8. AIR QUALITY

8.1 Introduction

8.1.1 This Chapter presents an assessment of the impacts of the proposed development on local air quality.

8.1.2 The interactions between the development and local air quality that will occur during the construction and operational phases of the development, and considered within this Chapter, are summarised below:

Impacts During Construction

- Emissions from construction plant and vehicles and the impact on local air quality both within the development site and on parts of the local road network used as haul routes and site access; and
- Dust and particulate disturbance and mobilisation during construction processes (site clearance, grading, landscaping, stockpiling, etc). Potential to effect parts of the development, which are already complete, and also off-site locations in proximity to the site of the construction activities.

Impacts During Operation

- Emissions from the proposed energy centre on the development site;
- Emissions from road traffic generated by the development using the surrounding network. There will be an impact on air quality within the development site itself, at locations adjacent to the surrounding road network and also, further afield, in the centre of Winchester, as traffic from the proposed development commutes into the city centre for business or leisure purposes.

8.1.3 The northwestern corner of the development site is located immediately to the south of the Harestock Waste Water Treatment Works. Atkins (on behalf of Southern Water) were consulted on the proposed development and they provided details of the existing odour releases from the Works (indicated in the form of an isopleth plot), which identifies an area within which sensitive development should not be located. This isopleth plot has been taken into account in the Masterplan with no built development located within the area on the ispoleth plot identified as being at risk of odour nuisance. There is currently no recurrent odour problem associated with Harestock Waste Water Treatment Works. Therefore, it is concluded that odour from the Works will not result in any adverse impact on the proposed development and no further consideration of odour is required in this Chapter.

8.2 Site Description

8.2.1 This site, known locally as Barton Farm, comprises 93.1 hectares of land. This area is allocated in the adopted Winchester District Local Plan as a reserve “Major Development Area” (MDA) to accommodate 2,000 new homes and a range of associated facilities. Winchester City Council (WCC) has declared an Air Quality Management Area (AQMA) in the city centre for the pollutants nitrogen dioxide (NO_2) and particulate matter (PM_{10}). This proposed development site lies to the north of the AQMA.

8.3 Assessment Methodology

8.3.1 The scope of this Chapter was outlined in the EIA Scoping Report submitted to Winchester City Council (WCC) and has been agreed with the Environmental Health Officer at WCC. It takes into account comments made on air quality in WCC’s Scoping Opinion (dated 21 April 2009). The methodology for the assessment of the impact of the proposed development on local air quality has included the following:

- Consultation with the Environmental Health Department of WCC, who have provided: information concerning the scope of the assessment relating to road traffic impacts during operation; details of air quality monitoring data for the city centre, which have been used in the

air quality assessment; and, detailed review and assessment information on local air quality in the city;

- A qualitative assessment of the potential impacts due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using information in guidance documents produced by the following organisations: Building Research Establishment (BRE), the Quality of Urban Air Review Group (QUARG), and the former Department of the Environment;
- An assessment of the impact on air quality due to emissions from traffic associated with the proposed development, once operational, using the dispersion model ADMS-Roads. The dispersion modelling will establish the impact of the proposed development on local air quality by predicting concentrations of relevant pollutants (nitrogen dioxide and particulate matter) both "without" and "with" development at a number of receptor locations shown on Figure 8.1. More details on the dispersion modelling are provided in Section 8.6;
- Assessment of emissions from the proposed energy centre using the dispersion model ADMS4.1; and
- Identification of suitable mitigation measures that should be applied during the construction and operational phases of the proposed development to reduce any adverse impacts.

8.4 Planning Policy

National Planning Policy and Guidance

Air Quality Strategy and Regulations (July 2007)

8.4.1 The Air Quality Strategy (AQS)[1] updated in July 2007 sets out the UK Government's policy on air quality. The AQS sets standards and objectives for nine main air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter, sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs).

8.4.2 Many of the objectives in the AQS were made statutory in England with the Air Quality (England) Regulations 2000[2] and the Air Quality (England) (Amendment) Regulations 2002[3] for the purpose of Local Air Quality Management (LAQM). The standards and objectives for each pollutant in the AQS and the Regulations are given in Appendix 8.1.

8.4.3 The AQS published in 2007 replaces the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (January 2000) and Addendum (February 2003). The majority of objectives set out in the previous version of the AQS have been retained; however the provisional objectives previously proposed for PM_{10} have been replaced in England, Wales and Northern Ireland with a new framework for considering the effects of a finer group of particulates known as '$PM_{2.5}$'. However, there is currently no requirement for Local Authorities to assess this pollutant as part of their statutory obligations.

The Environment Act (1995) – Local Air Quality Management (LAQM)

8.4.4 Under Part IV of the Environment Act[4], Local Authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives by the years defined in the Regulations. Where the objectives of the Air Quality Regulations are not likely to be achieved by the objective year, an Authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the Local Authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

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[1] Department for Environment, Food, and Rural Affairs (DEFRA) (July 2007) *The Air Quality Strategy for England, Scotland, Wales and Northern Ireland* (Volumes 1 and 2)
[2] HMSO (2000) *The Air Quality (England) Regulations 2000 – Statutory Instrument 2000 No.928*
[3] HMSO (2002) *The Air Quality (England) (Amendment) Regulations 2002 – Statutory Instrument 2002 No.3043*
[4] HMSO (1995) *The Environment Act*

8.4.5 The Department for Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by Local Authorities in their review and assessment work. This guidance, referred to in this Chapter as LAQM.TG(09)[5], has been used where appropriate in the assessment presented herein.

The Environmental Protection Act (1990)

8.4.6 Section 79 of the Environmental Protection Act[6], states that where a statutory nuisance is shown to exist, the Local Authority must serve an abatement notice. Definitions of statutory nuisance relevant to dust and particles are:

> ***"Any dust, steam, smell or other effluvia arising from industrial, trade or business premises or smoke, fumes or gases emitted from premises so as to be prejudicial to health or a nuisance", and***
>
> ***"any accumulation or deposit which is prejudicial to health or a nuisance"***

8.4.7 Failure to comply with an Abatement Notice is an offence and if necessary, the Local Authority may abate the nuisance and recover expenses.

8.4.8 Nuisance could be caused to occupiers of existing properties near to the proposed development due to dust/particulate generation during the construction phase. 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.

Planning Policy Statement 23 (PPS23) – Planning and Pollution Control

8.4.9 Policy guidance for Local Planning Authorities (in England only) regarding local air quality and new development is provided in PPS23[7]. PPS23 advises on the policies and practices that should be taken into account by those involved in the planning of any development that has the potential to cause pollution.

8.4.10 With regard to emissions to air, and specifically local air quality management, Appendix 1G of Annex 1 in PPS23 states that ***"any air quality consideration that relates to land use and its development is capable of being a material planning consideration"***. This is most likely to be the case in situations where the proposed development could produce an exceedence of the AQS objectives and result in an AQMA designation, or where development is proposed in an AQMA, or where a proposed development renders a Local Authority's AQAP unworkable. PPS23 also re-iterates that the presence of an AQMA should not result in the sterilisation of a site from development.

Regional Planning Policy

The South East Plan

8.4.11 The South East Plan[8] (adopted in May 2009) contains a couple of policies specific to air quality. Policy NRM9 – Air Quality states:

> ***"Strategies, plans, programmes and planning proposals should contribute to sustaining the current downward trend in air pollution in the region. This will include seeking improvements in air quality so that there is a significant reduction in the number of days of medium and high air pollution by 2026. Local development documents and development control can help to achieve improvements in local air quality through:***

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

[6] HMSO (1990) *The Environmental Protection Act*

[7] Communities and Local Government: *Planning Policy Statement 23: Planning and Pollution Control* (Oct 2004).

[8] Government Office for the South East (May 2009) *The South East Plan – Regional Spatial Strategy for the South East of England.*

(i) ensuring consistency with Air Quality Management Plans;
(ii) reducing the environmental impacts of transport, congestion management, and support the use of cleaner transport fuels;
(iii) mitigating the impact of development and reduce exposure to poor air quality through design, particularly for residential development in areas which already, or are likely to, exceed national air quality objectives;
(iv) encouraging the use of best practice during construction activities to reduce the levels of dust and other pollutants;
(v) assessing the potential impacts of new development and increased traffic levels on internationally designated nature conservation sites, and adopt avoidance and mitigation measures to address these impacts".

8.4.12 Policy NRM12 states:

> ***"Local development documents and other policies should encourage the integration of combined heat and power (CHP), including mini and micro–CHP, in all developments and district heating infrastructure in large scale developments in mixed use. The use of biomass fuel should be investigated and promoted where possible. Local authorities using their wider powers should promote awareness of the benefits of mini and micro-CHP in the existing build stock"***.

Local Planning Policy

Winchester District Local Plan

8.4.13 Policy DP.10 of the District Local Plan in particular relates to air quality and states:

> ***"Development which may generate air, land, light, surface water or groundwater pollution, and which accords with other relevant policies of this Plan, will only be permitted where the Local Planning Authority is satisfied that it has been designed to reduce the impact to an acceptable level. Proposals should comply with statutory standards of environmental protection policies required by the pollution control authorities, and include a statement setting out how the requirements have been met in designing the proposal"***.

8.4.14 WCC is currently working on their Local Development Framework (LDF). The LDF will consist of a folder of documents which will address the Winchester District community's economic, environmental, and social aims. The LDF is led by policies written in the regional plan known as a Regional Spatial Strategy, or for us, the South East Plan. With time the LDF will replace the Local Plan Review. A consultation draft of one of the documents that will be included in the LDF, the Core Strategy Preferred Option, is available on the Council's website. This document includes the strategic allocation of the Barton Farm site for mixed use development including 2,000 residential dwellings.

8.5 Baseline Conditions

8.5.1 The main source of emissions to air in the vicinity of the site is vehicles using the local road network.

8.5.2 Consultations with WCC confirmed that there are no significant industrial processes that will affect air quality in the locality of the site, and there are no current known issues concerning pollution, odour or other air quality related issues applicable to the site itself.

8.5.3 Background concentrations at locations outside of the city centre will be different to locations within Winchester City Centre. Consequently, two sets of background concentrations have been used in the assessment, one for receptors within the city centre and one for receptors outside the city centre. The location of the assessment receptors is shown on Figure 8.1.

8.5.4 Total background concentrations obtained from the UK Air Quality Archive[9] have been used to assess pollution concentrations at receptors located outside the city centre (receptors 1–11, 16–31 and 35–36) and are presented below in Table 8.1 for all assessment years. Background values for oxides of nitrogen (NO_x) are presented, as they are required in the conversion of modelled NO_x concentrations to total NO_2.

Table 8.1: Background Concentrations for Receptors Outside of the City Centre

Pollutant (μg/m^3)	2008	2009	2013	2018	2023
NO_x	18.75	17.87	15.43	13.26	12.50
NO_2	15.16	14.62	13.00	11.05	10.48
PM_{10}	17.19	17.00	16.57	16.29	16.21

8.5.5 Background concentrations obtained from WCC's automatic monitoring station at Godson House, near Friarsgate, have been used to assess pollution concentrations at receptors located within the city centre (receptors 12–15, 32–34 and 37-42). The 2008 concentrations measured at this monitoring site were factored forward to the assessment years using estimated background concentrations from the UKAQA for grid square 447500, 131500 and following guidance in given in LAQM.TG(09).

8.5.6 Table 8.2 shows the estimated and measured background concentrations of oxides NO_x, NO_2, and PM_{10} that were used in the assessment for the receptors inside the city centre**.**

Table 8.2: Background Concentrations for Receptors Inside of the City Centre

Pollutant (μg/m^3)	2008	2009	2013	2018	2023
NO_x	52.00	49.40	42.64	36.92	34.84
NO_2	27.00	25.92	23.22	19.71	18.63
PM_{10}	18.00	17.82	17.28	17.10	16.92

8.5.7 The data presented in Tables 8.1 and 8.2 indicate that NO_2 and PM_{10} concentrations, both measured and predicted, meet and will continue to meet the AQS objectives for these pollutants. Background concentrations of both pollutants are higher in the City Centre than outside, with NO_2 concentrations in the city centre being approximately 8-12μg/m^3 higher than those for locations outside the city centre.

Local Air Quality Monitoring

8.5.8 WCC currently carries out real-time monitoring of air quality at two locations in the city centre – a roadside site, in St Georges Street and an urban background site near Friarsgate. WCC also carries out diffusion tube monitoring throughout the city at a number of locations adjacent to principal routes through the city. These ongoing monitoring programmes have been underway for a number of years and are run by WCC as part of its air quality management programme, and to inform the review and assessment process.

8.5.9 Concentrations of NO_2 and PM_{10} measured at the automatic monitoring stations within the city centre are provided in Table 8.3 below.

[9] www.airquality.co.uk

Table 8.3: Concentrations Measured at Automatic Monitoring Stations in the City Centre 2006-2008

Pollutant	2006	2007	2008
Friarsgate (urban background)			
Annual mean NO_2 (µg/m^3)	28.0	27.0	27.0
Number of hourly mean NO_2 > 200µg/m^3	0	0	0
Annual mean PM_{10} (µg/m^3)	20.0	19.0	18.0
Number of 24 hour mean PM_{10} > 50µg/m^3	8	10	5.0
St George's Street (roadside)			
Annual mean NO_2 (µg/m^3)	51.0	51.0	48.0
Number of hourly mean NO_2 > 200µg/m^3	0	0	0
Annual mean PM_{10} (µg/m^3)	27.0	25.0	22.0
Number of 24 hour mean PM_{10} > 50µg/m^3	15	15	9

8.5.10 Table 8.3 indicates that the AQS objectives for NO_2 and PM_{10} concentrations were met at the Friarsgate site from 2006 to 2008 inclusive. The AQS objectives for NO_2 and PM_{10} concentrations were met at the St George's Street site from 2006 to 2008 inclusive, with the exception of annual mean NO_2 concentrations, which exceeded the corresponding AQS objective in all three years.

8.5.11 Concentrations of NO_2 measured at diffusion tube monitoring sites within the City over the last three full years when data were available are given in Table 8.4 below.

Table 8.4: Local Monitoring Data 2006-2008

Site	Location	Distance from Kerb (m)	Height above Ground (m)	Measured Concentration (µg/m^3)		
				2006	2007	2008
1	10 Eastgate Street	5.6	1.7	44.8	38.5	39.6
2	Co-located with Urban Background Monitoring Station at Friarsgate	9.7	1.8	44.1	41.0	39.3
3	Co-located with Urban Background Monitoring Station at Friarsgate	9.7	1.8	45.5	41.4	40.7
4	Co-located with Urban Background Monitoring Station at Friarsgate	9.7	1.8	44.1	40.4	39.6
5	Friarsgate	4.3	2.4	36.7	33.9	33.2
6	Upper Brook Street	8	2.5	49.7	46.8	49.8
7	Co-located with Roadside Monitoring Station at St George's Street	3.1	1.7	49.6	50.8	47.5

8	Co-located with Roadside Monitoring Station at St George's Street	3.1	1.7	49.1	50.3	48.3
9	Co-located with Roadside Monitoring Station at St George's Street	3.1	1.7	53.7	51.5	48.4
10	St Georges Street (1)	4.1	2.5	67.1	65.6	60.6
11	St Georges Street (2)	3.6	2.4	72.5	62.4	63.6
12	Jewry Street (1)	4.1	2.4	53.3	49.7	47.2
13	Jewry Street (2)	2.8	2.4	61.0	59.1	57.9
14	Southgate Street (1)	3.7	2.6	45.4	45.0	44.2
15	Southgate Street (2)	2.1	2.5	55.7	55.1	51.0
16	Sussex Street	3.6	2.6	47.4	44.1	46.0
17	City Road	6.6	3.0	48.9	42.2	40.7
18	74 North Wallis	1.2	2.7	54.8	46.5	47.1
19	15 North Wallis	3.7	2.3	41.5	36.7	36.9
24	Stockbridge Road	5.4	2.0	30.2	30.1	34.7
25	Andover Road (1)	6.5	2.3	36.4	36.9	35.4
26	Worthy Road (1)	2.2	2.5	39.0	35.9	33.3
27	Worthy Road (2)	2.2	2.5	37.7	36.9	34.3
28	Worthy Road (3)	2.2	2.5	38.4	36.9	34.9
31	Andover Road (2)	4.2	2.2	45.2	40.5	40.1
32	Bus Station	n/a	2.4	55.6	49.7	43.8
33	Parchment Street	1.2	2.2	39.0	32.4	32.3
34	Middle Brook Street	1.5	2.3	31.0	28.9	26.5

8.5.12 Table 8.4 indicates that the objective for annual mean NO_2 concentrations was exceeded at the majority of locations in the city centre between 2006 and 2008. The objective was met at a number of locations to the north of the city centre over the same period, with the exception of Site 31, located at the junction of Andover Road and Worthy Lane, where the objective was exceeded in all three years.

8.5.13 Annual mean NO_2 concentrations decreased at the majority of monitoring sites between 2006 and 2008. Concentrations remained relatively constant at the following locations - Upper Brook Street, Sussex Street and at the automatic monitoring station at St George's Street. However, significant decreases in annual mean NO_2 concentrations were measured at Sites 10 and 11, also located on St George's Street, over the same period.

Winchester City Council Review and Assessment of Local Air Quality

8.5.14 To date WCC has completed a comprehensive programme of modelling and monitoring of local air quality in the centre of the city as part of the review and assessment process. As a result of the findings of this work an AQMA was declared in Winchester City Centre due to predicted and measured exceedences of the AQS objectives for annual mean NO_2, annual mean PM_{10} and daily

mean PM_{10} concentrations. However, the Environmental Health Officer at WCC has advised that the AQMA designation for PM_{10} will be revoked in the near future as concentrations of this pollutant are below the relevant AQS objectives.

8.5.15 In 2006 WCC published their Air Quality Action Plan (AQAP). The AQAP details a number of measures to help improve air quality including:

- Providing an additional Park-and-Ride facility to the south of Winchester;
- Reviewing traffic management in the city including improving the communication of travel information in the city;
- Developing a Walking and Cycling Strategy;
- Continuation of roadside vehicle emissions testing;
- Continuation of environmentally linked parking strategy (offers discounts on city centre car park season tickets to drivers of "clean" vehicles);
- Reducing the level of emissions from the local bus fleet and from WCC and Hampshire County Council fleet vehicles;
- Raising public awareness of air quality issues;
- Encouraging businesses, schools and other organisations to develop Travel Plans; and
- Ensuring that new developments and transport schemes take account of their effects on air quality and the AQMA.

8.6 Identification and Evaluation of Key Impacts

Identification of Key Impacts

8.6.1 The key impact associated with the proposed development once operational is the change in local air quality due to vehicles accessing and leaving the site. Although, this is an important consideration along the road network in the vicinity of the site it is also of importance in the centre of Winchester where WCC has designated an AQMA.

Evaluation of Key Impacts – Road Traffic

8.6.2 For the prediction of impacts due to emissions arising from road traffic during operation, the air pollutant dispersion model ADMS Roads has been used. This 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.

8.6.3 Meteorological data, such as wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the Met Office observing station at Bournemouth Airport for 2008 at the request of WCC's Environmental Health Officer.

8.6.4 For the assessment, eight scenarios were modelled. These scenarios are as follows:

- 2008 "Model Verification";
- 2009 "Baseline";
- 2013 "Without Development";
- 2013 "With Development";
- 2018 "Without Development";
- 2018 "With Development";
- 2023 "Without Development"; and
- 2023 "With Development".

8.6.5 2013 is the year of first completions when 5% of total development will be operational. 2018 is the year in which 50% of total development will be operational and 2023 is the year in which it is anticipated that the whole development will be operational.

8.6.6 A summary of the traffic data and pollutant emission factors used in the assessment can be found in Appendix 8.2. It includes details of the traffic flows and speeds used for the road network

modelled in all assessment years considered. It should be noted that the proposed Local Centre and New Andover Road will not create a street canyon effect as the height of the proposed buildings either side of the New Andover Road is less than the distance between them. All of the roads modelled within the city centre have been modelled as street canyons at the request of the Environmental Health Officer at WCC.

8.6.7 Modelled annual mean oxides of nitrogen (NO_x) concentrations were converted to annual mean NO_2 concentrations using the methodology given in LAQM.TG(09) and the NO_x:NO_2 calculator available from the UKAQA. The calculator provides a method of calculating NO_2 from NO_x wherever NO_x emissions from road traffic are predicted using dispersion modelling.

8.6.8 For PM_{10}, the modelled annual mean concentrations were used to calculate the number of exceedences of the 24-hour mean objective for direct comparison with the relevant AQS objective, following the methodology given in LAQM.TG(09).

8.6.9 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, research carried out in 2003[10], determined that exceedences of the 1 hour mean objective were unlikely to occur where annual mean concentrations were below 60µg/m^3. Further research carried out in 2008[11] generally supported this relationship and as a result this criterion has been adopted for the purposes of local air quality review and assessment.

8.6.10 The ADMS Roads dispersion model has been widely validated for this type of assessment and is considered to be fit for purpose.

8.6.11 Model validation undertaken by the software developer will not have included validation in the vicinity of the development considered in this assessment. It is therefore necessary to perform a comparison of modelled results with local monitoring data at relevant locations. This process of verification attempts to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

8.6.12 Suitable local monitoring data for the purpose of model verification is available for concentrations at the locations shown in Table 8.5 below.

Table 8.5: Local Monitoring Data Used For Verification

Pollutant	Monitoring Site	2008 Annual Mean Concentration (µg/m^3)
NO_x	Diffusion Tube 12 Jewry Street (1)	NO_2 = 47.2
	Diffusion Tube 13 Jewry Street (2)	NO_2 = 57.9
	Diffusion Tube 25	NO_2 = 35.4
	St George's Street Automatic Monitor	NO_2 = 48.0
PM_{10}	St George's Street Automatic Monitor	PM_{10} = 22.0

8.6.13 Model verification has been undertaken following the methodology specified in Annex 3 of LAQM.TG(09) using the NO_x:NO_2 calculator available from the UKAQA to calculate the roadside NO_x component of the annual mean NO_2 concentrations measured at the diffusion tube sites.

[10] 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).
[11] A Cook: *Analysis of the relationship between annual mean nitrogen dioxide concentration and exceedences of the 1-hour mean AQS Objective* (2008).

8.6.14 For the verification of modelled NO_x roads component, two factors were calculated; one for receptors located outside the city centre (receptors 1–11, 16–31 and 35–36) using Diffusion Tube Sites 12 and 13, and one for receptors located inside the city centre (receptors 12–15, 32–34 and 37–42) using Diffusion Tube Site 25 at St George's Street Automatic Monitor.

8.6.15 Details of the verification calculations are presented in Appendix 8.3.

8.6.16 For the receptors outside of the City Centre, a factor of **11.01** was obtained during the verification process, whilst a factor of **6.16** was calculated for the receptors inside of the city centre (see Figure 8.1 for assessment receptor locations). These factors have been applied to the modelled NO_x roads component before addition of the relevant background NO_x concentrations and conversion to annual mean NO_2 concentrations.

8.6.17 A factor of **6.35** was obtained during the verification process for PM_{10} and this factor has been applied to the modelled PM_{10} roads component before addition of the background PM_{10}concentrations at all receptor locations.

Evaluation of Key Impacts – Energy Centre

8.6.18 The development proposals include an Energy Centre which is likely to contain two 350 kW(th) / 195kW(e) gas fired CHPs, three 600kW gas fired boilers and one 400kW gas fired boiler. Exact release parameters for these boilers are currently not known as the detailed design for the Energy Centre has not been undertaken; therefore estimates of these parameters have been made using suitable information for similar sized boilers from a manufacturer. Further air quality assessment will be required at the detailed design stage of the Energy Centre to update the modelling undertaken here.

8.6.19 It has been assumed for the purposes of this EIA that there will be three stacks associated with the Energy Centre: one for the CHP; one for the 600kW boilers; and a third for the 400kW boiler. It has been assumed that these will all be located next to each other in the centre of the Energy Centre roof. The stack heights have all been assumed to be 19m based on the location of the Energy Centre and the minimum requirement for discharge stacks heights as given in the HMIP Technical Guidance Note (Dispersion) D1 document (1990), which is that ***"a discharge stack should be at least 3m above any opening windows or ventilation inlets within a distance of 5 times the uncorrected stack height".*** These assumptions have been used in other parts of the EIA, such as the Landscape and Visual Impact Assessment documented at Chapter 11 of this Environmental Statement.

8.6.20 For the prediction of impacts due to emissions arising from the Energy Centre, the dispersion model ADMS 4.1 has been used. This model uses detailed information regarding emissions to air from industrial sources and local meteorological conditions to predict pollution concentrations at specific locations selected by the user. The meteorological data used in ADMS 4.1 was the same as used for the ADMS Roads modelling.

8.6.21 The predicted contribution of the Energy Centre emissions to concentrations of NO_2 at the receptors used in the assessment were added to the verified results for annual mean NO_2 concentrations from the ADMS Roads modelling to obtain total annual mean NO_2 concentrations for 2018 and 2023.

8.6.22 The table below (Table 8.6) shows the emission release parameters used in the assessment for modelling emissions from the Energy Centre.

Table 8.6: Emission Release Parameters for Energy Centre

Source	Stack height (m)	Stack Diameter (m)	Efflux Velocity (m/s)	Release Temperature (^{0}C)	NOx Emission Rates (g/s)
Each Gas CHP	19	0.25	3	71	0.0041
Each 600kW Gas Boiler	19	0.30	3	72	0.0070
400kW Gas Boiler	19	025	3	71	0.0041

8.6.23 It has been assumed that all of the boilers will be operating continuously on full load for 24 hours a day, everyday, for all months of the year, as this will provide a worst case assessment. It has also been assumed that all of the NO_x emitted from the Energy Centre will be converted to NO_2, which will also provide a worst case assessment.

8.6.24 The plant within the Energy Centre will not be fully utilised until 2023 when the development is expected to be fully operational, however it will be operational to a certain level in 2018, when approximately half of the development will be occupied. However, it has been assumed, in order to provide a worst case assessment, that the Energy Centre will be fully operational in 2018.

8.6.25 Quantitative assessments of the impacts on local air quality associated with the operation of the development have been completed against the current statutory standards and objectives for NO_2 and PM_{10} set out in Appendix 8.1 and evaluated against the significance criteria provided in Appendix 8.4.

8.6.26 To complete the assessment of operational phase impacts, a number of "receptors" were identified at which pollution concentrations were predicted. The locations of the assessment receptors are shown on Figure 8.1. They include locations adjacent or near to the routes that are likely to experience the greatest change in traffic volume as a result of the proposed development in addition to locations on the proposed development site itself.

8.6.27 The results of the dispersion modelling are discussed below and presented in Appendix 8.5.

Annual Average NO_2 Concentrations

8.6.28 The objective for annual mean NO_2 concentrations is 40µg/m^3 to be achieved by the end of 2005. The results of the dispersion modelling show that in the assessment years of 2008 and 2009 this concentration will be exceeded at 16 and 14 of the assessment receptors respectively. These receptors include some residential properties along Andover Road (Receptor Numbers 6, 7, 9, 10 and 11), some residential properties in Bereweeke Road (Receptor Number 20) and Stockbridge Road (Receptor Number 21) plus locations in the City Centre (Receptor Numbers 31-33, 36-41). The latter results agree with the conclusions of WCC's review and assessment work, which were that exceedences for this pollutant and averaging period were occurring in the city centre. The exceedences predicted at other locations may suggest the model is over predicting concentrations.

8.6.29 The highest predicted concentrations in 2008 and 2009 are 59.68µg/m^3 and 57.35µg/m^3 predicted at the city library (Receptor Number 38). However, the objective will not apply at this location as members of the public will not be present over the averaging period of the objective.

8.6.30 In the assessment year of 2013 (year of first completions), exceedences of the objective are predicted at 13 assessment receptors both with and without the development. The highest predicted concentrations are 51.41µg/m^3 and 51.45µg/m^3 for the "without" and "with development" scenarios respectively. These concentrations are again predicted at the city library (Receptor Number 38), where the objective will not apply. At all but one of the assessment receptors within the proposed development site, predicted concentrations meet the objective. A concentration of 41.92µg/m^3 is predicted at the proposed recreation space near the Local Centre (Receptor Number 44). However, the objective will not apply at this location as members of the public will not be present over the averaging period of the objective.

8.6.31 The proposed development will lead to an increase in annual mean NO_2 concentrations at the majority of assessment receptors in 2013. The maximum predicted increase is 2.91µg/m^3 at 77 Andover Road (Receptor Number 5). At all other receptors where an increase is predicted, the predicted increases range from 0.01 to 0.36µg/m^3. Some decreases are predicted to occur (at eight assessment receptors adjacent to the Andover Road and Stoney Lane – Receptor Numbers 1-4 and 24-27 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 7.18µg/m^3 at 95 Andover Road (Receptor Number 4).

8.6.32 16 assessment receptors are located within WCC's AQMA (Receptor Numbers 8-12, 15, 31-33, 35 to 41). In 2013, with the development partially operational, the increases in concentrations associated with the development range from 0.02-0.15µg/m^3. Exceedences are predicted at 11 of the assessment receptors, and therefore the impact of development traffic in the AQMA ranges from minor adverse to insignificant.

8.6.33 In the assessment year of 2018 (50% of the development operational), exceedences of the objective are predicted at eight assessment receptors in the "without development" scenario and nine assessment receptors in the "with development" scenario. The highest predicted concentrations are 46.52µg/m^3 and 46.91µg/m^3 for the "without" and "with development" scenarios respectively. These concentrations are again predicted at the city library (Receptor Number 38), where the objective will not apply. Concentrations meet the objective at all locations within the proposed development site.

8.6.34 The proposed development will lead to an increase in annual mean NO_2 concentrations at the majority of assessment receptors in this year. The maximum predicted increase is 4.12µg/m^3 at 77 Andover Road (Receptor Number 5). At all other locations where an increase is predicted, the predicted increases range from 0.03 to 1.60µg/m^3. Some decreases are predicted to occur (at three assessment receptors adjacent to the Andover Road – Receptor Numbers 2-4 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 6.32µg/m^3 at 95 Andover Road (Receptor Number 4).

8.6.35 In 2018, with some of the development operational, the increase in concentrations predicted at the receptors within WCC's AQMA range from 0.19 to 1.17µg/m^3. Exceedences are predicted at eight of the assessment receptors, and therefore the impact of development traffic in the AQMA ranges from minor adverse to insignificant.

8.6.36 In the assessment year of 2023 (development fully operational), exceedences of the objective are predicted at seven assessment receptors in the "without development" scenario and nine assessment receptors in the "with development" scenario. The highest predicted concentrations are 45.70µg/m^3 and 46.32µg/m^3 for the "without" and "with development" scenarios respectively. These concentrations are again predicted at the city library (Receptor Number 38), where the objective will not apply. A concentration of 40.35µg/m^3 is predicted at the proposed recreation space near the Local Centre (Receptor Number 44). However, the objective will not apply at this location as members of the public will not be present over the averaging period of the objective. The objective is met at all other receptors within the proposed development.

8.6.37 The proposed development will lead to an increase in annual mean NO_2 concentrations at the majority of assessment receptors in 2023. The maximum predicted increase is 5.61µg/m^3 at 77 Andover Road (Receptor Number 5). At all other locations where an increase is predicted, the predicted increases range from 0.12 to 3.29µg/m^3. Some decreases are predicted to occur (at three assessment receptors adjacent to the Andover Road – Receptor Numbers 2-4 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 6.07µg/m^3 at 95 Andover Road (Receptor Number 4).

8.6.38 In 2023, with the development fully operational, the increase in concentrations predicted at the receptors within WCC's AQMA range from 0.37 to 2.51µg/m^3. Exceedences are predicted at eight of the assessment receptors, and therefore the impact of development traffic in the AQMA ranges from minor adverse to insignificant.

8.6.39 According to the assessment significance criteria, the overall impact of the proposed development on annual mean NO_2 concentrations is: moderate adverse at one receptor; minor

adverse at thirteen receptors, insignificant at twenty four receptors; minor beneficial at two receptors; and, moderate beneficial at one receptor.

Hourly Average NO_2 Concentrations

8.6.40 The annual mean NO_2 concentrations predicted by the model were all below 60µg/m^3, and therefore exceedences of the hourly mean NO_2 concentration objective are unlikely to occur.

8.6.41 These results agree with the conclusions of WCC's review and assessment work.

Annual Average PM_{10} Concentrations

8.6.42 The objective for annual mean PM_{10} concentrations is 40µg/m^3 to be achieved by the end of 2004. The results of the dispersion modelling show that in the assessment years of 2008 and 2009 this objective is met at all of the assessment receptors. The highest predicted concentrations in 2008 and 2009 are 22.18µg/m^3 and 21.77µg/m^3 predicted at the city library (Receptor Number 38). However, the objective will not apply at this location as members of the public will not be present over the averaging period of the objective.

8.6.43 These results agree with the Environmental Health Officer at WCC's advice that exceedences for this pollutant and averaging period are not currently occurring in the city centre.

8.6.44 In the assessment year of 2013 (year of first completions), the highest predicted concentrations are 20.31µg/m^3 both "without" and "with development". These concentrations are again predicted at the city library (Receptor Number 38), where the objective will not apply.

8.6.45 The proposed development will lead to an increase in annual mean PM_{10} concentrations at twenty two of the assessment receptors in 2013. The maximum predicted increase is 0.15µg/m^3 at 77 Andover Road (Receptor Number 5). At the remaining receptors where an increase is predicted, the predicted increases range from 0.01 to 0.02µg/m^3. Decreases in concentrations are predicted to occur at three assessment receptors adjacent to the Andover Road (Receptor Numbers 2-4 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 0.28µg/m^3 at 95 Andover Road (Receptor Number 4). No change in concentrations is predicted at the remaining assessment receptors.

8.6.46 In the assessment year of 2018 (50% of the development operational), the highest predicted concentrations are 19.79µg/m^3 and 19.85µg/m^3 for the "without" and "with development" scenarios respectively. These concentrations are predicted at Crown Walk (Receptor Number 37).

8.6.47 The proposed development will lead to an increase in annual mean PM_{10} concentrations at the majority of the assessment receptors in 2018. The maximum predicted increase is 0.23µg/m^3 at 77 Andover Road (Receptor Number 5). At all other receptors where an increase is predicted, the predicted increases range from 0.01 to 0.11µg/m^3. Decreases in concentrations are predicted to occur at three assessment receptors adjacent to the Andover Road (Receptor Numbers 2-4 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 0.24µg/m^3 at 95 Andover Road (Receptor Number 4). No change in concentrations is predicted at four assessment receptors.

8.6.48 In the assessment year of 2023 (development fully operational), the highest predicted concentrations are 19.68µg/m^3 and 19.79µg/m^3 for the "without" and "with development" scenarios respectively. These concentrations are again predicted at Crown Walk (Receptor Number 37).

8.6.49 The proposed development will lead to an increase in annual mean PM_{10} concentrations at the majority of the assessment receptors. The maximum predicted increase is 0.34µg/m^3 at 77 Andover Road (Receptor Number 5). At all other receptors where an increase is predicted, the predicted increase ranges from 0.01 to 0.22µgm^3. Decreases in concentrations are predicted to occur at three assessment receptors adjacent to the Andover Road (Receptor Numbers 2-4 inclusive) as a result of the opening of the New Andover Road. The maximum predicted decrease is 0.23µg/m^3 at 95 Andover Road (Receptor Number 4).

8.6.50 According to the assessment significance criteria, the impact of the proposed development on annual mean PM_{10} concentrations is not significant.

Daily Average PM_{10} Concentrations

8.6.51 The objective for 24 hourly mean PM_{10} concentrations is 50µg/m^3 to be exceeded no more than 35 times a year by the end of 2004 and thereafter. The results of the dispersion modelling show that in the assessment years of 2008 and 2009 the number of days of exceedence is a maximum of 7 and 6 respectively, which is below the objective.

8.6.52 These results agree with the Environmental Health Officer at WCC's advice that exceedences for this pollutant and averaging period are not occurring in the City Centre.

8.6.53 The results of the dispersion modelling show that in the assessment years of 2013 and 2018 the number of days of exceedence is a maximum of 4 and 3 respectively, both with and without development. In the final assessment year of 2023, the maximum number of days of exceedence is 3, both with and without the development. The impact of the proposed development on daily mean PM_{10} concentrations is therefore considered to be insignificant.

Assessment of Construction Phase

8.6.54 Emissions produced during the construction phase can be divided into dust and fine particulate matter, each with different sources and potential impacts on local air quality.

8.6.55 Dust comprises large airborne particles of material, which are resident in the atmosphere for short periods of time after release at a point of disturbance (such as through excavation, aggregate crushing, cement processing, etc). Generally, these large particles are heavy enough to fall out of suspension in the air relatively quickly. Therefore, they do not cause long-term or long-distance changes to local air quality. Furthermore, they are too large to be drawn into the respiratory tract and do not therefore represent a significant risk to general public health. However, their deposition on surfaces causes soiling and dis-colouration and may therefore result in complaints of nuisance through amenity loss or perceived damage caused (which is usually of short-term duration).

8.6.56 There is potential for the generation and release of dust from the following construction processes on the site:

- materials handling and removal, general site clearance;
- stripping and relocating of materials;
- stockpile preparation and "wind blow" from stockpiles of material to be removed from the site;
- construction and road traffic passing over exposed soil surfaces during road works and improvements (such surfaces would be temporary);
- site excavations for foundations and groundwork;
- crushing and recycling of aggregates on site (if necessary);
- storage of dry fine construction materials; and
- batching of concrete on site (if required).

8.6.57 Particulate matter (PM_{10}), which may also be referred to as "fine particles" or "suspended particles", is released during disturbance of aggregate material in the same manner as dust. It is also released from the engines of site plant whilst they are running. However, it is much smaller in size (typically less than 10 µm or 1/100,000th of a metre in diameter). It therefore more readily remains suspended in the atmosphere for a longer period and can be transported by wind over a wider area than dust. It is small enough to be drawn into the lung during breathing, which in sensitive members of the public could cause an adverse reaction. As a result of this potential impact on public health, standards and objectives for PM_{10} are defined in the AQS.

8.6.58 As there are no formal assessment criteria for dust and PM_{10} generation and dispersion during construction, the significance of impacts associated with this phase of the proposed development has been determined qualitatively by:

- identifying the construction activities associated with the proposed development which could generate dust and PM_{10} and their likely duration;
- identifying sensitive receptors (eg schools, residential properties) within 200m of the construction site boundary; and
- the prevailing wind direction.

8.6.59 Exhaust emissions from construction vehicles will have an impact on local air quality both on site and adjacent to the routes used by these vehicles to access the site. As information on the number of vehicles associated with construction phase is not available, a qualitative assessment of their impact on local air quality has been undertaken by considering:

- the level of construction traffic likely to be generated by this phase of the development;
- the number and distance of sensitive receptors in the vicinity of the site and along the likely routes to be used by construction vehicles; and
- the likely duration of the construction phase and the nature of the construction activities undertaken.

8.6.60 Depending on wind speed and turbulence it is likely that the majority of dust and PM_{10} generated by construction activities will be deposited in the area immediately surrounding the source (up to 200 metres away), which could include existing and proposed residential properties. The majority of the impacts are likely to be related to the period over which the activity occurs (eg the "working-week" of approximately 55 hours per week of construction activity). However, in the instance of exposed soil, produced from significant earthwork activities, dust generation could occur 24 hours per day over the period during which such activities are to take place (due to wind-pickup) – unless exposed surfaces are covered or dampened down when activities cease at the end of each day and overnight.

8.6.61 During construction levels of PM_{10} in the locality will be elevated. Generally, the sources of PM_{10} during construction and materials handling will be similar in nature to those that may give rise to dust nuisance. As PM_{10} can remain suspended in the atmosphere longer than the particles that make up dust, their effect potentially could cover a larger area as they can be transferred over greater distances once airborne.

8.6.62 There are likely to be localised releases of PM_{10} from site plant, such as compressors, generators and excavators, released as a pollutant from their exhaust fumes. By nature, site plant tends to be used in demanding conditions at the extremes of its operating capacity. Therefore, on occasions increased and perceptible emissions (smoke and odour) may occur. However, as the magnitude of these releases are relatively small any adverse effects resulting from their use are likely to be relatively short-term and only significant within the vicinity of these items of machinery, with negligible impact outside the site boundary.

8.6.63 By consideration of the factors described above the overall impact of dust and PM_{10} generation and dispersion during the construction phase would be of moderate to minor adverse significance.

8.6.64 Construction traffic associated with the development will contribute to existing traffic levels on the surrounding road network. The greatest potential for impacts on air quality from traffic associated with the construction phase will be in the areas immediately adjacent to the roads used by construction traffic to access the site. The impacts are therefore considered to be of minor adverse significance.

8.7 Enhancement and Mitigation Proposals

Mitigation: Construction

8.7.1 Mitigation methods that could be implemented to minimise the production of dust and particulate matter include:

- surfaced and unsurfaced site access roads should be watered as necessary using a water bowser and surfaces kept in good order;

- vehicles carrying loose aggregate and workings should be sheeted at all times;
- design controls for construction equipment and vehicles and use of appropriately designed vehicles for materials handling;
- dampening of exposed soil and material stockpiles, if necessary, using sprinklers and hoses;
- observation of wind speed and direction prior to conducting dust-generating activities to determine the potential for dust nuisance to occur, avoiding potentially dust-generating activities during periods when wind direction may carry dust into sensitive areas and avoiding dust-generating operations during periods of high or gusty winds;
- stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of prevailing wind directions and seasonal variations in the prevailing wind;
- windbreak netting should be positioned around materials stockpiles and vehicle loading/ unloading areas, as well as exposed excavation and material handling operations;
- screening earthworks such as perimeter landscaping, etc should be completed as a priority to provide a physical barrier between the site and the surroundings;
- completed earthworks should be covered or vegetated as soon as is practicable;
- regular inspection and, if necessary, cleaning of local highways and site boundaries to check for dust deposits (and removal if necessary);
- on-site aggregate handling should be carried out in enclosed areas and transfer should be completed in a way that minimises the requirements to deposit materials from height;
- scaffolding should be covered with polythene sheets to form a barrier between the site and the surrounding locality;
- visual inspection of site perimeter to check for dust deposition (evident as soiling and marking) on vegetation, cars and other objects and taking remedial measures if necessary;
- minimise surface areas of stockpiles (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up;
- use of dust-suppressed tools for all operations;
- ensuring that all construction plant and equipment is maintained in good working order; and
- no unauthorised burning of any material anywhere on site.

8.7.2 Liaison with WCC should be maintained throughout the construction process. In addition, the main contractor should be required to nominate a representative (ie the site manger) to act as a contact point with WCC, the construction team and the local community to ensure that any air quality related issues that may arise are dealt with effectively and promptly. All other site sub-contractors should also nominate or appoint a suitable team member responsible for liaison with the lead contractor's representative and to ensure that sub-contractor construction activities are managed effectively.

8.7.3 The mitigation of PM_{10} releases due to material disturbance will be achieved in the same manner as the control of dust releases. By achieving effective control of sources of dust release, PM_{10} releases can be minimised at the same time.

8.7.4 The most effective control of particulate releases from site plant will be achieved by ensuring that all site plant is kept in good working order, and is of the appropriate capacity and specification for the job being carried out. There may be occasions when mechanical breakdown of site plant could cause short-term releases of excess particulate matter.

8.7.5 Short-term releases may also occur during start up (of diesel engines, etc). Regular visual checks and routine maintenance should be applied in accordance with the plant specification, to ensure that these releases are minimised. Faulty site plant should be decommissioned until repairs have been carried out and it has been tested and found to be operating satisfactorily.

8.7.6 Detailed mitigation measures to control construction traffic should be discussed with the relevant authorities, in order to establish the most suitable access route for the site traffic and service vehicles. The most effective mitigation will be achieved by ensuring that construction traffic does not pass along sensitive roads (residential roads, congested roads, via unsuitable junctions, etc) where possible and that vehicles are kept clean and sheeted when on public highways (through the use of wheel washers, etc). Timing of large-scale vehicle movements to avoid peak hours on the local road network would also be beneficial.

Operation

8.7.7 A Framework Travel Plan has been prepared to support the planning application for the development. A Travel Plan is a package of measures to encourage travel to the site by modes other than single occupancy car journeys. It will set out key objectives and propose measures to enable these objectives to be achieved.

8.7.8 In addition to the Travel Plan measures to minimise single occupancy car journeys, a number of highways improvements are proposed to mitigate the transportation impacts of the development, and pedestrian and cycle facility improvements are also proposed along the Andover Road.

8.7.9 Further details on all of the above measures are provided in the Transport Assessment.

8.8 Summary

8.8.1 An assessment of the potential impacts of the proposed development during the construction and operational phases has been undertaken. The assessment scope and methodology has been agreed in consultation with the Environmental Health Department of WCC.

Construction

8.8.2 A qualitative assessment of the potential impacts on local air quality from construction activities on the proposed redevelopment has been carried out. This showed that during site activities releases of dust and particulate matter (PM_{10}) were likely to occur. However, through good site practice and the implementation of suitable mitigation measures, the impact of dust and PM_{10} releases will be reduced and excessive releases prevented.

8.8.3 The residual effects of the construction phase on air quality are considered to be minor adverse to insignificant.

Operation

8.8.4 In addition, a quantitative assessment of the potential impacts during the operational phase was undertaken using computer dispersion models to predict the changes in NO_2 and PM_{10} concentrations that would occur due to traffic flows associated with the development and the proposed energy centre. Predictions were made for a number of years, including 2009 (the current year), 2013 (the year in which approximately 5% of the development will be operational)), 2018 (the year in which approximately 50% of the development will be operational) and 2023 (when the whole of the proposed development will be completed and occupied).

8.8.5 The results of the dispersion modelling showed that the proposed development would cause moderate to small increases in NO_2 concentrations at the majority of the assessment receptors and a small increase at the majority of assessment receptors for PM_{10}. Some decreases were predicted at a few properties due to the realignment of the Andover Road.

8.8.6 A Framework Travel Plan has been prepared to support the planning application for the development. A Travel Plan is a package of measures to encourage travel to the site by modes other than single occupancy car journeys. It will set out key objectives and propose measures to enable these objectives to be achieved. In addition to the Travel Plan measures to minimise single occupancy car journeys, a number of highways improvements are proposed to mitigate the transportation impacts of the development, and pedestrian and cycle facility improvements are also proposed along the Andover Road. These will mitigate the increases in NO_2 and PM_{10} concentrations predicted in the assessment.

8.8.7 According to the assessment significant criteria, the residual effect of the proposed development on annual mean NO_2 concentrations is: moderate adverse at one receptor; minor adverse at thirteen receptors, insignificant at twenty four receptors; minor beneficial at two receptors; and moderate beneficial at one receptor. The residual effect of the proposed development on annual mean PM_{10} concentrations is not significant.