and objectives for ten main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3-butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10}, $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3) and polycyclic aromatic hydrocarbons (PAHs).

2.3 The air quality standards are long-term benchmarks for ambient pollutant concentrations which represent negligible or zero risk to health, based on medical and scientific evidence reviewed by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO). These are general concentration limits, above which sensitive members of the public (e.g. children, the elderly and the unwell) might experience adverse health effects.

2.4 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedances of the standard over a given period.

2.5 For some pollutants there is both a long-term (annual mean) standard and a short-term standard. In the case of nitrogen dioxide (NO_2), the short-term standard is for a 1-hour averaging period, whereas for fine particulates (PM_{10}) it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants (e.g. temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road).

[1] The Air Quality Strategy for England, Scotland, Wales and Northern Ireland – July 2007.

2.6 The current statutory standards and objectives are set out in the table presented in **Appendix B**.

2.7 Of the pollutants included in the AQS, NO_2, PM_{10} and $PM_{2.5}$ will be particularly relevant to this project, as these are the primary pollutants associated with road traffic.

Local Air Quality Management (LAQM)

2.8 Part IV of the Environment Act 1995 also requires local authorities to periodically Review and Assess the quality of air within their administrative area. The Reviews have to consider the present and future air quality and whether any air quality objectives prescribed in Regulations are being achieved or are likely to be achieved in the future.

2.9 Where any of the prescribed air quality objectives are not likely to be achieved the authority concerned must designate that part an Air Quality Management Area (AQMA).

2.10 For each AQMA, the local authority has a duty to draw up an Air Quality Action Plan (AQAP) setting out the measures the authority intends to introduce to deliver improvements in local air quality in pursuit of the air quality objectives. Local authorities are not statutorily obliged to meet the objectives, but they must show that they are working towards them.

2.11 The Department of Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their Review and Assessment work[2]. This guidance, referred to in this chapter as LAQM.TG(09), has been used where appropriate in the assessment.

National Planning Policy Framework

2.12 Published on 27th March 2012, the National Planning Policy Framework (NPPF)[3] sets out the Government's planning policies for England and how these are expected to be applied. It replaces Planning Policy Statement 23: Planning and Pollution Control[4], which provided planning guidance for local authorities with regards to air quality.

[2] Department for Environment, Food and Rural Affairs (DEFRA), (2009): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09).

[3] Communities and Local Government: *National Planning Policy Framework* (March 2012)

[4] Office of the Deputy Prime Minister: *Planning Policy Statement 23: Planning and Pollution Control* (Oct 2004).

2.13 At the heart of the NPPF is a presumption in favour of sustainable development. It requires Local Plans to be consistent with the principles and policies set out in the Framework with the objective of contributing to the achievement of sustainable development.

2.14 Current planning law requires that applications for planning permission must be determined in accordance with the relevant development plan (i.e. Local Plan or Neighbourhood Plan). The NPPF should be taken into account in the preparation of development plans and therefore the policies set out within the Framework are a material consideration in planning decisions.

2.15 The NPPF identifies 12 core planning principles that should underpin both plan-making and decision-taking, including a requirement for planning to '*contribute to conserving and enhancing the natural environment and reducing pollution'.*

2.16 Under Policy 11: Conserving and Enhancing the Natural Environment, the Framework requires the planning system to *'prevent both new and existing developments from contributing to or being put at unacceptable risk or being adversely affected by unacceptable levels of air pollution'.*

2.17 In dealing specifically with air quality the Framework states that *'planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan'.*

3 METHODOLOGY

Scope of Assessment

3.1 The scope of the assessment has been determined in the following way:

- Review of air quality data for the area surrounding the site and background pollutant maps;
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment;
- Assess the likely impact on local air quality of incremental traffic increases along main roads due to the development of the proposed Park and Ride; and
- The assessment focuses on nitrogen dioxide as this is the pollutant of most concern in the area.

Operational Phase Methodology

3.2 A summary of the 2014 baseline annual average daily traffic (AADT) flows used in the assessment for model verification purposes are presented in Table 3.1. Traffic flow data for London Road West and High Street, Batheaston are not available at the present time and therefore air quality impacts associated with traffic flow increases on these sections of road have been assessed against existing baseline monitoring data. This data is considered representative of baseline concentrations at sensitive receptors adjacent to this road.

Table 3.1: Annual Average Daily Traffic Flows on London Road

Road Link	Baseline 2014	Speed (kph)	HGV (%)
London Road	20,696	27	4.87

3.3 Up to four thousand additional traffic movements are predicted from the Park and Ride. For the purposes of assessing impacts at London Road West and High Street Batheaston, two traffic increase scenarios have been assessed. Although the access to the Park & Ride will be from the A4 bypass, it is anticipated that the introduction of traffic control at the access of the Park & Ride will result in congestion on the bypass, therefore resulting in vehicles divert through Batheaston High Street, particularly at peak times of day.

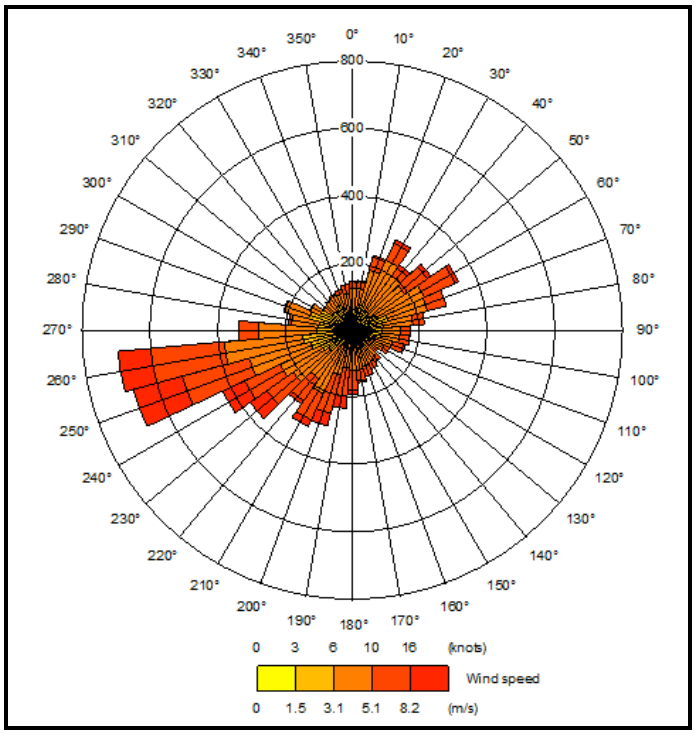
3.4 The following scenarios have therefore been included in the assessment:

- 2014 – London Road baseline (for model verification purposes);
- 2014 London Road West baseline + 1000 additional vehicles;
- 2014 London Road West baseline + 2000 additional vehicles;
- 2014 London Road West baseline + 2000 additional vehicles with reduced speeds at predicted congestion points.

3.5 The prediction of local air quality has been undertaken using the ADMS Roads 4 dispersion model. This is a commercially available dispersion model and has been widely validated for this type of assessment and used extensively in the Air Quality Review and Assessment process.

3.1 The model uses detailed information regarding traffic flows on the local road network and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. Meteorological data from Filton Airport has been used in the assessment which shows the prevailing wind direction from the south-west, as identified in Figure 3.1 below.

Figure 3.1: Wind Rose for Bristol Filton Meteorological Station



3.2 The model has been used to predict road specific concentrations of oxides of nitrogen (NOx) at selected receptors. The predicted concentrations of NO_x have been converted to NO_2 using the LAQM calculator available on the DEFRA air quality website[5].

3.3 Emission factors and background data used in the prediction of future air quality predict a gradual decline in pollution levels over time due to improved emissions from new vehicles and the gradual renewal of the vehicle fleet. However, recent monitoring carried out in urban areas throughout the UK have found that NO_2 concentrations are not declining as rapidly as previously thought and in some locations concentrations have increased. Monitoring carried out by BANES has shown no significant trend in concentrations in recent years.

3.4 It is recommended, following guidance set out in LAQM.TG(09)[6], that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. There is one automatic monitoring station in the vicinity of the development site (London Road AURN site), which has been used to verify the modelled concentrations. The model verification calculation is presented in **Appendix C**.

3.5 LAQM.TG(09)[9] does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research[7] has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed 60 µg/m^3.

3.6 Concentrations of oxides of nitrogen (NOx) have been predicted and a quantitative assessment of the effects on local air quality from road traffic emissions associated with the operation of the development have been completed against the current statutory standards and objectives set out in **Appendix B**.

Significance Criteria

[5] http://uk-air.defra.gov.uk

[6] Department for Environment, Food and Rural Affairs (2009): Part IV The Environment Act 1995 Local Air Quality Management Review and Assessment Technical Guidance, LAQM.TG(09).

[7] D Laxen and B Marner: Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites (July 2003).

3.7 The EPUK guidance[8] sets out criteria to be used to identify when an Air Quality Assessment is required in relation to development proposals, the type of Air Quality assessment required, and the significance of any predicted impact.

Table 3.2: Significance of Effects

Long term average concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL) (a)			
	1	2-5	5-10	>10
75% or less of AQAL	Negligible	Negligible	Slight adverse	Moderate adverse
76-94% of AQAL	Negligible	Slight adverse	Moderate adverse	Moderate adverse
95-102% of AQAL	Slight adverse	Moderate adverse	Moderate adverse	Substantial adverse
103-109% of AQAL	Moderate adverse	Moderate adverse	Substantial adverse	Substantial adverse
110% or more of AQAL	Moderate adverse	Substantial adverse	Substantial adverse	Substantial adverse
a) A change in concentration of less than 0.5% of the AQAL is considered insignificant, however, changes between 0.5% and 1% are rounded up to 1%				

Sensitive Receptors

3.8 LAQM.TG(09) describes in detail typical locations where consideration should be given to pollutants defined in the Regulations. Generally, the guidance suggests that all locations '*where members of the public are regularly present'* should be considered. At such locations, members of the public will be exposed to pollution over the time that they are present, and the most suitable averaging period of the pollutant needs to be used for assessment purposes.

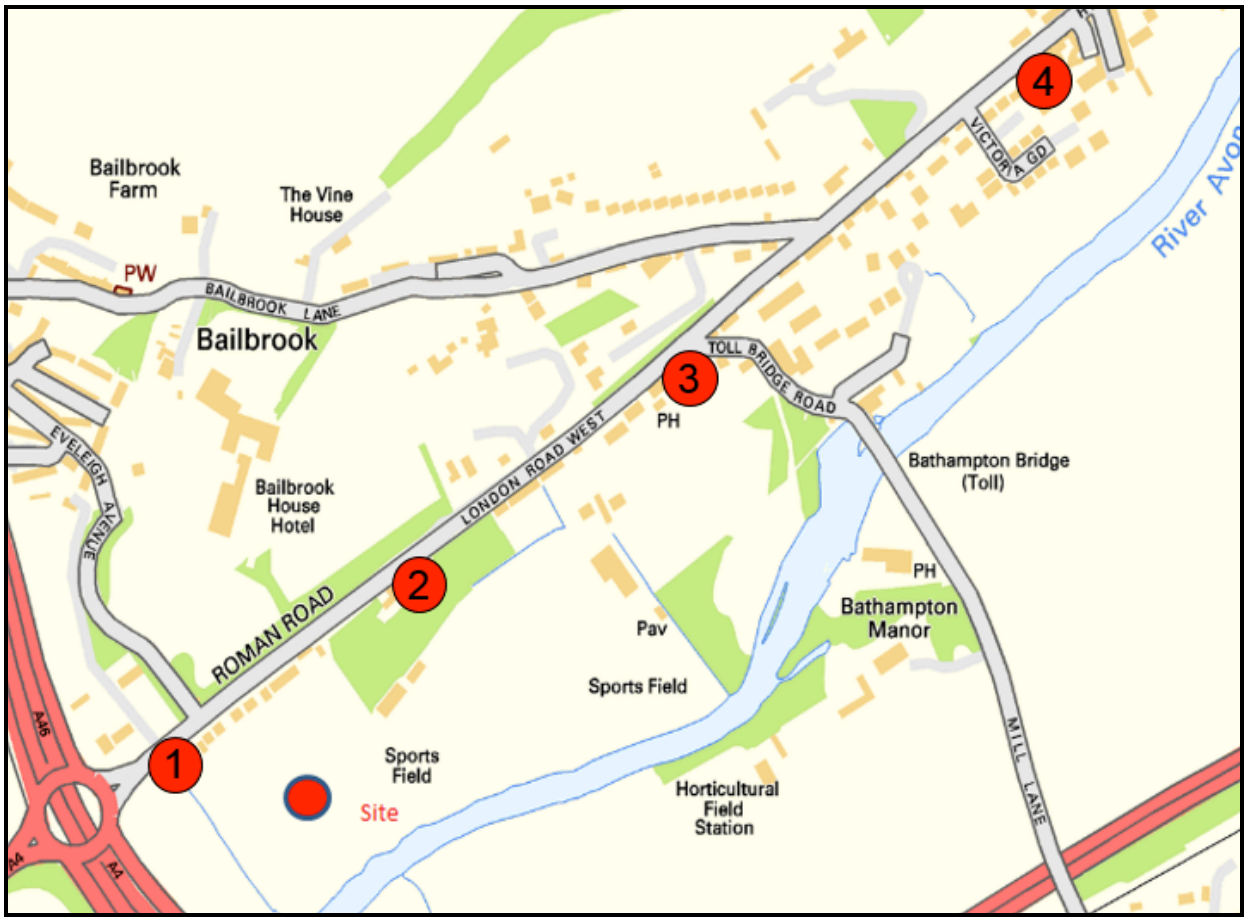
3.9 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standard (i.e. 15-minute mean or 1-hour mean) may be relevant. In a school, or adjacent to a private dwelling, however; where exposure may be for longer periods, comparison with long-term (such as 24-hour mean or annual mean) standards may be most appropriate. In general terms, concentrations associated with long-term standards are lower than short-term standards owing to the chronic health effects associated with exposure to low level pollution for longer periods of time.

[8] Environmental Protection UK (2010), Development Control: Planning for Air Quality (2010 Update).

3.10 The receptors used in the assessment represent existing residential dwellings and include the following (see Figure 3.2):

1. 68 London Road West;
2. 92 London Road West;
3. 156 London Road West; and
4. 228 High Street.

Figure 3.2: Sensitive Receptor Locations



4 BASELINE CONDITIONS

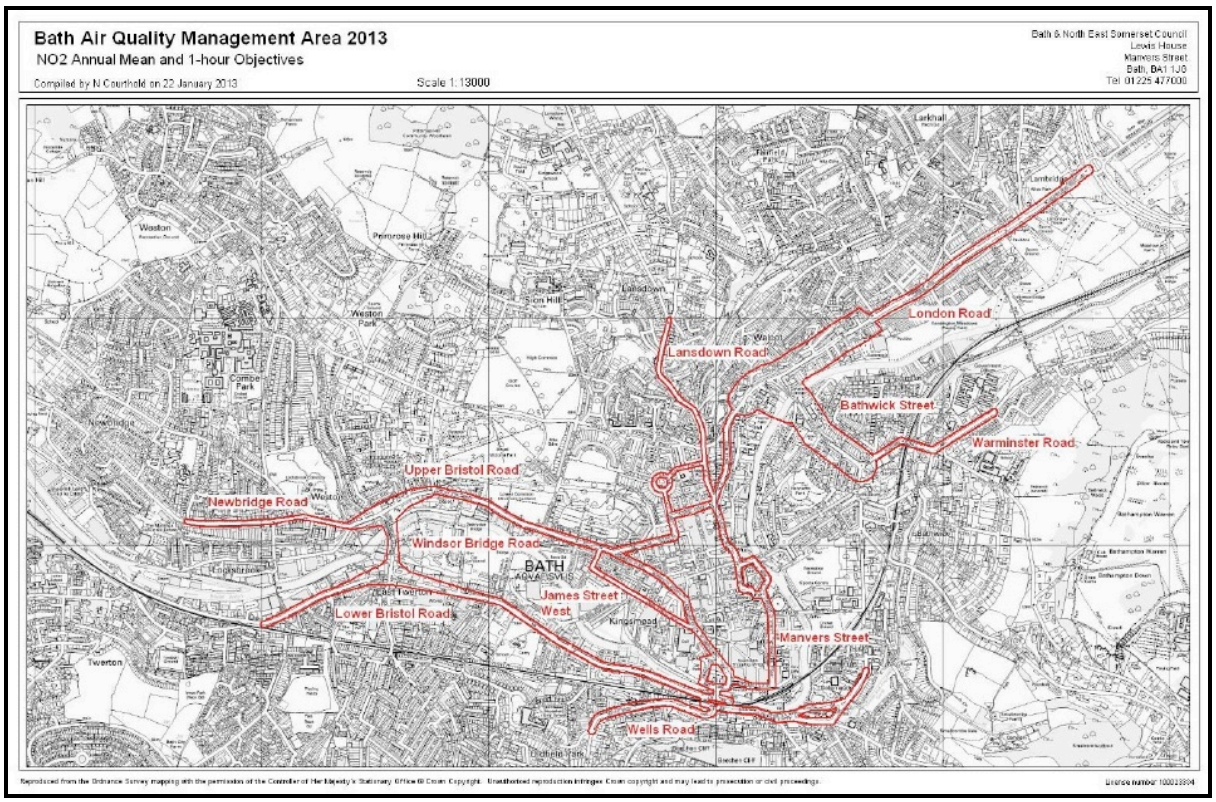
Bath and North East Somerset Review and Assessment of Air Quality

4.1 BANES have carried out detailed assessments of air quality in the area and as a result have declared four AQMA's due to exceedances of the annual mean NO_2 objective. These areas include A4 London Road, the major road network in Bath, Keynsham High Street and A4 Saltford.

4.2 Following Round 4 of the Review and Assessment process BANES identified a number of monitoring sites in Bath that exceeded 60 µg/m^3, which has resulted in a recommendation that the Bath AQMA be varied to include the 1-hour NO_2 objective.

4.3 The Bath AQMA includes the London Road as shown in Figure 4.1.

Figure 4.1: Location of BATH AQMA adjacent to Development Site



Automatic Local Monitoring Data

4.4 Bath and North East Somerset Council undertake automatic monitoring of both NO_2 and PM_{10}. The closest automatic monitoring station to the Park & Ride site is located on London Road (approximately 1.5km west). The location details and a summary of recent monitoring data are presented in Tables 4.1 and 4.2.

Table 4.1: Automatic Monitoring Locations

Site Name	Site Type	OS Grid Reference	Pollutants Monitored	Distance to kerb (m)
London Road	Roadside	375462, 165844	NO_2, Benzene	3m

Table 4.2: London Road Monitoring Site – NO_2

Statistic	2010	2011	2012	2013	2014
London Road					
Annual Mean (µg/m^3)	60	57	56	57	57
Number of hourly means > 200 µg/m^3	6	2	2	4	10

4.5 Annual mean NO_2 concentrations consistently exceed the air quality objective of 40 µg/m^3 at London Road, however the number of exceedences of the hourly mean objective are well within the 35 allowable within the objective.

4.6 Annual mean NO_2 concentrations recorded at this site have not significantly changed since 2010. The data shows a slight decrease in concentrations over the last 5 years.

Non-Automatic Monitoring

4.7 NO_2 diffusion tube monitoring is also carried out at a number of locations in Bath. The Batheaston 240 London Road monitoring site (DT58) lies closest to the Park and Ride site. A further two sites are located at roadside locations along London Road. Details of all three sites are presented in Table 4.3 below. All the diffusion tube data has been bias adjusted.

Table 4.3: Annual Mean NO_2 Concentrations Measured by Diffusion Tube (µg/m^3)

Site Name	Site Type	OS Grid Reference	Distance to kerb (m)	Annual mean concentrations (µg/m^3)				
				2010	2011	2012	2013	2014
Batheaston-240 London Road (58)	Roadside	377643, 167365	1 m	33	35	34	34	38
Batheaston-Brow Hill (56)	Roadside	377779, 167453	0.5 m	34	33	34	32	35
Batheaston - High Street 3 (57)	Roadside	377628, 167369	2 m	24	28	26	25	26

4.8 NO_2 data recorded at the three roadside sites shows highest concentrations at 240 London Road which are marginally below the 40 µg/m^3 objective. As there are many residential receptors on this road close to the roadside (1m away from the road) a conservative approach should be taken and the worst case concentration of 38 µg/m^3 should be used as a baseline for this section of road.

DEFRA Background Maps

4.9 In the absence of local background monitoring data annual mean concentrations of NO_2 have been obtained from the Defra UK-AIR background pollutant maps[9]. These 1 km grid resolution maps are derived from a complex modelling exercise that takes into account emissions inventories and measurements of ambient air pollution from both automated and non-automated sites.

4.10 The worst-case 2014 mapped background NO_2 concentration for London Road West of 18.6 µg/m^3 has been assumed for the purposes of the assessment.

[9] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

5 ASSESSMENT OF IMPACT

Operational Phase

NO_2 Concentrations

5.2 Table 5.1 presents the model results at residential receptors. As explained earlier in this report, in the absence of traffic data for London Road West the baseline was set at 38 ug/m^3 based on existing monitoring data. Table 5.1 identifies the increase for each scenario assessed.

5.3 Given that existing baseline concentrations are already close to the objective on London Road West, it can be seen that all scenarios assessed would result in exceedance of the annual mean objective for nitrogen dioxide. Based on the magnitude of impacts predicted by the sensitivity analysis, these would be classified as a moderate to substantial adverse effect.

Table 5.1: Predicted NO_2 increased at existing receptors with varying traffic scenarios (µg/m^3).

Receptor Number	2014 diffusion tube Baseline	+ 1000 vehicles	+ 2000 vehicles	+ 2000 vehicles and reduced speed
1	38.0	40.4	42.6	43.2
2	38.0	41.5	44.8	45.4
3	38.0	42.5	46.6	47.7
4	38.0	41.6	44.8	45.5

6 CONCLUSIONS

6.1 An air quality impact assessment has been carried out to assess potential operational impacts of the Bathampton Meadows Park & Ride on Batheaston.

6.2 ADMS Roads dispersion modelling has been carried out to assess the air quality impact of the Park and Ride on local air quality. The predicted concentrations indicate that there is the potential for exceedences of the annual air quality objective for NO_2 to occur at residential properties along London Road West/ High Street Batheaston as a result of increases in road traffic associated with the Park & Ride.

6.3 Given that existing baseline concentrations are already close to the objective on London Road West/ High Street Batheaston, it can be seen that all scenarios assessed would result in exceedance of the annual mean objective for nitrogen dioxide. Based on the magnitude of impacts predicted by the sensitivity analysis, these would be classified as a moderate to substantial adverse effect.

6.4 The additional traffic impacts for all scenarios assessed would also create areas of exceedance that do not currently exist. As air quality objectives are set for the protection of human health the creation of new areas of exceedance should be discouraged.

APPENDIX A - AIR QUALITY TERMINOLOGY

Term	Definition
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
AQMA	Air Quality Management Area.
DEFRA	Department for Environment, Food and Rural Affairs.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate air quality standard.
Fugitive emissions	Emissions arising from the passage of vehicles that do not arise from the exhaust system.
LAQM	Local Air Quality Management.
NO	Nitrogen monoxide, a.k.a. nitric oxide.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O_3	Ozone.
Percentile	The percentage of results below a given value.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
ppb parts per billion	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppb means that for every billion (10^9) units of air, there is one unit of pollutant present.
ppm parts per million	The concentration of a pollutant in the air in terms of volume ratio. A concentration of 1 ppm means that for every billion (10^6) units of air, there is one unit of pollutant present.
Ratification (Monitoring)	Involves a critical review of all information relating to a data set, in order to amend or reject the data. When the data have been ratified they represent the final data to be used (see also validation).
µg/m^3 micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1ug/m3 means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
UKAS	United Kingdom Accreditation Service.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
USA	Updating and Screening Assessment.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Validation (monitoring)	Screening monitoring data by visual examination to check for spurious and unusual measurements (see also ratification).
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

APPENDIX B - AIR QUALITY STANDARDS AND OBJECTIVES

Table B1: Air Quality Standards and Objectives

Pollutant	Standard (µg/m^3)	Averaging Period	No. of Permitted Exceedances
NO_2	200 (a)	1-Hour	18 per annum (99.8th percentile)
	40 (a)	Annual	-
(a) Air Quality Standards Regulations (2010)			

APPENDIX C – MODEL VERIFICATION

Most nitrogen dioxide (NO_2) is produced in the atmosphere by the reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions. Verification of concentrations predicted by the ADMS-Roads model has followed the methodology presented in LAQM.TG(09).

Predicted 2014 annual mean concentrations of NO_2 have been compared with the concentration measured at the London Road AURN site during 2014 of 57 µg/m^3.

The measured NO_2 concentration has been converted into an equivalent measured Road-NOx (i.e. the component of total NOx coming from road traffic) concentrations using the DEFRA NOx from NO_2 calculator. The conversion has assumed a background NO_2 concentration of 18.6 µg/m^3.

The ratio of the measured and modelled Road-NOx contributions provides an adjustment factor for the modelled Road-NOx concentrations. This factor is then applied to the modelled road NOx concentrations, before they are converted to Road-NO_2 using the DEFRA NOx to NO_2 calculator and added to the background NO_2 concentration to produce a total adjusted modelled NO_2 concentration. The model verification calculation is presented Table D1.

Table D1: Model Verification Calculation

Parameter	Value
Measured NO_2 Concentration	57.0 µg/m^3
Measured Road-NOx Concentration	92.6 µg/m^3
Modelled Road-NOx Concentration	26.7 µg/m^3
Adjustment Factor	3.47