

Land at Gas Works Road, Reading

Air Quality Assessment



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1 INTRODUCTION

1.1 Entran Limited has been commissioned to undertake an assessment of air quality impacts associated with the proposed re-development of land off Gas Works Road, Reading. The existing buildings on the Site are currently disused and the proposals are for the refurbishment of both buildings to provide 34 residential flats. The location of the Site is shown in Figure 1 and an indicative layout of the Site at ground floor level is set out in Figure 2.

1.2 Reading Borough Council (RBC) has declared a number of Air Quality Management Areas (AQMA's) within the borough due to exceedences of the annual mean NO₂ objective. The AQMA's cover an area in the centre of the town and the main arterial roads leading out of the town. The Site on Gas Works Road falls on the edge of the AQMA therefore there is a risk of exceedence of the national air quality objectives in this location and air quality is a high priority consideration.

1.3 This report presents the findings of a detailed air quality assessment of the potential impacts associated with the proposed development on local air quality. The type, source and significance of potential impacts are identified and the measures that should be employed to minimise these impacts are described.

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

Figure 1: Site Location Plan



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 2007¹, 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 (C₆H₆), 1,3-butadiene (C₄H₆), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO₂), particulate matter (PM₁₀, PM_{2.5}), sulphur dioxide (SO₂), ozone (O₃) 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 exceedences 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 (NO₂), the short-term standard is for a 1-hour averaging period, whereas for fine particulates (PM₁₀) 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, NO₂ and PM₁₀ 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 work². 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 Control⁴, 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'*.

Control of dust and particulates associated with construction

2.18 Section 79 of the *Environmental Protection Act (1990)* states that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Statutory nuisance is defined as:

- 'Any dust or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance', and
- 'any accumulation or deposit which is prejudicial to health or a nuisance'.

2.19 Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.



2.20 In the context of the proposed development, the main potential for nuisance of this nature will arise during the construction phase – potential sources being the clearance, earthworks, construction and landscaping processes.

2.21 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist – 'nuisance' is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred. However, research has been undertaken by a number of parties to determine community responses to such impacts and correlate these to dust deposition rates.

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; and
- Review of the traffic flow data, which has been used as an input to the air quality modelling assessment.

3.2 The development proposals would provide a total of 34 residential units. There would be no on-site provision for parking of private vehicles but there would be a number of cycle racks provided for use by all residents. The development is therefore classed as car free and would not generate a significant change in traffic on the adjacent road network in air quality terms. Operational traffic impacts have been scoped out of this assessment. However, due to the location of the Site, on the edge of the AQMA, there is the potential for the national air quality objectives to be exceeded. An assessment of air quality at the Site has therefore been undertaken to assess the suitability of the Site for residential development.

3.3 Consideration has also been given to emissions generated during the construction phase of the development and the impact these may have on adjacent sensitive receptors.

Construction Phase Methodology

Construction Traffic

3.4 During construction of the Proposed Development, lorries will require access to the Site to deliver and remove materials; earthmoving plant and other mobile machinery will work on site and generators and cranes will also be in operation. These machines produce exhaust emissions; of particular concern are emissions of NO₂ and PM₁₀.

3.5 Based on the development proposals it is anticipated that there will be no more than 10-15 additional HGV vehicles generated on the adjacent road network on any given day.

3.6 The recently published Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) air quality guidance⁵ sets out criteria to assist in establishing when an air quality assessment will be required. These criteria indicate that significant impacts on air quality are unlikely to occur where a development results in less than 25 additional vehicle per day in locations within an AQMA and less than 100 outside of an AQMA. It is therefore anticipated that construction traffic generated by the proposed development would result in a negligible impact on local NO₂ and PM₁₀ concentrations and has not been considered any further in this assessment.

Construction Dust

3.7 To assess the potential impacts associated with dust and PM₁₀ releases during the construction phase and to determine any necessary mitigation measures, an assessment based on the latest guidance from the Institute of Air Quality Management⁶ has been undertaken.

3.8 This approach divides construction activities into the following four categories:

- demolition;
- earthworks;
- construction; and
- trackout.

3.9 The assessment methodology requires consideration of dust effects arising from three potential impacts:

- annoyance due to dust soiling;
- harm to ecological receptors; and
- the risk of health effects due to a significant increase in exposure to PM₁₀.

3.10 The three impacts are assessed taking into account the sensitivity of the area likely to experience these effects, with the results of the assessment being used to define appropriate mitigation measures to prevent any significant effects at nearby receptors.

3.11 The IAQM guidance sets out the assessment into a number of steps. The first is an initial screening assessment to determine if there are any sensitive receptors (both human and

⁵ EPUK & IAQM (May 2015) Land-Use Planning & Development Control: Planning for Air Quality

⁶ Institute of Air Quality Management, (February 2014), *Guidance on the Assessment of Dust from Demolition and Construction*.

ecological) within 350 m of the site boundary or within 100m of the proposed construction haulage routes, thus determining the requirement for a more detailed evaluation.

3.12 Step 2 of the methodology assesses the risk of dust impacts for each construction activity and takes account of:

- the scale and nature of the works, which determines the potential dust emission magnitude (step 2a); and
- the sensitivity of the area (step 2b).

3.13 Risks are described in terms of there being a low, medium or high risk of dust effects for each of the four separate potential activities. This assessment is based on both IAQM criteria and professional judgement.

3.14 The outcome of the above two steps are then combined (step 2c) to identify the risk of dust impacts, which are described in terms of there being a low, medium or high risk of dust effects for each of the four activity groups and assuming no mitigation measures are in place.

3.15 Based on the identified risk, appropriate mitigation measures are identified as set out in the IAQM guidance.

3.16 All construction sites are different and the potential for dust impacts are dependent on a number of local factors. The methodology set out in the IAQM guidance is therefore considered as a framework for assessing dust impacts and a certain level of professional judgement is required in determining the effects from each site.

The significance of identified effects is evaluated post mitigation using professional judgement and assuming that the mitigation measures identified and set out within the assessment are implemented by way of a Dust Management Plan (DMP).

Operational Phase Methodology

3.17 The prediction of air quality at the Site has been undertaken using the ADMS Roads 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.

3.18 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 Heathrow Meteorological Station from 2012 has been used for the assessment.

3.19 The model has been used to predict road specific concentrations of oxides of nitrogen (NO_x) and Particulate Matter (PM_{10}) 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 website⁷.

3.20 Traffic data for the adjacent road network has been obtained from ATC survey counts carried out in 2014. The data has been factor back to 2012 to provide base flows for verification of the model against local monitoring data. The 2014 flows have also been factored forward to 2017 to provide base traffic flows in the anticipated completion year of the development. The data does not include flows along Gas Works Road. This is a very minor road in terms of traffic and therefore is not considered significant in air quality terms. The assessment has therefore focused on emissions from the main road network to the south-west of the Site including King's Road, Queen's Road and Forbury Road.

3.21 A summary of the traffic data used in the assessment can be found in **Appendix C**. The data includes details of annual average daily traffic flows (AADT), vehicle speeds and percentage HGV for the assessment years considered.

3.22 The emission factors released by DEFRA in July 2014, provided in the emissions factor toolkit EFT2014_6.0.1 have been used in the ADMS model (Version 4.0.1.0, released in December 2015) to predict existing and future traffic emissions.

3.23 To predict local air quality, traffic emissions predicted by the model must be added to local background concentrations. Background concentrations of NO_x and NO_2 have been taken from the nearby background automatic site which forms part of the DEFRA Automatic Urban and Rural Network (AURN). Data for 2012 has been used in the assessment and is provided in Table 3. PM_{10} concentrations are also monitored at the AURN site, however during 2012 data capture was less than 90% and therefore not considered suitable for use in the modelling assessment. Background data has therefore been taken from the DEFRA background maps. The data for 2012 and used in the assessment can be found in Table 8.

⁷ <http://uk-air.defra.gov.uk>

3.24 Emission factors and background data used in the prediction of future air quality concentrations 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 NO₂ concentrations are not declining as rapidly as previously thought and in some locations concentrations have increased. It is thought that this discrepancy is related to the on-road performance of modern diesel vehicles. Although the emission factors released in the latest EFT go some way towards addressing this disparity it does not fully tackle the discrepancy. The modelling assessment has therefore predicted NO_x and PM₁₀ concentrations in 2017 (the anticipated completion year) using 2012 emission factors and background concentrations. This is considered to represent a worst-case prediction of future air quality.

3.25 It is recommended, following guidance set out in LAQM.TG(09), that the model results are compared with measured data to determine whether the model results need adjusting to more accurately reflect local air quality. This process is known as verification.

3.26 LAQM.TG(09) recommends that model predictions should be within 25% (preferably 10%) of monitored concentrations for the model to be predicting with any degree of accuracy. The closest monitoring sites to the Site are located on King's Road and Queen's Road. One of these is an automatic monitoring site; however it is located at the junction of King's Road and London Road and therefore is not considered appropriate for verification. The ADMS model has been used to predicted concentrations at the King's Road and Queen's Road diffusion tube sites, details of which are set out in Table 7. The results of the comparison are presented below in Table 1.

Table 1: Comparison of Modelled and Monitored Nitrogen Dioxide Concentrations ($\mu\text{g}/\text{m}^3$)

Monitoring Locations	Measured Concentration	Modelled Concentration	% Difference
Queen's Road	37.0	30.0	-18.9
King's Road	36.0	28.00	-22.3

3.27 The comparison of monitored and modelled concentrations indicates that the model is under-predicting annual mean NO_2 concentrations by an average of 20%. Although this is within the required 25% of monitored concentrations as the model is under predicting at both locations it is therefore considered necessary to adjust the model results to better represent local concentrations. The results of the modelling assessment have been adjusted using the methodology given in LAQM.TG(09). Full details of the verification and calculation of adjustment factors are provided in **Appendix D**.

3.28 There is no suitable monitoring of PM_{10} data to allow verification of the PM_{10} model results. However, LAQM.TG(09) suggests applying the NO_x adjustment factor to modelled road- PM_{10} where no appropriate verification against PM_{10} data can be carried out. Therefore, the adjustment applied to predicted NO_x concentrations has also been applied to the modelled PM_{10} concentrations.

3.29 LAQM.TG(09) does not provide a method for the conversion of annual mean NO_2 concentrations to 1-hour mean NO_2 concentrations. However, research⁸ has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations do not exceed $60 \mu\text{g}/\text{m}^3$. Care has been taken to ensure that locations where the 1-hour mean objective is relevant are included in the assessment.

3.30 Quantitative assessment of the impacts 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** for NO_2 and PM_{10} .

⁸ 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).

Sensitive Receptors

3.31 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.

3.32 For instance, on a footpath, where exposure will be transient (for the duration of passage along that path) comparison with short-term standards (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 standards (such as 24 hour mean or annual mean) 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.

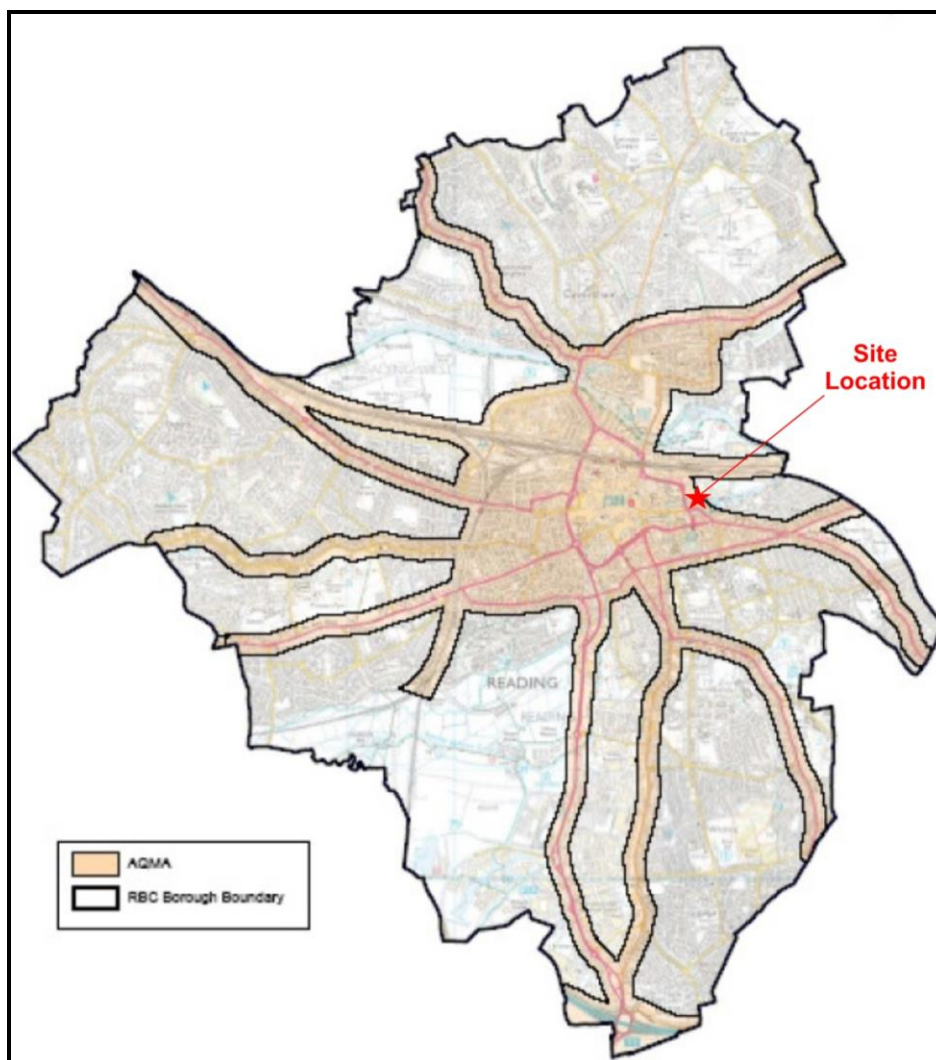
3.33 To assess the suitability of the Site for residential development NO₂ and PM₁₀ concentrations have been predicted across the Site in 2017. The predicted concentrations have been presented as contour plots in Figures 4 and 5.

4 BASELINE CONDITIONS

Reading Borough Council Review and Assessment of Air Quality

4.1 RBC has carried out detailed assessments of air quality in the area and as a result has declared a number of AQMA's due to exceedances of the annual mean NO₂ objective of 40 µg/m³. The AQMA covers the centre of the town and a number of the aerial roads travelling into the town centre. The AQMA is shown in Figure 3 below.

Figure 3: Location of Reading AQMA⁹



⁹ Reading Borough Council, 2013 Air Quality Progress Report, April 2013



4.2 The Development Site is located on the edge of the town centre AQMA as shown in Figure 3. There is a risk that NO₂ and PM₁₀ concentrations are exceeding the objectives at this location.

Automatic Local Monitoring Data

4.3 RBC undertake automatic monitoring of NO₂ and PM₁₀ at four locations within the Borough using automatic monitoring sites. Two of these are within 1 km of the Site; RD2, a roadside site on King's Road and the Reading AURN, a background site located at the Reading Old Cemetery.

4.4 Details of the two automatic monitoring sites are provided below in Table 2. NO₂ and PM₁₀ data recorded at each site between 2009 and 2015 are presented in Tables 3 to 6.

Table 2: Automatic Monitoring Locations

Site Name	Site Type	Grid Location	Is it in an AQMA?	Distance to kerb of nearest road
Reading AURN	Background	473441, 173198	N	100 m
King's Road (RD2)	Roadside	473057, 173205	Y	5 m

Table 3: Annual Average NO₂ Concentrations (µg/m³)

Site	Year						
	2009	2010	2011	2012	2013	2014	2015
AURN	22 ¹	26 ¹	27	25	27	27	21
King's Road	51	53	53 ¹	54	60.5	49.4 ¹	47.9 ¹
¹ data capture was less than 90% therefore comparison with annual objective should be treated with caution							

Table 4: Number of Exceedences of the 200 µg/m³ 1-hour NO₂ Objective

Site	Year						
	2009	2010	2011	2012	2013	2014	2015
AURN	n/a	n/a	2	0	0	0	0
King's Road	1	3	0 (155)	0	-	-	-
¹ data capture was less than 90% therefore the 98 th percentile is shown in brackets n/a - No data as data capture too low - No data available							

4.5 The data set out in Table 3 shows NO₂ concentrations exceeding the annual mean objective at the King's Road site. As previously discussed the site is located at the junction of King's Road and London Road which experiences low traffic speeds and therefore elevated vehicle emissions.

4.6 Data recorded at the AURN site shows background NO₂ concentrations to be less than 75% of the annual mean objective. The site is located approximately 100 m from London Road and 150-200 m from the King's Road/London Road junction, showing the rapid decline in NO₂ concentrations away from source.

4.7 The monitoring data shows no significant trend in concentrations since 2009 although concentrations in 2015 were lower than in 2009.

4.8 Although exceedence of the 1-hour objective has been recorded at both monitoring sites in the last 7 years, as the objective allows for 18 exceedences of the 200 µg/m³ limit in any year the objective has not been breached at either location.

4.9 The Development Site is located adjacent to the River Kennet, approximately 60 m from the King's Road. It is expected that NO₂ concentrations at the Site would be lower than recorded at the King's Road automatic site although higher than at the AURN site.

Table 5: Annual Average PM₁₀ Concentrations (µg/m³)

Site	Year						
	2009	2010	2011	2012	2013	2014	2015
AURN	16.5	16	19	18 ¹	-	-	-
King's Road	22	26	31	29 ¹	23.5	30.7 ¹	25.1 ¹
¹ data capture was less than 90% therefore comparison with annual objective should be treated with caution - No data could be downloaded from the DEFRA website for these years							

Table 6: Number of Exceedences of the 50 µg/m³ 24-hour PM₁₀ Objective

Site	Year						
	2009	2010	2011	2012	2013	2014	2015
AURN	0	1	8	8	-	-	-
King's Road	13 (30)	7	30 (52)	33	-	-	-
¹ data capture was less than 90% therefore the 90.4 th percentile is shown in brackets - No data available							

4.10 The data presented in Table 5 shows annual mean PM₁₀ concentrations below the objective at both the AURN site and the King's Road roadside site. Concentrations at both sites have been less than 75% of the objective during all monitoring years with the exception of 2011 and 2014 at the King's Road side where concentrations were just over 30 µg/m³.

4.11 The data recorded at the AURN site shows a slight increase in concentrations however as no data is available for 2013 onwards it is not known if this trend has continued. The data recorded at the King's Road site shows no significant trend in concentrations.

4.12 Exceedance of the short-term objective limit of 50 µg/m³ has been recorded at both monitoring sites. The objective allows for up to 35 exceedances of the objective limit during any given year therefore the objective has not been breached at either site, although the data would indicate a possible exceedance of the objective during 2011 based on the 90.4th percentile of 52 µg/m³. Additionally during 2012 there were 33 exceedences, only just below the allowable limit.

4.13 Overall the data indicates PM₁₀ concentrations below the objective limits at both roadside and background locations in the vicinity of the Site. Concentrations at the Site are therefore expected to meet both the annual mean and 24-hour objective for this pollutant.

Non-Automatic Monitoring

4.14 NO₂ is measured extensively across the borough using diffusion tubes. There are two sites within 1 km of the Development Site, one on King's Road and the other on Queen's Road. Details of the sites are set out in Table 7, along with concentrations recorded between 2008 and 2013.

4.15 All the diffusion tube data has been bias corrected using the national bias adjustment factors available in the DEFRA spread sheet available on the UK-Air website¹⁰.

4.16 The data presented in Table 7 shows annual mean NO₂ concentrations below the objective at both monitoring sites, although there was an increase in concentrations at the Queen's Road site during 2013 resulting in concentrations only just below the objective. In previous years concentrations have been very similar at both locations.

4.17 The data shows no significant trend in concentrations with a decrease recorded at both sites between 2008 and 2011 followed by an increase.

4.18 It is not possible to monitor short-term NO₂ concentrations using diffusion tubes, however, as discussed previously, research has concluded that exceedances of the 1-hour mean objective are generally unlikely to occur where annual mean concentrations are below 60 µg/m³. Based on the monitoring data presented in Table 7, exceedance of the short-term objective is unlikely to occur at either monitoring site.

4.19 As NO₂ concentrations are meeting the relevant objective limits at both monitoring locations, due to the Development Site being located over 50 m from King's Road, the main source of traffic emissions impacting air quality at the Site, it is expected that NO₂ concentrations at the Site will be below both the annual mean and 1-hour objective.

¹⁰ <http://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html>

Table 7: Annual Mean NO₂ Concentrations Measured by Diffusion Tube (µg/m³)

Site Name	Site Type	OS Grid Reference	Distance to kerb (m)	Annual mean concentrations (µg/m ³)					
				2008	2009	2010	2011	2012	2013
56 – Queens Road	Roadside	472010, 173222	6.5 m	37	34	35	33	37	39
8 – 276 King's Road	Roadside	472716, 173218	10 m	38	37	36	33	36	34

DEFRA Background Maps

4.20 Background concentrations have also been obtained from the 2011 DEFRA background pollutant maps. The maps provide an estimate of background concentrations between 2011 and 2030.

4.21 The average 2016 background concentrations for the grid square 472500, 173500, which includes the development site are set out in Table 8.

Table 8: Estimated Background Concentrations from DEFRA maps (µg/m³)

Pollutant	2016
NO ₂	25.4
PM ₁₀	18.8

4.22 The data presented in Table 8 shows that annual mean background concentrations of NO₂ and PM₁₀ are estimated to be below the 40 µg/m³ limit at the Site.

5 ASSESSMENT OF IMPACT, MITIGATION AND RESIDUAL EFFECTS

IMPACT – CONSTRUCTION PHASE

Site and Surroundings

5.1 The Site currently consists of a two buildings, both of which would be refurbished as part of the proposals. As there would be no significant demolition work undertaken an assessment of emissions associated with demolition activities has not been included within this assessment.

5.2 The main land uses adjacent to the site are a mix of office and commercial uses to the west and mainly residential dwellings to the east and south. Due to the close proximity of residential properties and places of work an assessment of impacts on human receptors has been undertaken.

5.3 Dust emissions from construction activities are unlikely to result in significant impacts on ecologically sensitive receptors beyond 50 m from the site boundary. There are no ecological receptors within 50 m of the site boundary therefore the impact of dust emissions during construction on local ecological receptors has not been considered within this assessment.

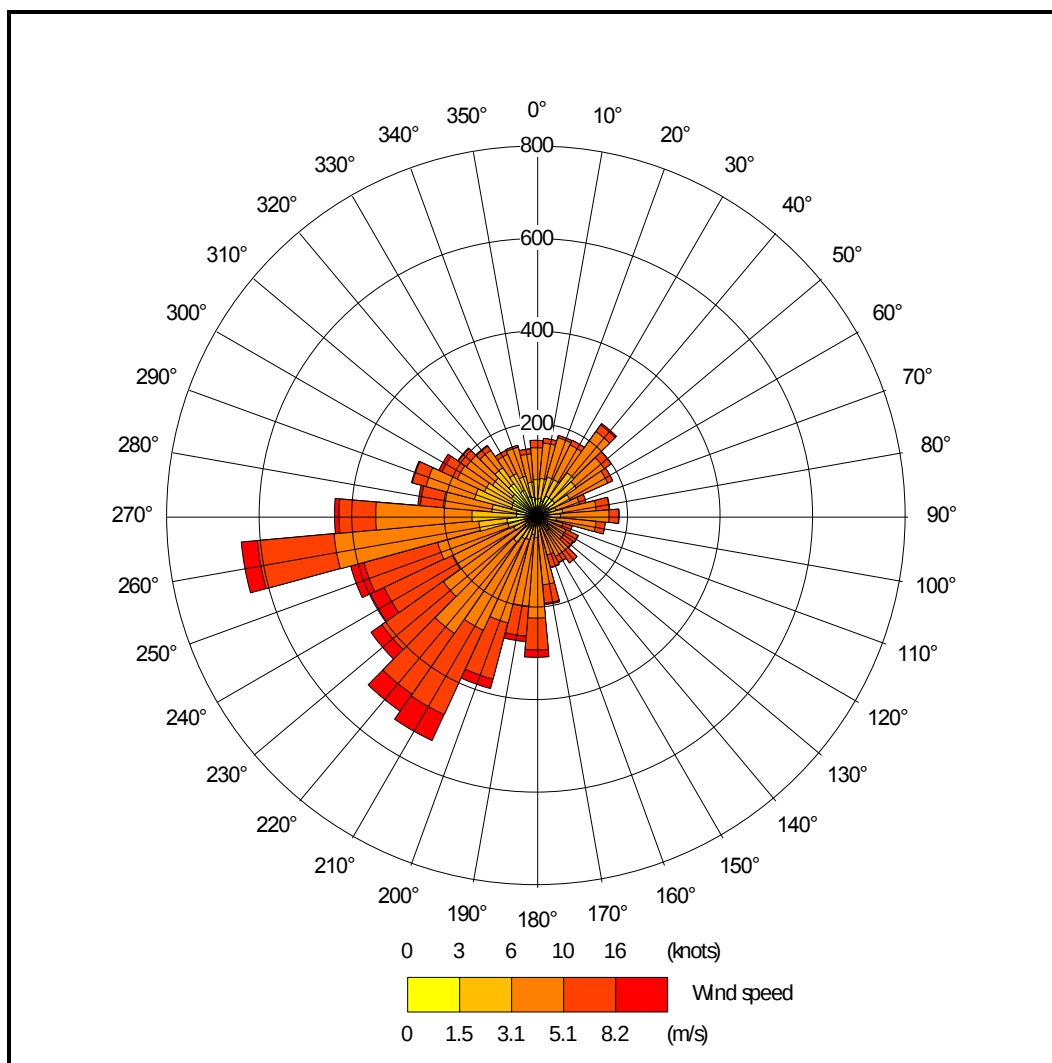
5.4 As detailed in section 4, PM₁₀ concentrations in the vicinity of the Site are expected to meet the air quality objectives. Based on data recorded at the AURN and King's Road monitoring sites and professional judgement it is expected that annual mean PM₁₀ concentrations at the Site would be in the region of 20-22 µg/m³.

5.5 The precise behaviour of the dust, its residence time in the atmosphere, and the distance it may travel before being deposited would depend upon a number of factors. These include wind direction and strength, local topography and the presence of intervening structures (buildings, etc.) that may intercept dust before it reaches sensitive locations. Furthermore, dust would be naturally suppressed by rainfall.

5.6 A windrose from the Heathrow Meteorological Station (2012) is provided below in Figure 3, which shows that the prevailing wind is from a south-west direction. Properties located to the north-east of any construction activities are therefore most likely to experience significant impacts as a result of dust generated during the construction process. The River Kennet lies to the north-east of the Site with Toys R Us further to the north-east on the opposite side of the River. Toys R Us is not considered to be sensitive to dust emissions. However, there is a

residential complex located on the corner of Gas Works Road and Kenavon Drive, also to the north-east which may experience some impacts.

Figure 3: Windrose for Heathrow Airport Meteorological Station (2012)



Potential Dust Emission Magnitude

5.7 The dust emission magnitude is based on the scale of anticipated works at the Site and has been defined as small, medium or large for each of the three activities; earthworks, construction and trackout. A summary of the dust emission magnitude for each activity is set out in Table 9.

Earthworks

5.8 Earthworks are those activities involved in preparing the Site for construction such as excavation of material, haulage, tipping, stockpiling and leveling.



5.9 The area of the Site is approximately 680 m². Furthermore, as the existing buildings would be retained there would be very little earthwork activities undertaken. The Site is therefore considered to have a dust emission class of 'small' with regards to earthwork activities.

Construction

5.10 There are a number of issues that can impact the dust emission class during construction activities including the size of the building, materials used for construction, the method of construction and the duration of the build.

5.11 The development proposals are for the refurbishment of the existing building with the addition of upper floors and pitched roofs and an extension to the larger building to the west over an existing single storey construction. Although the main construction materials would be brick and concrete, a potentially dusty material, the volume of construction would be less than 2000 m³. The Site is therefore considered to have a dust emission class of 'small' with regards to construction activities.

Trackout

5.12 The risk of impacts occurring during trackout is predominantly dependent on the number of vehicles accessing the Site on a daily basis. However, vehicle size and speed, the duration of activities and local geology are also factors which are used to determine the emission class of the Site as a result of trackout.

5.13 Given the size of the proposed development it is expected that there would be no more than 10-15 Heavy Duty Vehicles (HDV) accessing the Site each day and construction vehicles would not travel across the Site, therefore there would be little material tracked out onto the adjacent road network. The Site is therefore classed as 'small' with regards to trackout activities.

Table 9: Summary of Dust Risk Effects

Source	Magnitude
Earthworks	Small
Construction	Small
Trackout	Small

Sensitivity of Surrounding Area

5.14 The sensitivity of the surrounding area takes account of the following factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM₁₀, the local background concentrations; and
- site-specific factors i.e. whether there are natural shelters such as trees, to reduce the risk of wind-blown dust.

5.15 The main sensitive receptors adjacent to the Site are residential and office/commercial (classed as places of work). Based on the IAQM guidance residential properties are considered as high sensitivity receptors in relation to both dust soiling and health effects of PM₁₀, while places of work are of medium sensitivity. The closest residential receptors to the site are approximately 12 m, however there are less than 10 within 20 m, therefore the overall sensitivity of the surrounding area is considered to be 'medium' in relation to dust soiling.

5.16 As detailed above, PM₁₀ concentrations in the vicinity of the Site are expected to be in the region of 20-22 µg/m³. Based on the proximity of receptors to the site boundary and the local concentrations of PM₁₀ the sensitivity of the surrounding area is considered to be 'low' with regards human health impacts.

5.17 In relation to trackout, vehicles would gain access to the Site by travelling along Gas Works Road from the west via King's Road. As a general guide, impacts from trackout are unlikely to occur beyond 50 m from the site entrance for sites with a dust emission class of small. There are less than 10 residential receptors within 50 m of the site and 20 m of the roadside therefore the sensitivity of the area in relation to impacts from trackout are considered to be 'medium' for dust soiling and 'low' for human health.

5.18 A summary of the sensitivity of the area surrounding the Site in relation to each activity is provided below in Table 10.

Table 10: Summary of Dust Risk Effects

Source	Sensitivity of Surrounding Area	
	Dust Soiling	Human Health
Earthworks	Medium	Low
Construction	Medium	Low
Trackout	Medium	Low

Defining the Risk of Impacts

5.19 The dust emission magnitude as set out in Table 9 is combined with the sensitivity of the area (Table 10) to determine the risk of both dust soiling and human health impacts, assuming no mitigation measures have been applied at site. The risk of impacts associated with each activity is provided in Table 11 below and has been used to identify specific mitigation measures, which are set out later in this chapter.

Table 11: Summary of Dust Risk Effects

Source	Sensitivity of Surrounding Area	
	Dust Soiling	Human Health
Demolition	Low Risk	Low Risk
Earthworks	Low Risk	Low Risk
Construction	Low Risk	Low Risk
Trackout	Low Risk	Low Risk

IMPACT - OPERATIONAL PHASE

NO₂ Concentrations

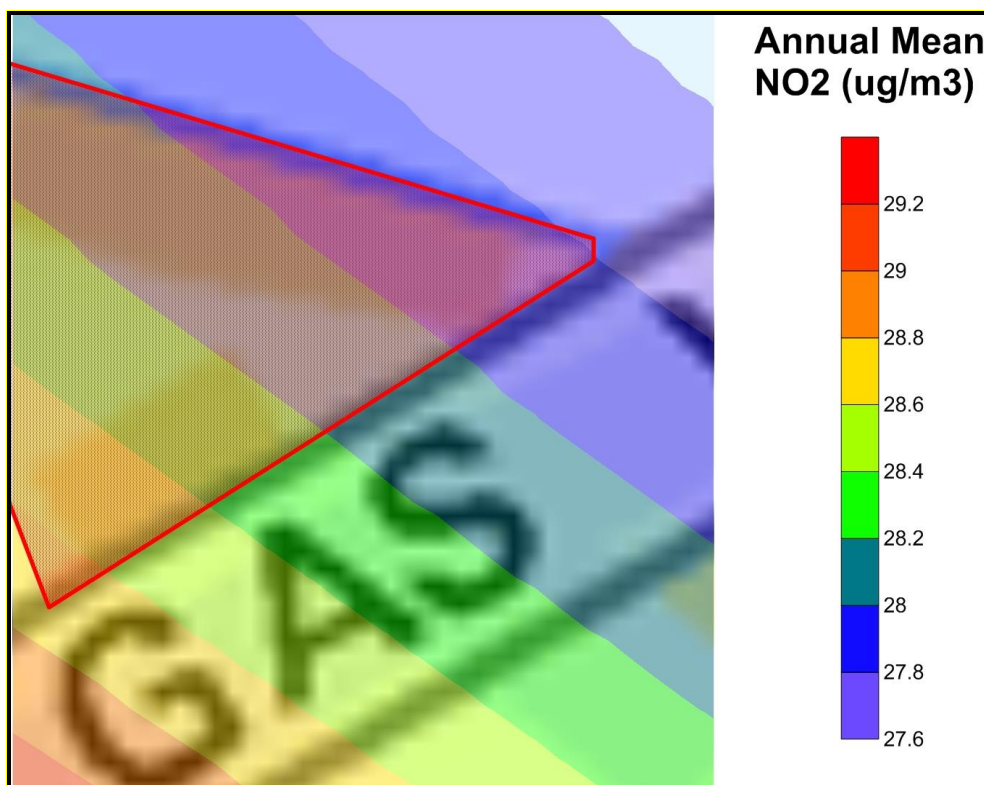
5.20 Annual mean NO₂ concentrations predicted at the Site are set out in Figure 4.

5.21 The modelling assessment is predicting annual mean NO₂ concentrations at less than 75% of the annual mean objective across the whole Site.

5.22 Based on the predicted annual average concentrations short-term NO₂ concentrations are not expected to exceed the 1-hour objective of 200 µg/m³ (not to be exceeded more than 18 times per year). Guidance referred to earlier in the report indicates that exceedance of the 1-hour objective is unlikely where the annual mean concentration is below 60 µg/m³.

5.23 Future occupants of the Site would not be exposed to NO₂ concentrations above the annual mean or 1-hour NO₂ objective therefore the impact of the development with regards new exposure to NO₂ is considered to be negligible.

Figure 4: Predicted Annual Mean Nitrogen Dioxide Concentrations at the Site in 2017



PM₁₀ Concentrations

5.24 Predicted annual mean PM₁₀ concentrations at the Site are set out in Figure 5.

5.25 The predicted annual mean PM₁₀ concentrations are less than 75% of the 40 µg/m³ objective across the Site.

5.26 The number of exceedences of 50 µg/m³, as a 24-hour mean PM₁₀ concentration, has been calculated from the annual mean following the approach set out by DEFRA in LAQM.TG(09):

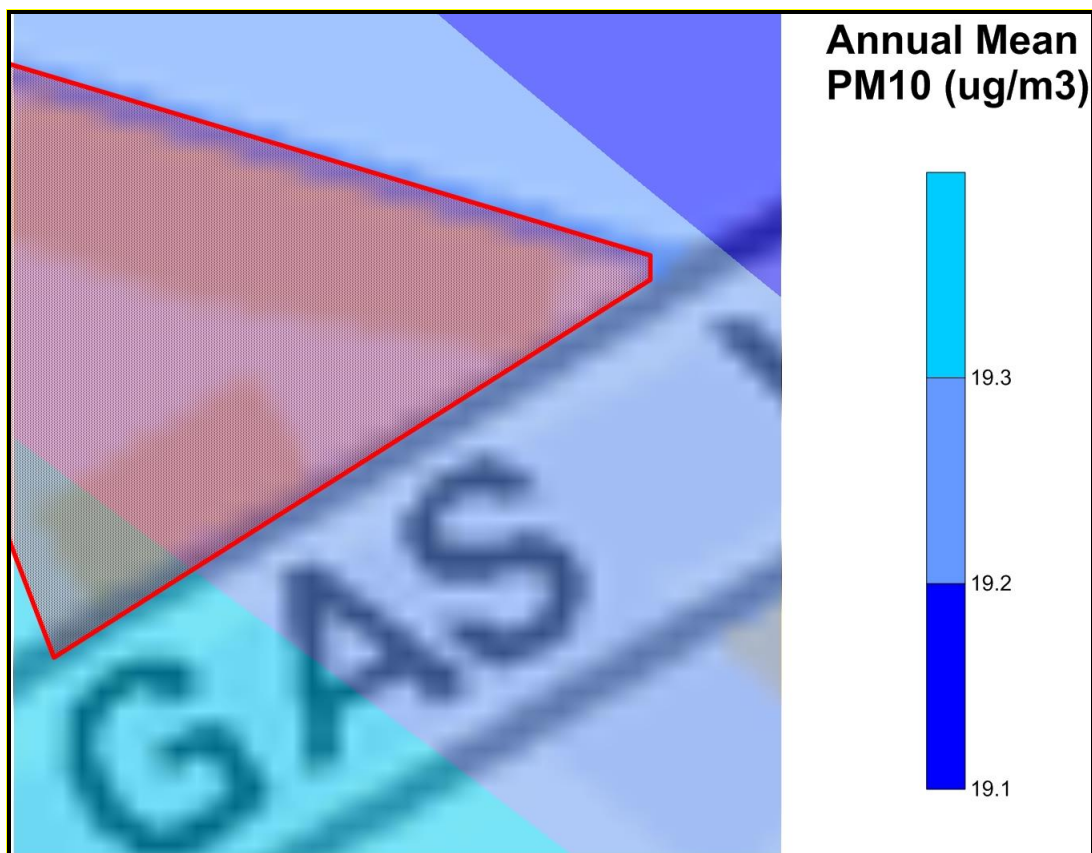
$$A = -18.5 + 0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$$

where A is the number of exceedences of 50 µg/m³ as a 24-hour mean PM₁₀ concentration.

5.27 Based on the above approach, the maximum number of days >50 µg/m³ PM₁₀ is predicted to be between 1 and 2 across the Site. The objective for this pollutant permits up to 35-days per annum and therefore exceedance of this objective is highly unlikely at the Site.

5.28 Future occupants of the Site would not be exposed to PM₁₀ concentrations above the annual mean or 24-hour objectives therefore the impact of the development with regards new exposure to PM₁₀ is also considered to be negligible.

Figure 5: Predicted Annual mean PM₁₀ Concentrations at the Site in 2017



MITIGATION

Construction Phase

5.29 The control of dust emissions from construction site activities relies upon management provision and mitigation techniques to reduce emissions of dust and limit dispersion. Where dust emission controls have been used effectively, large-scale operations have been successfully undertaken without impacts to nearby properties.

5.30 A low risk of impacts is predicted at adjacent residential properties during construction of the proposed development. Appropriate mitigation measures for the Site have been identified following the IAQM guidance and based on the risk effects presented in Table 11. It is recommended that the 'highly recommended' measures set out in **Appendix E** are incorporated into a DMP and approved by RBC prior to commencement of any work on site.

5.31 In addition to the 'recommended' measures, the IAQM guidance also sets out a number of 'desirable' measures which should also be considered for inclusion within the DMP. These are also set out in **Appendix E**.

5.32 Following implementation of the measures recommended for inclusion within the DMP the impact of emissions during construction of the proposed development would be negligible.

Operational Phase

5.33 The modelling assessment is predicting NO₂ concentrations below the NO₂ and PM₁₀ concentrations therefore no mitigation is considered necessary.

RESIDUAL EFFECTS

Construction phase

5.34 The greatest potential for dust nuisance problems to occur will generally be within 200m of the construction site perimeter. There may be limited incidences of increased dust deposited on property beyond this distance.

5.35 By following the mitigation measures outlined within this appraisal the impact will be substantially minimised. Residual impacts are therefore considered to be negligible.



Operational Phase

5.36 Residual impacts would be negligible during operation.

6 CONCLUSIONS

6.1 An air quality impact assessment has been carried out to assess both construction and operational impacts of the proposed development.

6.2 An assessment of the potential impacts during the construction phase has been carried out. This has shown that during this phase of the proposed development releases of dust and PM₁₀ are likely to occur during site activities. Through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM₁₀ releases may be effectively mitigated and the resultant impacts are considered to be negligible.

6.3 ADMS Roads dispersion modelling has been carried out to assess the suitability of the Site for residential development in relation to local traffic emissions.

6.4 The modelling assessment has predicted NO₂ and PM₁₀ concentrations below the relevant air quality objectives, the impacts of the assessment with regards new exposure is therefore considered to be negligible.



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 exceedences 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.
Exceedence	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.
NO₂	Nitrogen dioxide.
NO_x	Nitrogen oxides.
O₃	Ozone.
Percentile	The percentage of results below a given value.
PM₁₀	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/m³ micrograms per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of 1 µg/m ³ 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

Air Quality Objectives currently included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	Applies to	Standard		Objective		EU AQ Daughter Directive
		<i>Concentration</i>	<i>Measured as</i>	<i>Annual exceedences allowed</i>	Target date	
Nitrogen dioxide (NO ₂)	All UK	200 µg/m ³	1 hour mean	18	31.12.2005	As objective. target: 01.01.2010
	All UK	40 µg/m ³	annual mean		31.12.2005	As standard. target: 01.01.2010
Particulate Matter (PM ₁₀) (gravimetric)	All UK	40 µg/m ³	annual mean		31.12.2004	As standard. target: 01.01.2005
	All UK	50 µg/m ³	24 hour mean	35	31.12.2004	As objective. target: 01.01.2005
	Scotland	50 µg/m ³	24 hour mean	7	31.12.2010	As objective. target: 01.01.2010
	Scotland	18 µg/m ³	annual mean		31.12.2010	



APPENDIX C - SUMMARY OF TRAFFIC DATA

Traffic data utilised for the air quality assessment (AADT)

Road Link	Speed (kph)	% HGV	2012 Base	2017 Base
Forbury Road	48	12.3	23508	21810
King's Road north of Queens Road	40	6.3	11775	10925
Queen's Road west of King's Rd	40	10.0	9189	8526
Queen's Road west of Watlington St	48	8.9	19943	18503
King's Road south of Queen's Road	48	9.1	11974	11110

APPENDIX D – VERIFICATION AND ADJUSTMENT OF MODELLED CONCENTRATIONS

Most nitrogen dioxide (NO_2) is produced in the atmosphere by 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 model has followed the methodology presented in LAQM.TG(09).

The model has been run to predict annual mean road- NO_x concentrations at the King's Road and Queen's Road diffusion tube sites.

The model output of road- NO_x (i.e. the component of total NO_x coming from road traffic) has been compared to the 'measured' road- NO_x (Figure D1). The 'measured' road NO_x has been calculated from the measured NO_2 concentrations by using the DEFRA NO_x from NO_2 calculator available on the UK-AIR website.

Figure D1: Comparison of Modelled Road NO_x with measured Road NO_x

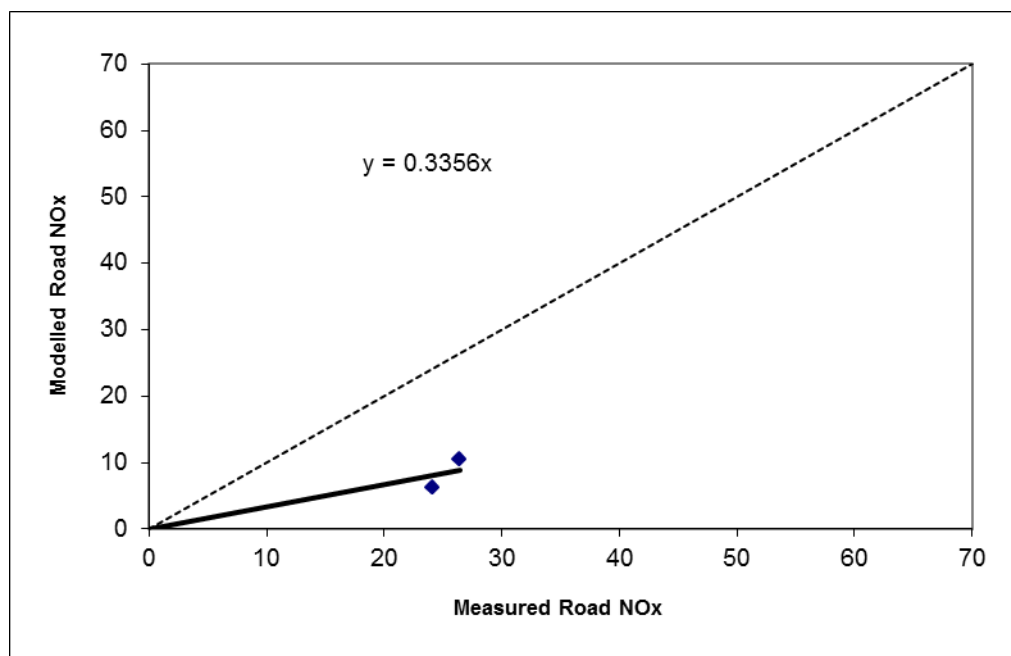
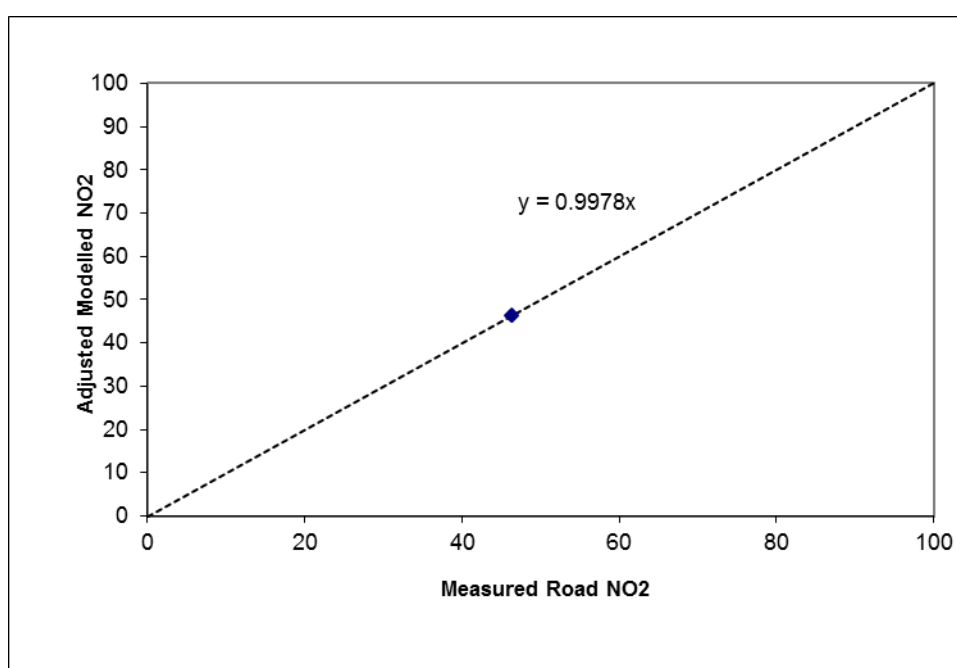


Figure D1 shows that the ADMS model under-predicted the road NO_x concentrations at the selected monitoring sites. An adjustment factor was therefore determined as the ratio between the measured road- NO_x contribution and the modelled road- NO_x contribution, forced through zero ($1/0.3356 = 2.98$). This factor has then been applied to the modelled road- NO_x concentration for each location to provide an adjusted modelled road- NO_x concentration.

The annual mean road-NO₂ concentration was determined using the DEFRA NO_x:NO₂ spread sheet calculation tool and added to the background NO₂ concentration to produce a total adjusted NO₂ concentration.

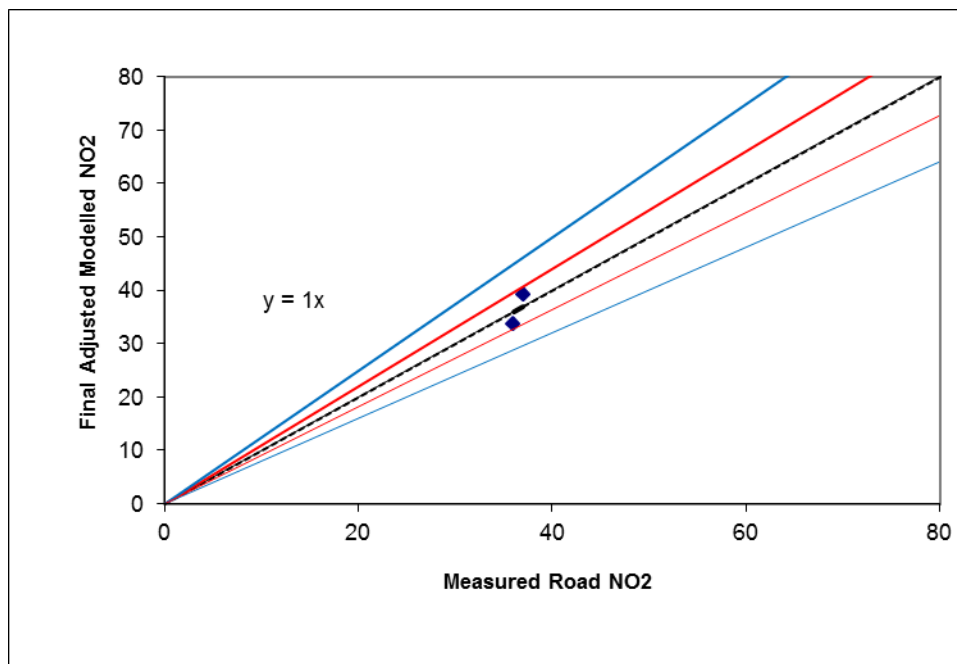
Figure D2 shows the adjusted modelled total NO₂ vs monitored NO₂. There is good agreement, but the best fit line forced through zero still has a slight departure from a 1:1 line, thus a secondary adjustment factor, to be applied to the adjusted modelled total NO₂, was calculated ($1/0.9978 = 1.003$).

Figure D2: Comparison of Modelled NO₂ with measured NO_x



After carrying out an initial adjustment there was a need for only a very small secondary adjustment of NO₂. The final adjustment modelled values are shown in Figure D3.

Figure D2: Comparison of Final Modelled NO₂ with measured NO_x



The adjustment factor of 2.98 has been applied to the modelled NO_x-road concentrations predicted at the Site. The predicted NO₂-road concentrations, calculated using the NO_x-NO₂ converter tool, have subsequently been added to background NO₂ concentrations and adjusted by 1.003 to provide the final predicted annual mean NO₂ concentrations at each receptor.

This method was also applied to the predicted PM₁₀ concentrations.



APPENDIX E – CONSTRUCTION MITIGATION MEASURES

It is recommended that the 'highly recommended' measures set out below are incorporated into a DMP and approved by RBC prior to commencement of any work on site:

- display the name and contact details of the person accountable for air quality and dust issues on the site boundary (i.e. the environment manager/engineer or site manager);
- display the head or regional office contact information on the site boundary;
- record all dust and air quality complaints, identify cause, take appropriate measures to reduce emissions in a timely manner and record the measures taken;
- make the complaints log available to the local authority when asked;
- record any exceptional incidents that cause dust and/or air emissions, either on- or off- site and the action taken to resolve the situation in the log book;
- carry out regular site inspections to monitor compliance with the DMP, record inspection results and make inspection log available to SBC when asked;
- increase frequency of site inspection by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged periods of dry or windy conditions;
- plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- erect solid screens or barriers around dusty activities or the site boundary as necessary that are at least as high as any stockpiles;
- avoid site runoff of water or mud;
- ensure all vehicles switch off engines when stationary - no idling vehicles;
- avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable;
- only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction e.g. suitable local exhaust ventilation systems;
- ensure an adequate water supply on site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- use enclosed chutes and conveyors and covered skips;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- avoid bonfires and burning of waste materials;
- use water-assisted dust sweepers on the access and local roads, to remove, as necessary, any material tracked out of the site;



-
- avoid dry sweeping of large areas;
 - ensure vehicles entering and leaving the site are covered to prevent the escape of materials during transport;
 - record all inspections of haul routes and any subsequent action in a site log book;
 - implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud) as required;
 - ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit.

The following 'desirable' measures should also be considered for inclusion within the DMP:

- undertake daily on-site and off-site inspection, where receptors area nearby, to monitor, record inspection results and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100 m of the site boundary;
- remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If being re-used on site, cover as detailed below;
- cover, seed or fence stockpiles to prevent wind whipping;
- ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods;
- keep site fencing, barriers and scaffolding clean using wet methods;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- avoid scabbling (roughening of concrete surfaces) if possible;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;