12 AIR QUALITY

12.1 Introduction

12.1.1 This chapter describes the potential air quality impacts associated with the proposed development at Island Farm, Bridgend. The assessment has been carried out by Air Quality Consultants Ltd on behalf of HD Limited.

12.1.2 The proposed development lies approximately 1.3 km to the south west of Bridgend town centre. The site is located to the south of the A48 and the southern settlement boundary of Bridgend. It is bounded to the east by Bridgend Science Park and Vale of Glamorgan rail line, to the west by Merthyr Mawr Road South and to the south by New Inn Road. There are residential properties to the north and northeast of the proposed development site.

12.1.3 The development would lead to an increase in traffic on the local roads, which may impact on air quality at existing residential properties. The main air pollutants of concern related to traffic emissions are nitrogen dioxide and fine particulate matter (PM_{10} and $PM_{2.5}$). There is also the potential for the construction activities to impact upon the surrounding area. The main pollutants of concern related to construction activities are dust and PM_{10}.

12.1.4 This report describes existing local air quality conditions (2009), and the predicted air quality in the future assuming that the proposed development does, or does not proceed. The assessment of traffic-related impacts focuses on 2012, which is the anticipated year of opening. The assessment of construction dust impacts focuses on the anticipated duration of the works.

12.1.5 This report has been prepared taking into account all relevant local and national guidance and regulations, and follows a methodology agreed with BCBC.

12.2 Policy and Legislation

Air Quality Strategy

12.2.1 The Air Quality Strategy (Defra and the Devolved Administrations (DAs), 2007) 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

12.2.2 Planning Policy for Wales (Welsh Assembly Government, 2002), published in March 2002, sets out a number of principles underpinning the approach to planning policy for sustainable development, including

> *"applying the precautionary principle. [Which means] cost effective measures to prevent possibly serious environmental damage should not be postponed just because of scientific uncertainty about how serious the risk is." (Paragraph 2.2.1)*

12.2.3 More specifically, it sets out in the section dealing with improving air quality, that

> *"Where pollution considerations … affect the use and development of land they can be material planning considerations. … The weight to be attached to such considerations will depend on the scope of the pollution control system in each case and the effect on land use and amenity." (Paragraph 13.10.3).*

12.2.4 It goes on to say in paragraph 13.12.1 that

> *"material considerations in determining applications for potentially polluting development are likely to include:*
>
> *Location …;*
>
> *Impact on health and amenity;*
>
> *The risk and impact of potential pollution from the development insofar as this might have an effect on the use of other land and the surrounding environment …;*
>
> *Prevention of nuisance;"*

12.2.5 Planning Policy for Wales (Welsh Assembly Government, 2002) is supplemented by a series of Technical Advice Notes, however none of these apply to air quality. It is therefore appropriate to make reference to Planning Policy Statement 23: Planning and Pollution Control ("PPS23") published by the UK Government (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.

12.2.6 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.

12.2.7 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, as such an approach could sterilise development.

Local Policies

12.2.8 The Bridgend Unitary Development Plan (UDP)[23] was adopted in May 2005. It is based on 14 central themes, one of which is Environment.

12.2.9 Policy EV30 relates to air quality, it states:

> *"Major development proposals which would be harmful to air quality by virtue of the additional new traffic movements they would generate, will not be permitted unless accompanied by effective mitigation measures".*

12.2.10 The Council's Environmental and Sustainable Development (LA21) Policy states that the Council - will make every effort to minimise and avoid the release of pollutants that may cause environmental damage to air, land or water.

12.2.11 Recent changes to the planning legislation require the Council to replace the UDP with a Local Development Framework (LDF). This portfolio of planning documents, individually known as Local Development Documents, will deliver the spatial development strategy for Bridgend and build upon existing local and regional strategies and initiatives.

12.3 Methodology and Assessment Criteria

Health Criteria

12.3.1 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 (Wales) 2000 (Stationery Office, 2000) and the Air Quality (Wales) (Amendment) Regulations 2002 (Stationery Office, 2002). The relevant objectives for this assessment are provided in Table 12.1.

23 For further information: http://www.bridgend.gov.uk/BCBCUDP/english/text/text03.htm

Table 12.1: Air Quality Objectives for Nitrogen Dioxide and PM_{10}

Pollutant	Time Period	Objective
Nitrogen Dioxide	1-hour mean	200 μg/m^3 not to be exceeded more than 18 times a year
	Annual mean	40 μg/m^3
Fine Particles (PM_{10})[a]	24-hour mean	50 μg/m^3 not to be exceeded more than 35 times a year
	Annual mean	40 μg/m^3

[a] Measured by the gravimetric method.

12.3.2 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. Measurements across the UK have shown that in typical situations, the 1-hour nitrogen dioxide objective is unlikely to be exceeded where the annual mean concentration is below 60 μg/m^3 (Defra and the DAs, 2009a).

12.3.3 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 (Stationery Office, 2007). 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.

12.3.4 More recently, new health criteria have been introduced for $PM_{2.5}$ and these are shown summarised in Table 12.2. The 2007 Air Quality Strategy (Defra and the DAs, 2007) sets out both an exposure-reduction approach and a "backstop" annual mean objective for $PM_{2.5}$. The former is an objective focused on reducing average exposures across the most heavily populated areas of the country, and is not directly applicable to individual schemes. It is supported by the "backstop objective" or concentration cap to ensure a minimum environmental standard. These $PM_{2.5}$ objectives have not been included in Regulations.

Table 12.2: Relevant Air Quality Criteria for $PM_{2.5}$

	Time Period	Objective/Obligation	To be achieved by
UK objectives	Annual mean	25 μg/m^3	2020
	3 year running annual mean	15% reduction in concentrations measured at urban background sites	Between 2010 and 2020
European obligations	Annual mean	Target value of 25 μg/m^3	2010

	Time Period	Objective/Obligation	To be achieved by
	Annual mean	Limit value of 25 µg/m^3	2015
	Annual mean	Stage 2 indicative Limit value of 20 µg/m^3	2020
	3 year Average Exposure Indicator (AEI)[a]	Exposure reduction target relative to the AEI depending on the 2010 value of the 3 year AEI (ranging from a 0% to a 20% reduction)	2020
	3 year Average Exposure Indicator (AEI)	Exposure concentration obligation of 20 µg/m^3	2015

[a] The 3 year running annual mean or AEI is calculated from the $PM_{2.5}$ concentration averaged across all urban background monitoring locations in the UK e.g. the AEI for 2010 is the mean concentration measured over 2008, 2009 and 2010.

12.3.5 A new air quality directive (2008/50/EC) was adopted in May 2008, and includes a national exposure reduction target, a target value and a limit value for $PM_{2.5}$. The UK Government will need to transpose the requirements of this new directive into national legislation by 11 June 2010.

Construction Dust Criteria

12.3.6 There are no formal assessment criteria for dust. In the absence of formal criteria, a set of distance based criteria has been developed (Table 12.3). These criteria are based on the professional experience of the consultants, drawn from many years of involvement with assessments of different types of project, together with discussions with practitioners in the field, and consideration of a range of published reports.

Table 12.3: 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 µg/m^3

12.3.7 There is also the possibility of dust being tracked out of the site along roads. Table 12.4 sets out the assessment criteria in terms of distance from the site to which significant dust may be tracked out and the potential distance from the roadside for significant effects.

Table 12.4: Assessment Criteria for Construction Dust Track-Out with Standard Mitigation in Place

Source		**Potential Distance from roadways for Significant Effects (Distance from edge of road)**		
Scale	**Distance along roadways that dust might be tracked**	**Soiling**	**PM_{10}**	**Vegetation effects**
Major	250 m	50 m	15 m	15 m
Moderate	100 m	25 m	10 m	10 m
Minor	25 m	15 m	5 m	5 m

Significance Criteria

12.3.8 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 'Development Control: Planning for Air Quality' (NSCA, 2006). The criteria describing the magnitude of change due to the scheme are set out in Table 12.5, while Table 12.6 sets out the significance criteria, which relate the magnitude of change to the air quality objectives.

Table12.5: Definition of Impact Magnitude for Changes in Ambient Pollutant Concentrations

Magnitude of Change	**Annual Mean**	**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 12.6: 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.

12.4 Baseline Data and Assessment

Existing Conditions

12.4.1 Existing sources of emission 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 of the area. Industrial and waste management sources that may affect the area have been identified using Defra and the DAs' latest data from the UK Pollution Release and Transfer Register (Defra and the DAs, 2009b). Local sources have also been identified through discussion with the Environmental Health Department, as well as through examination of the Council's air quality Review and Assessment reports.

12.4.2 Information on existing air quality has been obtained by collating the results of monitoring carried out by the local authority. This covers both the study area and nearby sites, the latter being used to provide context for the assessment. The closest monitoring sites to the proposed development are shown in Figure 1 in Appendix 12.2. The background concentrations across the study area have been defined using the national pollution maps published by Defra and the DAs (2009c). These cover the whole country on a 1x1 km grid.

Road Traffic Impacts

Sensitive Locations

12.4.3 Concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$ have been predicted at a number of worst-case locations. Receptors have been selected to represent these worst-case locations. Relevant sensitive locations are places where members of the public might be expected to be regularly present over the averaging period of the objectives. For the annual mean and daily mean objectives that are the primary focus of this assessment, sensitive receptors will generally be residential properties, schools, nursing homes, etc.. When selecting these receptors, particular attention has been given to assessing impacts close to junctions, where traffic may become congested, and where there is a combined effect of several road links.

12.4.4 Eleven residential properties have been identified as receptors for the assessment. These locations are described in Table 12.7 and shown in Figure 2, Appendix 12.2 In addition, concentrations have been modelled at six Council-run diffusion tube monitoring sites located at Ewenny Junction (Figure 1, Appendix 12.2), in order to verify the modelled results (see Appendix 12.1 for verification method).

Table 12.7: Description of Receptor Locations

Receptor	Type	Description
Receptor 1	Roadside	14 Bryn Melys
Receptor 2	Roadside	26 Banc Gelli Las
Receptor 3	Roadside	13 Merthyr Mawr Road
Receptor 4	Roadside	103 Ewenny Road
Receptor 5	Roadside	45 Ewenny Road

Receptor	Type	Description
Receptor 6	Roadside	4 Waterton Road
Receptor 7	Roadside	5 Waterton Road
Receptor 8	Roadside	25 St Mary's View
Receptor 9	Roadside	19 Picton Gardens
Receptor 10	Roadside	Birch Court
Receptor 11	Roadside	131 Ewenny Road

Impact Predictions

12.4.5 Predictions of annual mean nitrogen dioxide, PM_{10} and $PM_{2.5}$ concentrations have been carried out for the current year (2009), and the year of opening (2012). For 2012, predictions have been made assuming both that the development does proceed (With Scheme), and does not proceed (Without Scheme). As explained in Appendix 12, the number of 24-hour PM_{10} exceedences has been calculated from the annual mean following the relationship given by Defra and the DAs (2009a). The likelihood of the 1-hour objective for nitrogen dioxide being exceeded has been assessed qualitatively, making reference to guidance provided by Defra and the DAs (2009a), the number of match events anticipated within a year, and the likelihood of these events coinciding with worst-case air quality conditions.

12.4.6 Predictions have been carried out using the ADMS-Roads dispersion model (v2.3). The model requires the user to provide various input data, including the Annual Average Daily Traffic (AADT) flow, the proportion of heavy duty vehicles (HDVs), the vehicle speed and the road characteristics e.g. whether there is street canyon. It is also necessary to input background pollutant concentrations. These have been derived from the national maps discussed in the section on Existing Conditions. Road geometry has been determined using maps and photographs and from a site visit. Average vehicle speeds have been estimated based on direct observation and taking account of local anecdotal evidence.

12.4.7 Annual Average Daily Traffic (AADT) flows, and the proportions of HDVs for the existing and future baseline scenarios have been derived from the traffic flows provided by Opus International Consultants (Opus) in line with their transport assessment described in Chapter 6. The peak-hour flows were used to predict AADT equivalent flows by comparing them with diurnal traffic counts carried out on local roads, as provided by Opus.

12.4.8 With-scheme flows were derived from a number of sources. Opus provided peak-hour predictions of site-generated traffic from the science park and separate predictions for peak-hour traffic generated by the sports and leisure facilities. The science park data were factored to AADT equivalents comparing them with diurnal traffic counts carried out on local roads, as provided by Opus. The sports and leisure flows were factored using diurnal profiles specific to sports and leisure facilities provided by Opus. In addition to these data, Opus also provided daily estimates of bus and car movements associated with the park and ride scheme.

12.4.9 In terms of match-event traffic, the following assumptions have been made:

- The Celtic Crusaders Stadium would host four events per year with a crowd of

15,000 and nine events per year with a crowd of 7,500.

- Bridgend Ravens would host 15 events per year with a crowd of 5,000.
- Bridgend Town would host 19 events per year with a crowd of 2,000.

12.4.10 These figures are considered to be worst-case in that they will over-predict the number of event-visitors to the site in the 2012 assessment year. Opus has provided predicted traffic generation figures for each of these event types. As shown in Section 12.5, the worst-case locations for local air quality are around Ewenny Cross. Opus has thus predicted event-related traffic volumes across the site and around Ewenny Cross and these flows have been included in the With Scheme dispersion modelling. The effect of event-related traffic on receptors away from Ewenny Cross has not been included in the model. To place this omission into context, match events are expected to generate approximately 40,000 car trips over the course of a year and approximately 12,000 bus and coach trips. These compare with existing flows on the A48 of approximately 7.3 million car movements per year and 214,000 HGV movements. Thus, on an annual total (and therefore annual average) basis, event-related traffic would add less than 1% to existing flows on the A48. The omission of these trips will therefore not significantly affect the predictions of annual mean concentrations.

12.4.11 Opus has stated that its traffic flow predictions are likely to overstate the impact of the scheme. Thus, the air quality impacts predicted in this chapter are likely to be worst-case estimates. The traffic flow data used in this assessment are summarised in Appendix 12.

12.4.12 The ADMS model calculates vehicle exhaust emissions from the Design Manual for Roads and Bridges (DMRB) database. There are currently no $PM_{2.5}$ vehicle emissions factors within this dataset and it has thus been necessary to estimate $PM_{2.5}$ emissions from the PM_{10} data. The Airborne Particles Expert Group (1999) recommended a $PM_{2.5}$ to PM_{10} ratio of 0.8 for non-catalyst petrol vehicles, and 0.9 for all other vehicles. The DMRB database shows that non-catalyst petrol vehicles comprised only 4% of the vehicle fleet in 2008[24]; gradually declining in years thereafter. It is not practicable to apply different $PM_{2.5}$ ratios to different vehicle types, but given the very small number of non-catalyst petrol vehicles on the road, this is unlikely to introduce any significant error, and so a worst-case approach of assuming a 0.9 ratio for all vehicles has been applied. To calculate $PM_{2.5}$ concentrations, the predicted road PM_{10} contribution has been factored by 0.9 and then added to the background $PM_{2.5}$ concentration.

12.4.13 The DMRB factors include pollutant emissions from exhausts, but do not include PM_{10} and $PM_{2.5}$ emissions from brake and tyre wear, or from resuspension, and these have therefore been derived separately. The National Atmospheric Emissions Inventory (NAEI) (Defra and the DAs, 2009d) provides separate brake and tyre wear emission factors for PM_{10} for a range of different vehicle types. These emissions factors have been aggregated using the fleet composition data which underpin the DMRB database. The United States Environmental Protection Agency (USEPA, 1995) suggests that 70% of tyre wear PM_{10} is present as $PM_{2.5}$, whilst 40% of brake wear PM_{10} is present as $PM_{2.5}$. These ratios have been applied to the NAEI PM_{10} data to derive $PM_{2.5}$ emission factors.

[24] This includes the predicted fraction of the fleet with failed catalysts.

12.4.14 The Air Quality Expert Group (AQEG, 2005) cites a value of 0.04 g/km for resuspended PM_{10}, but cautions that applying this value may double-count some of the emissions. In the absence of more reliable information, this value has been used to provide a worst-case assessment. Pace (2005) examined the amount of $PM_{2.5}$ in resuspended road PM_{10} concentrations, and cited factors ranging from 3% to 25%, with 25% considered likely to significantly overestimate $PM_{2.5}$ emissions on a national (US) level. A value of 25% has been assumed in this assessment, representing a conservative approach. These additional emissions from brake and tyre wear, and resuspension, have been entered into the ADMS model on a link-by-link basis.

Construction Impacts

12.4.15 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 areas of sensitive vegetation or ecology that are very close to dust sources may also be susceptible to some negative effects.

12.4.16 It is very difficult to quantify emissions of dust from construction activities. It is thus common practice to provide a qualitative assessment of potential impacts, making reference to the assessment criteria set out in Table 12.3 and Table 12.4.

Assessment

12.4.17 A search using Defra and the DA's latest data from the UK Pollution Release and Transfer Register (Defra and the DAs, 2009b) did not identify any industrial or waste management sources within 1 km of the proposed development.

12.4.18 Bridgend CBC has investigated air quality within its area as part of its responsibilities under the LAQM regime. As part of the second round of review and assessment, the Council completed its Updating and Screening Assessment in 2003, and concluded that three areas, including Ewenny Cross, would not be able to meet the annual mean objective for nitrogen dioxide and PM_{10}, and as a result a Detailed Assessment was carried out. The subsequent Detailed Assessment, completed in 2006, concluded that the air quality objectives for nitrogen dioxide and PM_{10} were being met at the three road junctions assessed; therefore an AQMA was not required. Subsequent to this, the Council's 2009 Progress Report (Bridgend CBC, 2009) noted that measured annual mean concentrations at Ewenny Cross are above the level of the objective. The Council thus intends to carry out a further Detailed Assessment for the houses around this junction.

12.4.19 There are no automatic monitoring stations close to the development site, but BCBC operates six nitrogen dioxide diffusion tube monitoring sites in the area (Figure 1 in Appendix 12.2). Data have been provided for 2008, and are summarised in Table 12.8.

Table 12.8: Summary of Nitrogen Dioxide (NO_2) Diffusion Tube Monitoring (2008)[a]

Site No.	Site Type	Location	NO_2 concentration ($\mu g/m^3$)[b]
41	Roadside	Priory Avenue, Bridgend	27
42	Roadside	A48 Bypass, Bridgend	50

43	Roadside	A48 Bypass, Bridgend	43
44	Roadside	Ewenny Rd, Bridgend	32
55	Roadside	STL, Ewenny Rd, Bridgend	21
56	Roadside	Ewenny Rd, Bridgend	28
Objective			40

[a] All data have been bias adjusted by the Council using a national factor of 0.80 in version 03/09 of the spreadsheet available at www.uwe.ac.uk/aqm/review).

[b] Objective exceedences highlighted in bold.

12.4.20 The closest station monitoring PM_{10} concentrations is at Talbot Road, Kenfig Hill about 8 km northwest of the site. This monitoring site was established to measure PM_{10} levels in relation to Margam Mine opencast coal site. Monitoring has been carried out using an Opsis SM200 particle monitor. Annual mean concentrations for this site in 2008 are shown in Table12.9. There are no monitors measuring $PM_{2.5}$ concentrations in the Borough.

Table 12.9: Summary of PM_{10} Monitoring (2008)

Site	Site Type	Location	Annual Mean (µg/m3)	No. Days >50µg/m^3
Kenfig Hill	Industrial	Station Rd, Kenfig Hill	17.7	0 (45.6[a])
Objectives			**40**	**35**

[a] 98th percentile (data capture 75%).

12.4.21 In addition to these locally measured concentrations, estimated background concentrations in the study area have been obtained from the national maps (Table 12.10). The estimated background nitrogen dioxide concentrations are lower than the 2008 measured values set out in Table 12.8. This is because all the diffusion tubes are at roadside locations and therefore would be expected to have higher concentrations. The measured PM_{10} concentration is similar to the mapped value.

Table 12.10: Estimated Annual Mean Background Pollutant Concentrations in 2009 and 2012 (µg/m^3)

Year	NOx	NO_2	PM_{10}	$PM_{2.5}$
2009	17.5	14.6	18.0	11.0
2012	15.9	13.4	17.7	10.7
Objectives	-	40	40	25 [a]

[a] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 µg/m^3 is to be met by 2015.

12.4.22 The ADMS model has been used to predict baseline concentrations of nitrogen dioxide, PM_{10}

and $PM_{2.5}$ at each of the receptor locations identified in Table 12.7. The results, covering both existing baseline and future year baseline (Without Scheme), are set out in Tables 12.11 and 12.12.

12.4.23 The predicted annual mean concentration of nitrogen dioxide at Receptor 4 (Ewenny Cross) exceeds the objective in 2009. By 2012, a range of measures introduced at national and international levels to reduce emissions from road vehicles and other sectors are expected to result in an improvement at this location. Thus, the predictions show that in 2012, the objective will be achieved without the scheme. The objective is predicted to be achieved at all of the other receptors in 2009 and 2012. In terms of PM_{10} the annual mean and 24-hour objectives are expected to be achieved at every receptor. Similarly, the predictions for $PM_{2.5}$ are well below the limit value.

12.4.24 These results are consistent with the conclusions of BCBC in the outcome of its air quality review and assessment work.

Table 12.11: Modelled Annual Mean Baseline Concentrations of Nitrogen Dioxide (µg/m^3)

Location	Annual mean [a]	
	Existing (2009)	2012
Receptor 1	19.5	18.0
Receptor 2	19.2	17.8
Receptor 3	24.2	23.0
Receptor 4	40.8	37.9
Receptor 5	24.5	22.7
Receptor 6	26.3	24.5
Receptor 7	24.6	22.8
Receptor 8	32.6	29.8
Receptor 9	30.0	27.9
Receptor 10	31.8	29.4
Receptor 11	23.4	21.3
Objective	40	40

[a] Objective exceedences highlighted in bold.

Table 12.12: Modelled Baseline Concentrations of PM_{10} and $PM_{2.5}$

Location	**PM_{10}[a]**				**$PM_{2.5}$**	
	Annual mean ($\mu g/m^3$)		No.Days >50$\mu g/m^3$		Annual mean ($\mu g/m^3$)	
	Existing (2009)	2012	Existing (2009)	2012	Existing (2009)	2012
Receptor 1	17.4	17.1	1	1	10.8	10.5
Receptor 2	17.4	17.1	1	1	10.8	10.5
Receptor 3	18.8	18.6	2	2	11.7	11.4
Receptor 4	23.1	22.5	8	7	14.8	14.1
Receptor 5	19.7	19.3	3	3	12.2	11.9
Receptor 6	19.2	18.9	3	2	12.4	11.6
Receptor 7	19.0	18.6	2	2	12.1	11.4
Receptor 8	20.0	19.5	3	3	13.2	12.0
Receptor 9	20.8	20.4	4	4	13.0	12.6
Receptor 10	21.1	20.7	5	4	13.4	12.8
Receptor 11	19.5	19.1	3	2	12.3	11.7
Objective	**40**	**40**	**35**	**35**	**25[b]**	**25[b]**

[a] The numbers of days with PM_{10} concentrations greater than 50$\mu g/m^3$ has been estimated from the relationship with the annual mean concentration described in Defra, 2009a.

[b] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 $\mu g/m^3$ is to be met by 2015.

12.5 Predicted Effects

Road Traffic Impacts

12.5.1 Predicted annual mean concentrations of nitrogen dioxide, PM_{10} and $PM_{2.5}$, as well as days with PM_{10} >50 $\mu g/m^3$, are set out in Table 12.13, for both the "Without Scheme" and "With Scheme" scenarios.

12.5.2 At Receptor 4, which is adjacent to Ewenny Cross, the annual mean nitrogen dioxide objective is predicted to be exceeded in 2012 with the proposed scheme, albeit by a very small margin. Table 12.13 shows that without the scheme, this would not be the case and the objective would be achieved. It should, however, be noted that the predicted concentration at this receptor with the proposed scheme (40.9 $\mu g/m^3$) is only slightly higher than the existing (2009) concentration shown in Table 12.11 (40.8 $\mu g/m^3$). The predicted concentrations at each of the other receptors are below the annual mean nitrogen dioxide objective in 2012 with and without the proposed scheme. All of the predictions for PM_{10} and $PM_{2.5}$ are below the relevant objectives and limit value with and without the proposed scheme.

Table 12.13: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2012 - Annual Mean ($\mu g/m^3$) and Number of Days with PM_{10} > 50 $\mu g/m^3$ [a]

Location	2012 "Without Scheme"				2012 "With Scheme"			
	NO_2	PM_{10}		$PM_{2.5}$	NO_2	PM_{10}		$PM_{2.5}$
	Annual Mean	Annual Mean	Days[b]	Annual Mean	Annual Mean	Annual Mean	Days[b]	Annual Mean
Receptor 1	18.0	17.1	1	10.5	18.9	17.3	1	10.6
Receptor 2	17.8	17.1	1	10.5	18.7	17.3	1	10.7
Receptor 3	23.0	18.6	2	11.4	24.2	18.9	2	11.6
Receptor 4	37.9	22.5	7	14.1	40.9	23.4	9	14.7
Receptor 5	22.7	19.3	3	11.9	24.5	19.7	3	12.1
Receptor 6	24.5	18.9	2	11.6	24.9	19.0	2	11.6
Receptor 7	22.8	18.6	2	11.4	23.5	18.8	2	11.5
Receptor 8	29.8	19.5	3	12.0	30.6	19.7	3	12.2
Receptor 9	27.9	20.4	4	12.6	29.8	20.9	5	12.9
Receptor 10	29.4	20.7	4	12.8	31.2	21.1	5	13.1
Receptor 11	21.3	19.1	2	11.7	24.0	19.5	3	12.0
Objectives	40	40	35	25[c]	40	40	35	25[c]

[a] Objective exceedences highlighted in bold.

[b] The numbers of days with PM_{10} concentrations greater than 50$\mu g/m^3$ has been estimated from the relationship with the annual mean concentration described in Defra, 2009a.

[c] There are no objectives for $PM_{2.5}$ that apply during these years, however the European Union limit value of 25 $\mu g/m^3$ is to be met by 2015.

12.5.3 All of the predicted annual mean nitrogen dioxide concentrations are well below 60 $\mu g/m^3$, and thus Defra and the DAs (2009a) suggests that exceedences of the 1-hour objective for nitrogen dioxide will be unlikely. The relationship presented by Defra and the DAs may, however, not always apply in situations where traffic flows are heavily influenced by atypical events. It is thus worthwhile considering whether match event flows are likely to give rise to exceedences of the 1-hour objective for nitrogen dioxide.

12.5.4 The 1-hour objective would only be exceeded if there were more than 18 exceedences of 200 $\mu g/m^3$ as a 1-hour mean nitrogen dioxide concentration within a calendar year. Match event traffic would thus only be likely to lead to an objective exceedence if a large number of additional trips coincided with periods during which existing traffic flows were high and meteorological conditions were particularly poor more than 18 times in a year. As noted in Section 12.3, it is assumed that in a typical year, the Scheme is likely to cater for four full-capacity crowds at the Celtic Crusaders Stadium (1,240 vehicle trips), nine part-capacity crowds at the Celtic Crusaders Stadium (1,091 vehicle trips), 15 capacity crowds at Bridgend Ravens (1,040 vehicle trips), and 19 capacity crows at Bridgend Town FC/tennis centre (667

vehicle trips). These events are highly unlikely take place during weekday peak-hours, when the road network is at its busiest and thus local emissions are highest. Taking account of the number of events in a year, the level of traffic generation associated with these events, and the likelihood of them coinciding with poor air quality conditions, it is considered that the risk of the 1-hour air quality objective being exceeded is negligible.

12.5.5 The changes in annual mean concentrations and days with PM_{10} >50 µg/m^3 brought about by the scheme are shown in Table 12.14. The largest predicted change in nitrogen dioxide concentrations is at Receptor 11, which is opposite the entrance to the science park. Here, the predicted change in concentrations would be 13%, or medium in terms of the criteria given in Table 12.5. Since the predicted concentrations would remain well below the objective with or without the proposed scheme, this impact is judged to be slight adverse in terms of the criteria given in Table 12.6. All of the other predicted changes in annual mean nitrogen dioxide concentrations are either slight adverse or negligible, with the exception of Receptor 4. At Receptor 4, an 8% increase would cause the concentration to move from below to above the objective. Table 12.6 suggests that this impact should be described as substantial adverse. In terms of PM_{10} and $PM_{2.5}$, all of the predicted changes are judged to be negligible. It should be stressed that these results are based upon worst-case traffic data assumptions as described in Chapter- 6 and will thus tend to over-state the air quality impacts.

Table 12.14: Change in Predicted Concentrations Between "With Scheme" and "Without Scheme" Conditions in 2012[a]

Location	NO_2	PM_{10}		$PM_{2.5}$
	Annual Mean (µg/m^3)	Annual Mean (µg/m^3)	No. Days >50µg/m^3	Annual Mean (µg/m^3)
Receptor 1	5.0%	1.1%	0.1	1.1%
Receptor 2	4.8%	1.1%	0.1	1.1%
Receptor 3	5.2%	1.9%	0.3	1.9%
Receptor 4	7.9%	4.0%	1.7	4.4%
Receptor 5	8.2%	1.9%	0.4	2.0%
Receptor 6	1.5%	0.5%	0.1	0.5%
Receptor 7	2.7%	0.8%	0.1	0.7%
Receptor 8	2.7%	1.0%	0.2	1.0%
Receptor 9	6.8%	2.3%	0.6	2.5%
Receptor 10	6.0%	2.2%	0.7	2.4%
Receptor 11	12.8%	2.4%	0.5	2.6%

[a] Based on un-rounded values

Boiler Impacts

12.5.6 The proposals would include a gas boiler along with sustainable heating sources such as solar power. Defra and the DAs (2009a) do not require local authorities to assess impacts related to gas boilers since they are considered unlikely to give rise to air quality problems. Furthermore, the boiler would be sited more than 200m from any existing residential receptors and would be vented by an appropriate stack. The risk of emissions from the boiler plant giving rise to any significant air quality impacts is thus judged to be negligible.

Construction Impacts

12.5.7 The site is currently farmland, and there will be no extensive demolition works required. The greatest potential for construction impacts is likely to be from the initial phase of site preparation, and from the passage of vehicles travelling across unpaved ground during periods of dry weather. There is also the potential for dust emissions during the handling of dusty materials and the cutting of stone/concrete. In addition, dust may be tracked out of the site onto the adjoining road network. Any impacts would be of a localised and temporary nature.

12.5.8 A total construction period of up to 20 months is envisaged for the sports and leisure phase and 60 months for the science park.

12.5.9 Construction traffic will initially access the site from Ewenny Road through the science Park. This will be for a period of about six months until the A48 access road is built. Once the A48 access road is constructed all development traffic will use this entrance.

12.5.10 Assuming that standard mitigation measures are applied, the construction activities are judged to be potentially “Major” in scale based upon the criteria defined in Table 12.3. Thus, significant dust-soiling impacts could occur within a distance up to 100 m from the source, whilst PM_{10} impacts could extend out to 25 m. Figure 3 in Appendix 12.2 shows the potential extent of construction dust-soiling.

12.5.11 The existing properties surrounding the proposed development are largely orientated with their gardens facing towards the site boundary. There is mature landscaping surrounding the site boundary, and the gardens of the existing residential properties are well screened.

12.5.12 Specific attention would need to be paid to construction activities carried out near to existing properties, particularly on occasions of southwesterly winds. However it should be noted that it is the distance from the dust-emitting source that is important, and the construction activity may not take place at the site boundary.

12.5.13 Dust can be tracked out of construction sites onto neighbouring roads. This can then be raised as airborne dust by passing vehicles. With mitigation, it is considered that there is a potential for significant dust to be found along off-site roads up to 250 m from the site entrance, with dust-soiling impacts potentially extending up to 50 m either side of these roads whilst PM_{10} impacts could extend out to 15 m. Figure 4 in Appendix 12.2 shows the extent of construction dust track-out. Dust emissions from the access road can be very effectively controlled, and it is not likely that significant impacts would occur.

12.5.14 There are no areas of sensitive vegetation within 25 m of the site boundary, and any significant impacts can be discounted.

12.5.15 Any effects will be temporary and relatively short-lived, and will only arise during dry weather with the wind blowing towards a receptor, at a time when dust is being generated and mitigation measures are not being fully effective. Such conditions would only arise occasionally during the construction period, further limiting the potential for any impacts.

12.6 Mitigation and Enhancements

Road Traffic Impacts

12.6.1 The assessment has shown that the scheme is likely to increase annual mean concentrations around Ewenny Junction. This is an area where existing air quality is known to be poor due to existing levels of traffic congestion and where the Council thus intends to instigate traffic improvement works (see Chapter 6). No precise details are available as to how the proposed traffic improvements might alter flows and speeds around the junction. In order to demonstrate the type of effect that might be achieved, the existing junction and road layout has been modelled using different average vehicle speed assumptions which simulate the effect of relieving congestion.

12.6.2 The predictions presented in Sections 12.4 and 12.5 are based upon assumed annual average speeds around Ewenny Junction which range from 10 to 40 kph on different sections of the junction and its approach roads. Table 12.15 presents the predicted concentrations at the worst-case receptor (Receptor 4) assuming that all of the average speeds around this junction are increased by 5kph and 10kph. This shows that relieving congestion around the junction and thus increasing average speeds has the potential to more than offset the increase in nitrogen dioxide concentrations associated with the proposed scheme and thus prevent the objective from being exceeded. Conditions in 2012 without the scheme but with improvements to the junction have not been modelled, but it is not unreasonable to assume that the change in concentrations at Receptor 4 would remain between 5% and 10% (as predicted in Table 12.14). Thus, the impact of the scheme would be, at most, slight adverse in terms of the criteria given in Table 12.6.

Table 12.15: Predicted Concentrations of Nitrogen Dioxide (NO_2), PM_{10} and $PM_{2.5}$ in 2012 - Annual Mean ($\mu g/m^3$) and Number of Days with PM_{10} > 50 $\mu g/m^3$ at Receptor 4 in 2012 With Scheme Assuming Different Junction Speeds

	NO_2	**PM_{10}**		**$PM_{2.5}$**
	Annual Mean	Annual Mean	Days	Annual Mean
Existing Junction Speeds	40.8	23.4	9	14.7
Junction Speeds + 5kph	38.8	23.0	8	14.3
Junction Speeds + 10kph	37.5	22.7	8	14.1
Objectives	**40**	**40**	**35**	**25**[a]

[a] Objective exceedences highlighted in bold.

12.6.3 The predictions presented above all assume that buses serving the park and ride would

conform to the national average bus fleet composition in 2012 as predicted by the DfT. A recent study on behalf of Defra and the DAs (Wilson, 2009) has shown (e.g. Figure 8 of Wilson, 2009) that upgrading a bus fleet from this default composition to one consisting entirely of newer buses which conform to emissions standard Euro IV, would reduce emissions of oxides of nitrogen by almost 40%. If it is assumed that emissions from park and ride buses are reduced by 40%, then the total predicted nitrogen dioxide concentration at Receptor 4 (at existing junction speeds) falls from 40.9 $\mu g/m^3$ to 40.8 $\mu g/m^3$.

Construction Impacts

12.6.4 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). 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:

- Phasing the development so that at any one time, construction activity is largely confined to relatively small portions of the site, away from occupied premises;
- 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 areas;
- 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;
- Minimising any dust generating activities on very dry or windy days;
- Sheeting of all lorries carrying materials on and off site;
- Locating 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.

12.6.5 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.

12.7 Summary and Conclusions

12.7.1 The air quality impacts associated with the construction and operation of the proposed development at Island Farm, Bridgend have been assessed. Existing conditions within the study area show that the annual mean objective for nitrogen dioxide is being exceeded around Ewenny Cross. The Council is investigating air quality in this area and may, in the future, need to declare and Air Quality Management Area for this pollutant.

12.7.2 The operational impacts are principally those associated with road traffic emissions. The impact of increased emissions arising from the additional traffic on local roads has been assessed. Concentrations have been modelled for eleven worst-case receptors, representing existing properties where impacts are expected to be greatest

12.7.3 The impact of road traffic emissions has been modelled using a standard approach, and it is concluded that if the scheme were to proceed without any upgrade to the existing Ewenny Cross junction, the annual mean objective for nitrogen dioxide would be exceeded. Because the objective would be exceeded, this impact has been judged to be substantial adverse. The same modelling shows that if annual average speeds around the junction were to increase by 5kph, the objective would not be exceeded. It is expected that in this situation, the impact of the scheme would be, at most, slight adverse.

12.7.4 Away from Ewenny Cross, no objective exceedences are predicted either with or without the proposed scheme and the impacts are judged to be, at most, slight adverse.

12.7.5 The construction works have the potential to create dust. During construction it will therefore be necessary to apply a package of mitigation measures to minimise dust emission. Even with these measures in place, there remains a risk that a number of existing off-site properties might be affected by occasional dust-soiling impacts. Any effects will be temporary and relatively short lived, and will only arise during dry weather with the wind blowing towards a receptor, at a time when dust is being generated and mitigation measures are not being fully effective. The overall impacts during construction are judged to be minor adverse.

12.8 References

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12.9 Glossary

Standards A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal.

Objectives A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides.

Exceedence A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations.

AQMA Air Quality Management Area

DMRB Design Manual for Roads and Bridges

ADMS Atmospheric Dispersion Modelling System

PM_{10} Small airborne particles less than 10 micrometers in aerodynamic diameter.

$PM_{2.5}$ Small airborne particles less than 2.5 micrometers in aerodynamic diameter.

NO_2 Nitrogen dioxide.

NO Nitric oxide.

NOx Nitrogen oxides (taken to be NO_2 + NO).

$\mu g/m^3$ Microgrammes per cubic metre.

HDV Heavy Duty Vehicles (> 3.5 tonnes)