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Air Quality Assessment of the Proposed Barnsley School Development 3: Wombwell



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1 Introduction

1.1 This report assesses the air quality impacts associated with the development of the third of 3 new secondary schools in the Barnsley area. The impacts assessed are those resulting from construction activity and those caused by changes in traffic flows related to operation of the site. The main air pollutant of concern related to construction activity is dust. The main air pollutants of concern related to traffic are fine particulate matter (PM_{10}) and nitrogen dioxide.

1.2 Existing local air quality, the likely future air quality in the absence of the new development, and the likely future air quality if the development goes ahead, are all defined. The assessment of construction dust focuses on the anticipated duration of works. The assessment of traffic-related impacts focuses on the year 2011, when the development is proposed to be completed and the site is to become fully operational.

2 Policy Context and Assessment Criteria

Air Quality Strategy

2.1 The Air Quality Strategy (Defra, 2007a) provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the Local Air Quality Management (LAQM) regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Planning Policy

2.2 National policy on air quality and planning is set out in Planning Policy Statement 23 (PPS23) (ODPM, 2004). This contains advice on when air quality should be a material consideration in development control decisions. Existing, and likely future, air quality should be taken into account,

as well as the presence of any AQMAs. PPS23 notes that the findings of local authority air quality reviews and assessments will be important, as they will identify local air pollution problems, which may in turn influence the siting of certain types of development. The need for compliance with any statutory environmental quality standards or objectives, including the air quality objectives prescribed by the Air Quality Regulations 2000 (Stationery Office, 2000) and Amending Regulations 2002 (Stationery Office, 2002), will also be a factor in determining whether air quality is a material consideration.

2.3 Further emphasis is given to the importance of air quality objectives and AQMAs in the Appendices to PPS23. The impact of a development on air quality is likely to be particularly important:

- where the development is proposed inside, or adjacent to an AQMA;
- where the development could in itself result in the designation of an AQMA; and
- where to grant planning permission would conflict with, or render unworkable, elements of a LA's air quality action plan.

2.4 PPS23 states clearly that not all planning applications for developments inside or adjacent to AQMAs should be refused, even if the development would result in a deterioration of local air quality.

Local Policies

2.5 In 2001 Barnsley MBC declared a traffic related Air Quality Management Area. As a result of this the Council drafted an Air Quality Action Plan (AQAP) in order to reduce traffic related emissions. Following the declaration of further transport related AQMAs in the borough in 2005, the action plan measures have subsequently been integrated into the second South Yorkshire Local Transport Plan (LTP). The Council has also agreed a Local Public Service Agreement (LPSA) target with the Government relating to congestion, road safety and air quality. The AQPA is currently being revised and follows on from previous action plan annual progress reports (APRs).

Assessment Criteria

Health Criteria

2.6 The Government has established a set of air quality standards and objectives to protect human health. The 'standards' are set as concentrations below which effects are unlikely even in sensitive population groups, or below which risks to public health would be exceedingly small. They are based purely upon the scientific and medical evidence of the effects of an individual pollutant. The

'objectives' set out the extent to which the Government expects the standards to be achieved by a certain date. They take account of economic efficiency, practicability, technical feasibility and timescale. The objectives for use by local authorities are prescribed within the Air Quality Regulations, 2000 (Stationery Office, 2000) and the Air Quality (England) (Amendment) Regulations 2002, (Stationery Office, 2002). The relevant objectives for this assessment are provided in Table 1.

Table 1: Relevant Air Quality Objectives

Pollutant	Time Period	Objective	To be achieved by[a]
Nitrogen Dioxide	1-hour mean	200 $\mu g/m^3$ not to be exceeded more than 18 times a year	2005
	Annual mean	40 $\mu g/m^3$	2005
Fine Particles (PM_{10})[b]	24-hour mean	50 $\mu g/m^3$ not to be exceeded more than 35 times a year	2004
	Annual mean	40 $\mu g/m^3$	2004

[a] The achievement dates for the UK objectives are the end of the specified year.

[b] Measured by the gravimetric method.

2.7 The objectives for nitrogen dioxide and PM_{10} were to have been achieved by 2005 and 2004 respectively, and continue to apply in all future years thereafter. The Air Quality Strategy Addendum (Defra, 2003) proposed a set of more stringent provisional objectives for PM_{10} to be achieved by 2010. However, the 2007 Air Quality Strategy replaces these provisional PM_{10} objectives with an exposure-reduction approach for $PM_{2.5}$. The exposure-reduction objective will be a 15% reduction in average urban background concentrations across the UK between 2010 and 2020. It will be supplemented with a 'backstop' annual mean objective for $PM_{2.5}$ of 25 $\mu g/m^3$ to be achieved by 2020, which is designed to deliver a minimum level of protection to all areas. Examination of UK monitoring data shows it is highly unlikely that the $PM_{2.5}$ backstop objective will be exceeded if the 24-hour PM_{10} objective is attained. These $PM_{2.5}$ objectives have not been included in Regulations, and they are not considered further in this assessment.

2.8 The European Union has also set limit values for both nitrogen dioxide and PM_{10}. Achievement of these values is a national obligation rather than a local one. The limit values for nitrogen dioxide are the same levels as the UK objectives, and are to be achieved by 2010. The limit values for PM_{10} are also the same level as the UK statutory objectives, and were to be achieved by 2005. The objectives are the same as, or more stringent than, the limit values, thus it is appropriate to focus the assessment on the objectives.

Construction Dust Criteria

2.9 There are no formal assessment criteria for dust. In the absence of formal criteria, a set of distance based criteria has been developed. These criteria are based on the professional experience of the consultants, drawn from many years of involvement with assessments of many different types of project, together with discussions with many practitioners in the field, and consideration of a range of published reports.

Table 2: Assessment Criteria for Dust from Construction Activities, with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	**Description**	**Soiling**	**PM_{10} [a]**	**Vegetation effects**
Major	Large construction sites, with high use of haul routes	100 m	25 m	25 m
Moderate	Moderate sized construction sites, with moderate use of haul routes	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul routes	25 m	10 m	10 m

[a] Significance based on the 2004 objective, which allows 35 daily exceedences/year of 50 $\mu g/m^3$

Significance Criteria

2.10 There is no official guidance in the UK on how to define the magnitude of air quality impacts or their significance. Criteria have therefore been developed by Air Quality Consultants to define 'impact magnitude' and 'overall impact significance'. The definition of impact magnitude is solely related to the degree of change in pollutant concentrations. Impact significance takes account of the impact magnitude and of the absolute concentrations and how they relate to the air quality objectives or relevant standards. These criteria have been adopted by the Irish National Roads Authority in its 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (NRA, 2006). They are also set out as an example in the National Society for Clean Air guidance document 'Planning Control: Planning for Air Quality' (NSCA, 2006). The criteria describing the magnitude of change due to the scheme are set out in Table 3, while Table 4 sets out the significance criteria, which relate the magnitude of change to the air quality objectives.

Table 3: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	Annual Mean NO_2 / PM_{10}	Days PM_{10} >50 $\mu g/m^3$
Very large	Increase/decrease > 25%	Increase/decrease > 25 days
Large	Increase/decrease 15-25%	Increase/decrease 15-25 days
Medium	Increase/decrease 10-15%	Increase/decrease 10-15 days
Small	Increase/decrease 5-10%	Increase/decrease 5-10 days
Very Small	Increase/decrease 1-5%	Increase/decrease 1-5 days
Extremely Small	Increase/decrease <1%	Increase/decrease <1 days

Table 4: Air Quality Impact Significance Criteria

Absolute Concentration in Relation to Objective	Change in Concentration					
	Extremely Small	Very Small	Small	Medium	Large	Very Large
Decrease with Scheme						
Above Objective with Scheme	slight beneficial	slight beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Above Objective in Do-min, Below with Scheme	slight beneficial	moderate beneficial	substantial beneficial	substantial beneficial	very substantial beneficial	very substantial beneficial
Below Objective in Do-min	negligible	slight beneficial	slight beneficial	moderate beneficial	moderate beneficial	substantial beneficial
Well Below Objective in Do-min	negligible	negligible	slight beneficial	slight beneficial	slight beneficial	moderate beneficial
Increase with Scheme						
Above Objective in Do-min	slight adverse	slight adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Objective in Do-min, Above with Scheme	slight adverse	moderate adverse	substantial adverse	substantial adverse	very substantial adverse	very substantial adverse
Below Objective with Scheme	negligible	slight adverse	slight adverse	moderate adverse	moderate adverse	substantial adverse
Well Below Objective with Scheme	negligible	negligible	slight adverse	slight adverse	slight adverse	moderate adverse

'Do-min' = future baseline condition in the assessment year

'Below Objective' = 75-100% of the objective level

'Well Below Objective' = < 75% of the objective level.

3 Methodology

3.1 Existing sources of emissions within the study area have been defined using a number of approaches. A site visit has been carried out to identify existing sources from a visual inspection. In addition, the results of Barnsley MBC's air quality review and assessment work[1] have been considered in terms of their relevance to the proposed development, especially with regards to existing sources of pollutants that may have an impact upon the development site. These two sources of information and the Environment Agency website have been used to review existing industrial operations in the area. The site visit did not identify any potential sources of air pollution, aside from road traffic. Further to this the local authority has not identified any potential sources within its Review and Assessment work.

3.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers nearby sites, as no monitoring is being carried out close to the site, to provide context for the assessment. The background concentrations at the site have been defined using the national pollution maps published by Defra (Defra, 2007b). These cover the whole country on a 1x1 km grid. Future year baseline concentrations have been derived from existing values using the forward projection calculator published by Defra. This is based on national projections of concentration changes over future years.

3.3 The methodology set out by the Highways Agency in its Design Manual for Roads and Bridges (DMRB), V1.03c (Highways Agency, 2007) has been used as the basis for the assessment of traffic-related air quality impacts. The DMRB provides a means of predicting concentrations taking account of the number of vehicles; the proportion of heavy-duty vehicles; the distance from the road to the receptor; and the speed of the vehicles. It also takes account of the effects of legislation on future emissions.

3.4 The DMRB methodology requires the road traffic contributions to be added to background concentrations. Estimated background concentrations for each 1km x 1km area of the UK are provided on the Government's Air Quality Archive website (www.airquality.co.uk). (Defra, 2007b). Where necessary, concentrations have been adjusted to specific years using correction factors provided by the Air Quality Archive (Defra, 2007b).

3.5 The DMRB model predicts concentrations at predefined locations. Sensitive locations are places where members of the public might be regularly exposed to air pollutants over the time period of

[1] Available via links at http://www.barnsley.gov.uk/service/airquality/management.asp

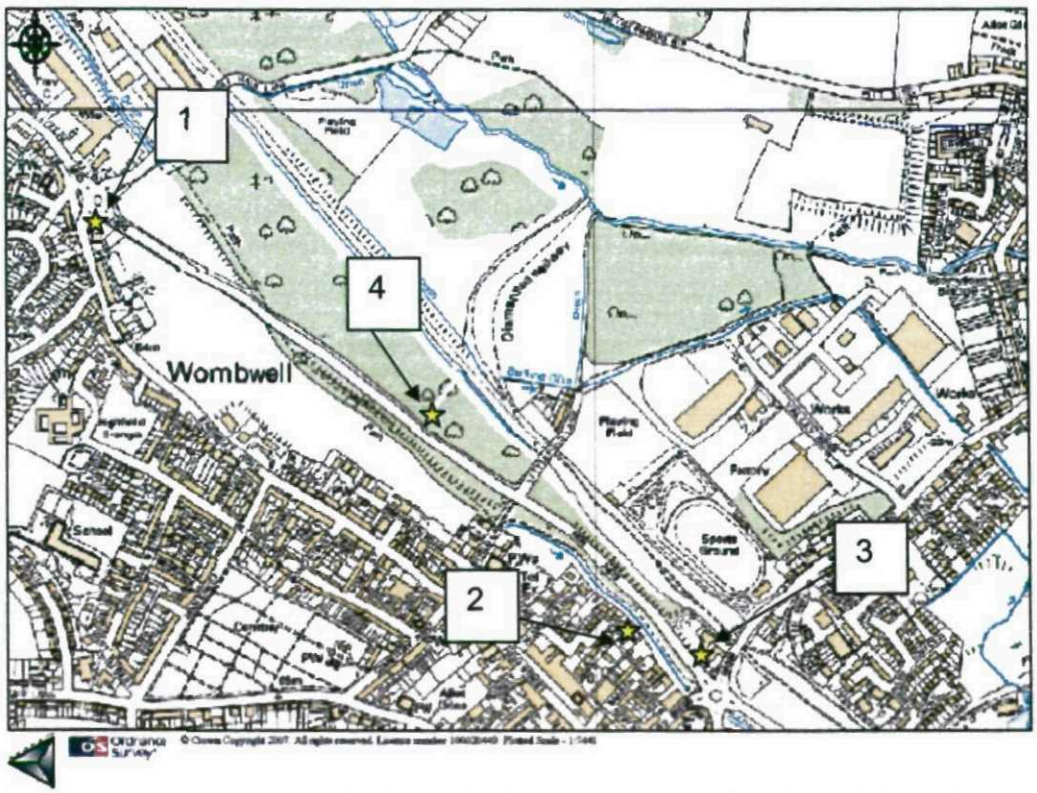
the objective. For the annual mean and 24-hour objectives that are the focus of this assessment, sensitive locations will be residential properties. Impacts will be greatest close to roads with significantly changed traffic flows and, in particular, close to junctions, where traffic will move more slowly and several roads may have a combined influence. A residential property, a hotel and a public house have been selected as receptors for air quality modelling. The fourth receptor does not represent a sensitive location but is included to give a nominal indicative prediction of the worst-case air quality next to the proposed school access junction on Michells Way. Locations close to junctions have been used to represent a worst-case scenario (i.e. busy, potentially slow moving traffic). They are described in Table 5. These represent locations at which the impacts of the scheme are expected to be greatest, with impacts being smaller at greater distances.

Table 5: Receptors

Receptor	Location
Receptor 1	The White Rose Public House (29.4m)
Receptor 2	26 Marsh Street (35.2m)
Receptor 3	The Railway Hotel (20.4m)
Receptor 4	Nominal Receptor adjacent to Mitchells Way (10m) close to the proposed school access road (10m)

[a] Distance in metres from the centreline of Mitchells Way

3.6 A map indicating the receptor locations is provided below.



3.7 Annual Average Daily Traffic (AADT) flows, with percentage HDVs, have been provided by Sanderson Associates. Annual average vehicle speeds have been estimated based on speed restrictions and proximity to junctions.

3.8 Locations sensitive to dust emitted during construction will be places where members of the public are regularly present. Residential properties and commercial operations close to the site will be most sensitive to construction dust. Any sensitive vegetation or ecology that is very close to dust sources might also suffer some negative effects.

4 Baseline Conditions

4.1 The school site is located north of the River Dove to the northeast of Wombwell. It is bordered by Pitt Street to the north, Leyfield Place/Branham Croft to the east, industrial units of Valley Road to the south and grassland/woodland to the west. There are a number of existing residential properties at Leyfield Place and Branham Croft that are close to the site. There are no residential properties close to the proposed school access road.

4.2 The local authority has identified areas within Barnsley where nitrogen dioxide concentrations are likely to exceed air quality objectives. There are currently four AQMAs within Barnsley, along the M1 and other major roads within the borough. A consultation draft detailed assessment has recommended declaration of two further areas on Harborough Hill and Burton Road. Old Mill Lane has also been identified as potentially exceeding and is now being carefully monitored. However the proposed development site at Wombwell is not located in the vicinity of these AQMAs and additional traffic movements associated with the proposed development are unlikely to have a measurable impact on the air quality within them. The nearest AQMA is in Rotherham, approximately 1.8 km south of the proposed development site.

4.3 Wombwell Sewerage Treatment Works (STW) is approximately 0.45 km to the southeast of the site. This is an Environment Agency authorised process. There are lots of existing residential properties closer to the works than the proposed development site. Due to the distance from the STW to the site, it is unlikely that there will be any related impacts.

4.4 Barnsley MBC have confirmed that in the last 3 years there have been no air quality complaints in relation to Station Road Industrial Estate, on Valley Road, to the south of the proposed development site.

4.5 Table 6 sets out the relevant existing and predicted future nitrogen dioxide concentrations at the diffusion tube monitoring site described in the methodology section. The tube is located nearer to the road than any of the receptors in the assessment. It also includes the estimated background concentration at the development site, and the modelled baseline conditions at the receptors described in the Assessment Methodology.

Table 6: Summary of Annual Mean Nitrogen Dioxide Concentration Without the Development µg/m^3

Location	Description	2006	2011
Measurement [a]			
Wombwell Lane	Roadside	36.9	30.8 [b]
Estimate [c]			
Local Background	Background	18.3	16.8
Modelled			
Receptor 1	Roadside	25.8	21.8
Receptor 2	Roadside	24.3	20.7
Receptor 3	Roadside	28.0	23.4
Receptor 4	Roadside	29.6	24.5
Statutory Objective		**40**	

[a] Data (June 06 – May 07) bias adjusted, adjusted to annual mean and provided by Barnsley MBC

[b] Estimated from 2006 monitoring data using the future year projection factors available from Defra (2007b)

[c] Results from national background map (Defra, 2007b)

4.6 Table 7 sets out the annual mean PM_{10} concentrations and the number of 24-hour PM_{10} exceedences at the monitoring site described in the Methodology section. It also includes the estimated background concentrations at the application site, and modelled baseline conditions at the receptors described in the methodology.

Table 7: Summary of Annual Mean PM_{10} Concentrations and Number of Days > 50 $\mu g/m^3$ without the Development

Location	Description	2006 Annual Mean	2011 Annual Mean	2006 no. Days > 50 $\mu g/m^3$ [b]	2011 no. Days > 50 $\mu g/m^3$ [b]
Measurement [a]					
Cudworth	Urban Background	24.6	23.0	12	8
Estimate [c]					
Local Background	Background	20.8	19.5	4	3
Modelled					
Receptor 1	Roadside	23.2	20.5	8	4
Receptor 2	Roadside	22.3	20.1	7	4
Receptor 3	Roadside	24.0	21.1	10	5
Receptor 4	Roadside	24.0	21.0	10	5
Statutory Objective		**40**		**35**	

[a] Estimated from 2005 monitoring data using the future year projection factors available from Defra (2007b)

[b] Estimated using the relationship with annual mean described in LAQM.TG(03) (Defra, 2003)

[c] Results from national background map (Defra, 2007b)

5 Assessment of Construction Dust Impacts

5.1 Construction activities have the potential to generate dust. The site is vacant land at the moment; therefore no demolition will be required. The main sources of dust are likely to be vehicles travelling over unpaved ground during dry weather, the handling of dusty materials and the cutting of stone/concrete. There is also the potential for dust to be tracked out of the site along roads.

5.2 The primary receptors for dust impacts will be any nearby residential properties. Commercial premises in the area may also be affected. Assuming that the measures set out in the mitigation section are adhered to, construction activities during the initial phase of demolition are likely to be moderate in terms of the criteria set out in Table 2. Thus significant soiling effects may extend out

to 50 m from the dust source, while PM_{10} impacts might extend out to 15 m. Therefore 44 residential properties on Branham Croft, Leyfield Place and Pitt Street may experience significant dust-soiling during the construction.

5.3 There are 20 properties within 15 metres of the development site. Most of these back onto the site boundary and are found in Leyfield Place and Branham Court. These properties may experience some PM_{10} impacts. It is not believed that there is any particularly sensitive vegetation within 10-15 m of locations where dust is likely to be generated.

5.4 Any dust incidents would be highly dependent on the weather, requiring dry conditions and winds blowing towards a receptor. This would need to be combined with an activity creating dust close to that receptor. The combination of conditions to allow significant dust soiling at any off-site location should therefore be very infrequent.

6 Assessment of Traffic Related Impacts

6.1 As described in the methodology section, 3 receptors have been selected to represent existing sensitive locations, at which any traffic-related air quality impacts are expected to be greatest, while a fourth represents worst-case air quality close to the proposed school access road junction. Pollutant concentrations have been predicted for the year 2011, both without and with the development. Predicted concentrations at each receptor are set out in Tables 8, 9 and 10.

Table 8: Predicted Annual Mean Nitrogen Dioxide Concentrations ($\mu g/m^3$) With and Without the Development

Receptor	2006	2011 without development	2011 with development	% change
Receptor 1	25.8	21.8	21.9	0.7
Receptor 2	24.3	20.7	20.8	0.6
Receptor 3	28.0	23.4	23.6	0.8
Receptor 4	29.6	24.5	25.7	4.4
Statutory Objective		40		

6.2 The development will have an extremely small impact on nitrogen dioxide concentrations at the worst-case receptors. Even at the nominal worst-case receptor (4) the impact is very small with less than a 5% increase. Concentrations of nitrogen dioxide remain well below the objective either with or without the development.

Table 9: Predicted Annual Mean PM_{10} Concentrations ($\mu g/m^3$) With and Without the Development

Receptor	2006	2011 without development	2011 with development	% change
Receptor 1	23.2	20.5	20.6	0.2
Receptor 2	22.3	20.1	20.1	0.1
Receptor 3	24.0	21.1	21.2	0.3
Receptor 4	24.0	21.0	21.7	3.2
Statutory Objective		40		

Table 10: Predicted Number of Days with PM_{10} Concentrations Greater than 50 $\mu g/m^3$ With and Without the Development

Receptor	2006	2011 without development	2011 with development	Change in number of days
Receptor 1	8	4	4	0
Receptor 2	7	4	4	0
Receptor 3	10	5	5	0
Receptor 4	10	5	6	1
Statutory Objective		35		

6.3 The annual mean PM_{10} objective is expected to be achieved at every receptor location with or without the proposed development. The development is predicted to cause less than a 0.5% change in annual mean concentrations at the worst-case receptors (1–3), which is considered extremely small (see Table 3). Even at the nominal worst-case receptor (4) the change in very small.

6.4 Table 10 shows that the proposed development will also have no impact on the number of exceedences of $50\mu g/m^3$ as a 24-hour mean PM_{10} concentration at Receptors 1 to 3, and that the objective will be achieved at all locations. Receptor 4 shows a one day increase in the number of

exceedences of 50μg/m^3 as a 24-hour mean PM_{10} concentration, however it remains well below the objective.

6.5 Based on the significance criteria in Table 4, the extremely small and very small predicted changes in concentration are all judged to be negligible.

6.6 The car park proposed as part of the school has the potential to create extra emissions from cold starts. These have not been included as part of the assessment. It is considered that a small proportion of vehicles will be affected and that as concentrations are currently predicted to be well below the objective level, this impact is likely to be negligible.

7 Mitigation of Impacts

7.1 Mitigation measures to reduce pollutant emissions from road traffic are principally being delivered by the introduction of more stringent emissions standards for new vehicles, largely via European legislation. This assessment has identified no specific requirement to mitigate the effects of road traffic associated with the proposed development.

7.2 Measures to mitigate dust emissions would be required during the construction phase of the development in order to reduce impacts upon nearby residential properties. Guidance is available from the Building Research Establishment on controlling dust from construction sites (BRE, 2003), with Part 2 dealing with demolition and site preparation activities. This reflects best practice experience of dust controls and has been used, together with the professional experience of the consultant, to draw up the following set of measures that should, where practicable, be incorporated into the specification for the works. Mitigation should be straightforward, as most of the necessary measures are routinely employed as 'good practice' on construction sites. The measures are likely to include:

- Use of water-sprays to ensure that any unpaved routes across the site are maintained in a damp condition when in use. Use of consolidated surfaces close to residential boundary;
- Imposition and enforcement of a 5mph speed limit on unpaved ground;
- Hard surfacing of the proposed new access road at an early stage of the works;
- Minimise any dust generating activities on very dry or windy days;
- Sheeting of all lorries carrying materials on and off site;

- Location and/or covering of stockpiles as far from sensitive locations as possible, and provision of appropriate hoardings;
- Wherever practicable, off-road plant to use Ultra-Low Sulphur Diesel and be equipped with exhaust after-treatment;
- Regular cleaning of all paved areas on-site;
- Use of a jet-spray vehicle and wheel wash for all vehicles leaving the site;
- Regular use of a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site; and
- Use of water suppression during any cutting of stone or concrete.

7.3 Where mitigation measures rely on water, it is expected that only sufficient water will be applied to damp down the material. There should not be any excess to potentially contaminate local watercourses.

8 Conclusions

8.1 The potential air quality impacts of road-traffic associated with the proposed development have been assessed at four receptors, which represent worst-case locations where air quality impacts will be greatest. Concentrations of nitrogen dioxide and PM_{10} have been estimated for 2011 both with and without the development. Results show that changes in traffic volumes will have a negligible impact on local pollutant concentrations, even at the worst-case location. Even with the development, concentrations of nitrogen dioxide and PM_{10} remain well below the objectives.

8.2 Dust may be generated during construction, therefore it will be necessary to apply a package of mitigation measures to minimise dust emissions. Even with these measures in place, a small number of existing residential properties might potentially be affected by occasional dust soiling impacts. However the construction period will be brief and any impacts will be temporary and infrequent, depending on the coincidence of certain weather conditions with dust raising activities close to a property.

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Glossary

Exceedence	A period of time where the concentration of a pollutant is greater than the appropriate air quality objective.
AQMA	Air Quality Management Area
DMRB	Design Manual for Roads and Bridges (Highways Agency 2003)
PM_{10}	Small airborne particles, more specifically particulate matter less than 10 micrometers in aerodynamic diameter.
m	Metres.
$\mu g/m^3$	Microgrammes per cubic metre.