

North Littlehampton

Fitzalan Link Road
Planning Application

Air Quality Assessment

February 2011



Proposed Fitzalan Link Road, Littlehampton

Air Quality Assessment

February 2011

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Document Control

Project: Proposed Fitzalan Link Road

Client: Greencore Group

Job Number: A0

File Origin:

Document Checking:

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Issue	Date	Status
1	17 th Dec 2009	First Issue to Client
2	23 rd February	Second issue following amendments to Masterplan
3		
4		



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1.0 Introduction

This report presents an assessment of the potential air quality impacts associated with the proposed Fitzalan Link Road, including the North Littlehampton Strategic Development Area mixed used development located further north of the site near Toddington Park. The report has been commissioned to consider the specific effects of additional traffic on the local highway network and the effect of road traffic emissions on the proposed new residential receptor locations.

It is identified that Nitrogen Dioxide and Respirable Particulate Matter (NO₂ and PM₁₀) from traffic and transport emission sources are the key pollutants to be considered. The impact of the proposed scheme has been assessed for its significance on existing and future air quality at key receptor locations as a result of the development. Air quality effects of the proposed scheme are assessed during both the construction and operational phases and the potential cumulative effects of emissions from multiple sources are considered.

Levels of traffic-derived pollutants, represented by NO₂ have been predicted at local representative receptors using the ADMS (Atmospheric Dispersion Modelling Software) Roads pollution model and referenced to EU air quality limits and UK air quality objectives. The magnitude and significance of the changes have been referenced to non statutory guidance issued by Environmental Protection UK.

The assessment has considered the following scenarios:

- 2008 'Existing' (baseline for model verification purposes only)
- 2016 'Without' the proposed Fitzalan Link Road north of Littlehampton Academy, including the North Littlehampton development
- 2016 'With' the proposed Fitzalan Link Road north of Littlehampton Academy, including the North Littlehampton development



2.0 Policy and Legislative Context

The following documents were consulted during the undertaking of this assessment:

Legislation and Best Practice Guidance

- The Air Quality Standards Regulations, 2007;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007;
- Development Control: Planning for Air Quality, National Society for Clean Air and Environmental Protection, 2010.
- The Control of Dust and Emissions from Construction and Demolition – Best Practice Guide, Greater London Authority and London Councils, 2006.
- Guidance on the Control of Odour and Noise from Commercial Kitchen Exhaust Systems, DEFRA, 2005
- Planning Policy Statement 23: Planning and Pollution Control, ODPM, 2004
- Planning Policy Statement 23: Planning and Pollution Control, Annex 1 Pollution Control, Water and Air Quality, ODPM, 2004
- London Atmospheric Emissions Inventory 2010

Websites Consulted

- Google maps (maps.google.co.uk);
- The UK National Air Quality Archive (www.airquality.co.uk);
- Department for Transport Matrix (www.dft.go.uk/matrix); and,
- Multi-Agency Geographic Information for the Countryside (www.magic.gov.uk).
- Envirocheck.com
- The UK National Air Quality Archive (www.airquality.co.uk);



Specific Documents Consulted

- The Arun District Local Plan 2003, Arun District Council
- 2009 Air Quality Updating and Screening Assessment for Arun District Council

2.1 Air Quality Legislative Framework

2.1.1 European Legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- **Directive 99/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter;
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values for benzene and carbon monoxide; and,
- **Directive 2002/3/EC** – the Third Air Quality "Daughter" Directive – seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- **Directive 2004/107/EC** – sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.1.2 UK Legislation

The Air Quality Standards Regulations (2007) seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive within Wales. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2007 No. 64 Regulation 14 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.



The UK Air Quality Strategy is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution.

For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. Adopted national standards are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) and have been translated into a set of Statutory Objectives within the Air Quality Regulations (2000) SI 928, and subsequent amendments.

The AQOs for pollutants included within the Air Quality Strategy and assessed as part of the scope of this report are presented in Table 1 along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 1: Air Quality Standards, Objectives, Limit and Target Values

Pollutant	Measured As	Air Quality Strategy for England, Scotland, Wales and Northern Ireland		EU Daughter Directives	WHO Guidelines
		2000 Objectives	2001/2003/ 2007 Objectives	Limit Value	Guidelines
NO ₂	1-hour mean	200µg.m ⁻³ by end of 2005 (max 18 exceedences a year)	200µg.m ⁻³ by end of 2005 (max 18 exceedences a year)	200µg.m ⁻³ by end of 2009 (max 18 exceedences a year)	200µg.m ⁻³
	Annual mean	40µg.m ⁻³ by end of 2005	40µg.m ⁻³ by end of 2005	40µg.m ⁻³ by end of 2009	40µg.m ⁻³
	Annual mean for protection of vegetation and ecosystems	30µg.m ⁻³ as NO _x by end of 2000	30µg.m ⁻³ as NO _x by end of 2000	30µg.m ⁻³ as NO _x 19 th July 2001	
PM ₁₀	24-hour mean	50µg.m ⁻³ by end of 2004 (max 35 exceedences a year)		50µg.m ⁻³ by end of 2004 (max 35 exceedences a year)	
	Annual mean	40µg.m ⁻³ by end of 2004		40µg.m ⁻³ by end of 2004	

Within the context of this assessment, the annual mean objectives are those against which residential receptors will be assessed and the short term Objectives apply to all receptor locations both residential and non residential.

Local Air Quality Management Technical Guidance TG(09) paragraph 2.31 states that;



"Previous research carried out on behalf of Defra and the devolved administrations identified a relationship between the annual mean and the 1-hour mean objective, such that exceedences of the latter were considered unlikely where the annual mean was below 60 µg/m³."

Therefore, for the purposes of this assessment, the 1 hour mean Objective for nitrogen dioxide is assumed to be met at receptor locations if the annual mean is determined to be less than 60 µg/m³.

2.2 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) Local Authorities (LAs) are required to periodically review and assess air quality within their area of jurisdiction under the system of LAQM. This review and assessment of air quality involves assessing present and likely future air quality against the AQOs. If it is predicted that levels at the façade of buildings where members of the public are regularly present (normally residential properties) are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

2.3 Dust Nuisance

The main requirements with respect to dust control from industrial or trade premises not regulated under the Environmental Permitting (England and Wales) Regulations (2010) and subsequent amendments is that provided in Section 79 of Part III of the Environmental Protection Act (1990). The Act defines a statutory nuisance as:

"any dust, steam, smell or other effluvia arising on industrial trade or business premises and being prejudicial to health or a nuisance."

Enforcement of the Act, in regard to statutory nuisance, is under the jurisdiction of the local Environmental Health Department, whose officers are deemed to provide an independent evaluation of nuisance. If the LA is satisfied that a statutory nuisance exists, or is likely to occur or happen again, it must serve an Abatement Notice under Part III of the Environmental Protection Act (1990). A defence is to show that the process to which the nuisance has been attributed and its operation are being controlled according to Best Practice Measures (BPM).



2.4 Planning Policy and Guidance

2.4.1 National Policy

Planning Policy Statement 23 (PPS23) Planning and Pollution Control iterates the need for development to contribute to the principles of sustainability. Amongst the matters for inclusion in taking decisions on planning applications are the potential effects of new developments in or close to AQMAs and areas of poor air quality. The need to consider local air quality reviews and other assessments is also referenced. The key elements of PPS 23 are contained in three paragraphs of Appendix 1G, as follows:

"1G.1 Any air quality consideration that relates to land use and its development is capable of being a material planning consideration. Wherever a proposed development is likely to have significant air quality impacts, close co-operation between Local Planning Authorities and those with responsibilities for air quality and pollution control will be essential. The impact on ambient air quality is likely to be particularly important:

- Where the development is proposed inside, or adjacent to, an air quality management area (AQMA) designated under Part IV of the Environment Act 1995;*
- 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 the LA's Air Quality Action Plan.*

1G.2 It is not the case that all planning applications for developments inside or adjacent to AQMAs should be refused if the developments would result in a deterioration of local air quality. Such an approach could sterilise development, particularly where authorities have designated their entire areas as AQMAs. LPAs, transport authorities and pollution control authorities should work together to ensure development has a beneficial impact on the environment, for example by exploring the possibility of securing mitigation measures that would allow the proposal to proceed. Road transport is recognised as a significant contributor to poor local air quality, particularly in urban areas. LPAs can play a key role by ensuring that developments reduce the need to travel and encouraging more sustainable travel choices.

1G.3 All such applications, should be supported by such information as is necessary to allow a full consideration of the impact of the proposal on the air quality of the area. It may be appropriate in some circumstances for the developer to fund mitigation measures elsewhere inside the AQMA to offset any increase in local pollutant emissions as a consequence of the



proposed development. These measures could be secured through Section 106 Agreements. Paragraph 1.50 of this Annex gives advice on the use of planning obligations."

Additional national policy guidance includes Planning Policy Statement 3 (PPS3): Housing and Planning Policy Guidance Note 13 (PPG13): Transport. These emphasise the need to achieve sustainable forms of development, with particular reference to high density developments on brownfield sites in urban areas. Such developments, especially those located in city and town centres, will reduce the need to travel by car, thereby contributing to reduced vehicle emissions.

2.4.2 Regional and Local Policy

Development within the administrative area of Arun District Council is controlled and facilitated via a number of 'saved' policies within the Arun Local Plan.

A number of these policies relate directly to Air Quality as a material planning consideration and have therefore being taken into account throughout the course of this assessment. Of these, General Policy 34 states that:

"Development that contributes to air pollution through dust, smell, fumes, smoke, heat, radiation, gases, steam or other forms of pollution will not be permitted unless the council decides that the health, safety and amenity of users of the site and surrounding land is not put at risk and the quality of the environment would not be damaged or put at risk."



3.0 Assessment Methodology

The assessment includes the outcomes of a site walkover to determine existing potential local sources of air pollution, together with a desk based study of available information.

The air quality assessment includes the establishment of baseline ambient air quality and an evaluation of impacts associated with the construction and operational phases surrounding the proposed development site. The assessment is primarily based on the effects of NO₂ and PM₁₀ levels at sensitive receptors surrounding the proposed development.

Air quality monitoring data has been obtained from Arun District Council who operate a nitrogen dioxide survey network at a number of different locations within Littlehampton area. Results for the monitoring year which correlates with baseline traffic data (2008) has been used for the purposes of the assessment. Additionally, in order to get a better understanding of the special distribution of NO₂ pollutants surrounding the site, WYG Environmental has undertaken a short-term diffusion tube survey at seven locations in and around the local road network. The survey locations are illustrated on Figure SK02, Appendix A.

The effect of any increase in local traffic movements has been predicted using ADMS Roads. This is an Environment Agency approved and fully validated modelling system for the prediction of the dispersion of air pollution based on Gaussian dispersion theory. Full details of the model's validation can be found on the following web site, <http://www.cerc.co.uk/software/publications.htm>.

The methods used in constructing the model are undertaken in accordance with recommendations outlined by the model developers, Cambridge Environmental Research Consultants (CERC). The most significant factors that affect model results are the following:

- background concentrations;
- meteorological data;
- source inputs (traffic data, stack emissions data).

Information regarding current and expected future traffic loads has been derived from traffic data produced by Mayer Brown Transport Planners as detailed in section 5.2.

A qualitative assessment of impacts on local air quality due to construction has been undertaken and mitigation measures proposed for all significant construction impacts identified.



3.1 Predicting Magnitude of Impact

Magnitude (scale of change) is determined by considering the predicted deviation from baseline conditions. Quantifiable assessment of magnitude has been undertaken where possible.

Impacts of the proposed development on air quality have been assessed with reference to the baseline conditions and environmental assessment criteria. The rationale for determining the magnitude of an impact is shown in Table 2. The rationale is derived in part from the magnitude matrix described in table 4 of the EPUK non statutory guidance "Development Control: Planning for Air Quality (2010 Update)".

Table 2: Methodology for Assessing Magnitude of Impacts on Air Quality

Magnitude of Impact ⁽¹⁾	Description	Description
Large	Impact resulting in a considerable change in baseline environmental conditions (i) with severe undesirable/desirable consequences on the receiving environment.	- Air quality varies between the do minimum and do something by more than 10% of the air quality criterion. - Substantial risk that emissions will generate statutory nuisance complaints, resulting in formal action. - Area affected is less than 10m from an active construction site.
Medium	Impact resulting in a discernable change in baseline environmental conditions (i) with undesirable/desirable conditions	- Air quality varies between the do minimum and do something by 5 - 10% of the air quality criterion. - Moderate risk that emissions will generate statutory nuisance complaints, resulting in formal action. - Area affected is within 100m of a major active construction site.
Small	Impact resulting in a discernable change in baseline environmental conditions with undesirable/desirable conditions that can be tolerated.	- Air quality varies between the do minimum and do something by 1 - 5% of the air quality criterion. - Slight risk that emissions will generate statutory nuisance complaints, resulting in formal action. - Area affected is between 100m and 1,000m of a major active construction site or up to 100m from a minor active construction site, a demolition site or compound.
Imperceptible ⁽²⁾	No discernable change in baseline environmental conditions.	- Air quality varies between the do minimum and do something by less than 1% of the air quality criterion. - Little or no cause for nuisance complaints to be made. - Area affected is 100m from any minor construction activity of 1,000m from any major construction activity.

NOTE (1) An impacts magnitude can be either positive or negative, except for negligible.

(2) If the assessor is certain that a receptor or attribute of a feature will suffer no impact whatsoever then the term 'No Impact' can be used in the place of 'Negligible Impact'. However, it is not usually possible to determine 'No Impact' in many cases with 100% certainty so the term 'Negligible' should be used in these cases.

The stated methodology has been developed by WYG and was based on the example assessment criteria for air quality provided in the Environmental Protection UK guidance document Development Control: Planning for Air Quality for road vehicle exhaust emission impacts and MPS2: Annex 1 for dust impacts.

Impacts may be of the following nature, which are identified where relevant:

- Negative or positive;
- Direct or indirect;



- Temporary or permanent;
- Short, medium or long-term;
- Reversible or irreversible; and,
- Cumulative.

3.2 Sensitivity of Receptor

Receptors can demonstrate different sensitivities to changes in their environment. For the purpose of this assessment sensitivity is determined as Very High, High, Medium or Low as detailed in Table 3.

Table 3: Methodology for Assessing Sensitivity of Receptor

Sensitivity	Description
Very High	• Do Minimum pollutant concentration already exceeding the relevant AQO. • Receptors of very high sensitivity to dust, such as: hospitals and clinics, retirement homes, painting and furnishing, hi-tech industries and food processing.
High	• Do Minimum pollutant concentration already 90 - 100% of the relevant AQO. • Receptors of high sensitivity to dust, such as: schools, residential areas, food retailers, glasshouses and nurseries, horticultural land and offices.
Medium	• Do Minimum pollutant concentration between 75-90% of the relevant AQO. • Receptors of medium sensitivity to dust, such as: farms, outdoor storage, light and heavy industry.
Low	• Do Minimum pollutant concentration less than 75% of the relevant AQO • All other dust sensitive receptors not identified above.

3.3 Assessment of Impact Significance

Table 4 shows how the interaction of magnitude and sensitivity results in the significance of an environmental effect. If the scale of the impact magnitude is negative then the resulting effect is adverse. If the scale of the impact magnitude is positive then the resulting effect is beneficial.

**Table 4: Impact Significance Matrix**

Absolute Concentration in Relation to Objective / Limit Value (Sensitivity)	Change in Concentration (Magnitude)		
	Small	Medium	Large
Increase with Development			
Very High	Slight Adverse	Moderate Adverse	Substantial Adverse
High	Slight Adverse	Moderate Adverse	Moderate Adverse
Medium	Negligible	Slight Adverse	Slight Adverse
Low	Negligible	Negligible	Slight Adverse
Decrease with Development			
Very High	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
High	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Medium	Negligible	Slight Beneficial	Slight Beneficial
Low	Negligible	Negligible	Slight Beneficial

Finally, it is considered important to attribute a level of confidence by which the predicted impact has been assessed. For the purposes of this assessment, the criteria for these definitions are set out in Table 5.

Table 5: Impact Prediction Confidence

Confidence Level	Description
High	The significance of an environmental effect is an informed estimate likely to be based on reliable data or subjective judgement with reference to similar schemes. Further information would not result in any change to assessment of significance.
Low	The significance of an environmental effect is a best estimate likely to be based on subjective judgement without reference to similar schemes. Further information would be needed to confirm assessment of significance.



4.0 Baseline Conditions

4.1 Air Quality in Littlehampton

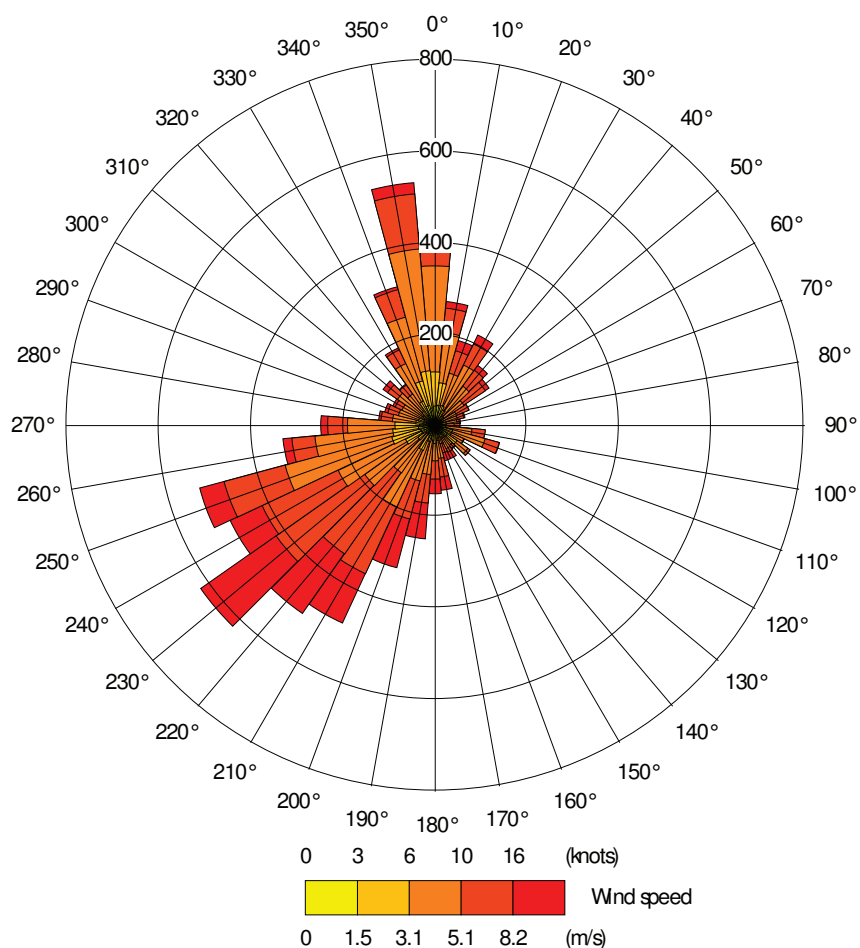
Arun District Council (ADC) is the administering local authority for the Littlehampton area. Following detailed Review and Assessment of air quality within the district the Council has not deemed it necessary to designate any Air Quality Management Areas. As a result the Council has not been required to adopt an Air Quality Action Plan or related Local Air Quality Management Strategies.

4.2 Meteorological Data

Meteorological conditions have significant influence over air pollutant concentrations and dispersion. Pollutant levels can vary significantly from season to season as well as year to year, thus any long-term trends need to be established using several years of data. The ADMS models calculate the dispersion of pollutants on an hourly basis using a year of local hourly meteorological data. The meteorological data used in the assessment is derived from the Shoreham Met Station for the year 2008, which is the nearest meteorological station with all the complete parameters necessary for the ADMS model and is considered representative of meteorological conditions in Littlehampton.



Figure 1: Shoreham 2008



4.3 Emission Sources

The site walkover identified that traffic and rail derived pollutants were likely to be the most significant local source of pollutants affecting the site. There are likely to be some atmospheric emissions from commercial and industrial units to the north of the proposed development, however emissions from these will have been captured during the air quality survey and so will have been included in the model verification process described later in this chapter.



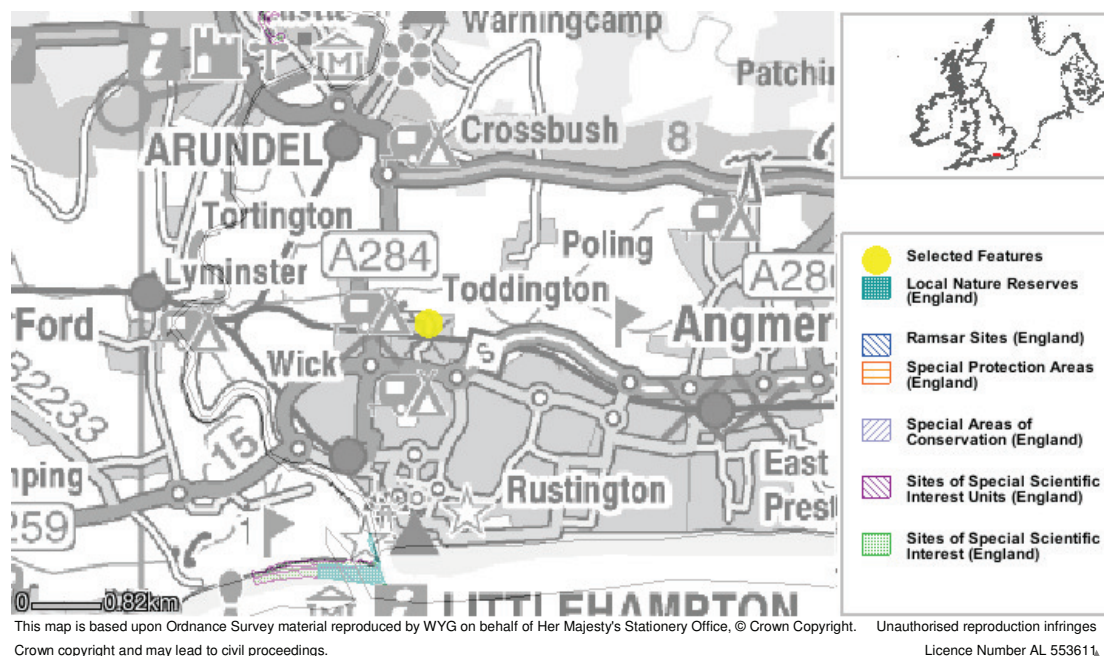
Beyond the immediate site surroundings there are no significant contributing sources of nitrogen dioxide or particulate matter regulated by the Environment Agency under the Environmental Permitting Regulations (EPR) according to the Agency's online Industrial Emissions Archive.

Emissions from rail sources have also been assessed and considered. Arun District Council contains no locations where steam or diesel locomotives operate. In addition to this, Littlehampton does not contain any major rail lines (as identified in Table 5.1 of LAQM TG (09)), or have background concentrations higher than 25 mg/m³. Stationary or moving trains do not cause long term exposure and on this basis rail emissions are considered negligible in the context of this assessment. Nevertheless, emissions from the railway sources within the study area have been included in the atmospheric dispersion model to help verify diffusion tube data.

4.4 Ecological Receptors

DMRB recommends considering the effects of any proposed road schemes on ecological as well as human receptors. DMRB paragraph 3.13 lists the designated sites which should be considered as those which may have features which may be sensitive to air pollution. Designated Sites include SSSIs, SAPs, SACs and RAMSAR sites.

As illustrated by figure 2, there are no designated sites within 200 metres of those roads meeting the DMRB criteria, according to the interactive Magic Website. As such no ecological receptors have been considered as part of this detailed assessment.

**Figure 2: Key Ecological Receptors****Formatted:** Font: 6 pt

4.5 Sensitive Receptors

4.5.1 Construction Phase

Receptors that are considered as part of the construction phase assessment are primarily those existing receptors in close proximity to the proposed development boundary. It should be noted that the assessment does not include an exhaustive list of all receptors likely to be effected by construction activity and those assessed illustrate representative worst case locations.

4.5.2 Operational Phase

Receptors that are considered as part of the operational phase air quality assessment are primarily those existing receptors that are situated within the immediate vicinity of the proposed development site, or alternatively along arterial routes likely to be effected by changes in traffic flow. That is those located along the A259, B2187, Lyminster Road and connecting links. Several non-residential receptors have also being selected with the view that they may be sensitive to changes in air quality, including the adjacent Littlehampton Academy and Cornfield School. The receptor locations are summarised in table 11 (section 6.1) and the spatial locations of all of the receptors are illustrated in Appendix SK02. Receptor locations are



positioned at the building façade at 1.5 m height. Receptor locations representative of the proposed units on the development site have also been considered within the context of this assessment.

4.6 Baseline Ambient Air Quality

Air quality monitoring is undertaken by ADC as part of its duties under the Environment Act. As a member of the Sussex Air Quality Partnership the Council benefits from coordinated monitoring of air pollutants across the region via 20 automatic monitoring stations. However, ADC operates a network of 14 additional non-continuous monitors across the county, the results of which are published in the Council's most recent 2009 Air Quality Update and Screening Assessment.

Within the vicinity of the proposed development, the Council operates two non-continuous monitors. A description of these locations is provided in Table 6 below along with a summary of the bias corrected monitoring results from the monitoring year which correlates with the baseline traffic data (2008).

Table 6: ADC Nitrogen Dioxide Monitoring Locations

Monitoring Location Reference	Address	Monitoring Location OS Reference	2008 Bias Corrected Result ($\mu\text{g}/\text{m}^3$)
ABC 1	Worthing Road	503439 , 103364	31.2
ABC 2	Terminus Road	502564 , 102149	28.4

In order to support the Council's own monitoring data, a short term air quality survey was conducted by WYG to obtain a spatial representation of current air quality in the area of the development, as referenced in section 3. The survey has been used to obtain baseline air quality data and enable the air quality model to be adequately verified in order to provide the best possible representation of conditions at the site. A description of each monitoring location and a basis for sampling at each position is provided in Table 7 below. The monitoring locations are illustrated in SK01.

The survey uses nitrogen dioxide passive diffusion tubes, which are positioned at various roadside locations in and around the development site. The diffusion tubes are exposed for periods of approximately one month for up to 3 periods. The tubes were then analysed by a UKAS accredited laboratory (Gradko International Ltd) using the 20% TEA method.

Table 7: WYG Nitrogen Dioxide Monitoring Locations

Monitoring Location	Name	Description	OS Coordinate X, Y	
WYG 1	Mill Lane (Entrance to Waste Recycling Centre)	Roadside	502864	104054



WYG 2	Toddington Lane (Development site)	Background	503443	103849
WYG 3	Toddington Lane (Development site)	Background	503754	103807
WYG 4	Toddington Lane (Development site)	Background	503670	104076
WYG 5	Lyminster Road (North of rail crossing)	Roadside	502746	103970
WYG 6	Lyminster Road (South of rail crossing)	Roadside	502709	103657
WYG 7	A259 (behind Dual Carriage Way)	Roadside	504018	103524

A roadside monitoring location is defined as a site sampling location over 1m from a busy road. An urban background site is defined as an urban location distanced from sources and therefore broadly representative of city-wide background conditions.

The survey started in May 2008 and was completed in September 2008. The survey results have been bias corrected and seasonally adjusted in accordance with the guidance in LAQM Technical Guidance (TG (09)) as detailed below.

4.7 Bias Correction

Survey results are 'bias corrected' in order to provide an adjustment to account for the relative precision of the monitoring technique used. The bias correction factor used is obtained from an on-line spreadsheet based tool¹ which publishes the bias correction factors of numerous surveys from across the UK, in order to obtain a national average correction factor for the analysis technique. The bias correction factor used is taken from the most recently published data from 2008 surveys. A summary of the surveys used and the bias correction factor calculated is summarised in Table 8 below.

¹ at <http://www.uwe.ac.uk/aqm/review/diffusiontube131108.xls>

**Table 8: Bias Correction Adjustment Factor for Gradko 20% TEA**

Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) ($\mu\text{g}/\text{m}^3$)	Automatic Monitor Mean Conc. (Cm) ($\mu\text{g}/\text{m}^3$)	Bias (B)	Tube Precision	Bias Adjustment Factor (A) (Cm/Dm)
Nottingham CC	9	36	32	11.9%	G	0.89
Nottingham CC	9	44	42	5.5%	G	0.95
Belfast CC	11	41	33	26.7%	G	0.79
Crewe and Nantwich BC	10	33	32	4.2%	G	0.96
Dudley MBC	12	49	42	17.6%	G	0.85
Dudley MBC	12	30	28	6.9%	P	0.94
Dudley MBC	12	18	17	4.7%	G	0.96
Ellesmere Port & Neston BC	12	45	42	7.4%	G	0.93
Rhondda Cynon Taf CBC	12	35	35	0.0%	G	1.00
South Hams DC	10	41	40	2.6%	G	0.97
Rushmoor BC	12	42	38	9.3%	G	0.91
AEA Tech Intercomparison	12	117	116	1.2%	G	0.99
Blackburn with Darwen BC	12	31	26	19.5%	P	0.84
Central Bedfordshire	11	44	38	17.2%	G	0.85
Cheshire East Council	12	55	45	22.1%	G	0.82
Cheshire East Council	12	28	28	0.1%	G	1.00
Gedling BC	9	44	34	27.0%	G	0.79
North Warwickshire BC	10	52	46	11.5%	G	0.90
Newtownabbey BC	12	38	36	6.2%	P	0.94
Dartford Council	12	61	58	5.3%	P	0.95
Rhondda Cynon Taf CBC	12	36	40	-9.5%	G	1.11
Overall factor based on 21 studies						0.92

4.8 Seasonal Adjustment

Air quality is known to vary throughout the year due to changes in emissions and the effects of seasonal weather changes. The application of a 'seasonal adjustment factor' is necessary to account for the relative influence of weather conditions during the survey period compared to annualised weather conditions. Paragraph 3.16 and Box 3.2 of TG (09) provides a method to adjust short term monitoring data to extrapolate annualised averages.



The seasonal correction factor for all monitoring locations is obtained from the nearest roadside AUN (automatic urban network) monitoring stations within a maximum permissible radius of 50 miles from the site.

AUN stations in Portsmouth and Southampton have been used to calculate the seasonal adjustment factor for the WYG short term monitoring data. The seasonal correction factor has been calculated based on the process summarised in Table 9 and from data obtained from the UK Air Quality Archive website.

Table 9: Seasonal Adjustment Calculation for WYG Diffusion Tube Results

Site	Annual Mean 2008 (Am)	Period Mean May– July 2008 (Pm)	Ratio (Am/Pm)
Portsmouth AUN	23.4	15.22	1.54
Southampton AUN	35.8	27.5	1.30
Seasonal Adjustment Factor			1.42

The results of the air quality survey are summarised in Table 10 below.

Air Quality Assessment: Fitzalan Link Road, Littlehampton

**Table 10: Results of Site-specific NO₂ Monitoring Program**

Location REF	Period 1	Period 2	Period 3	Period 3	Average	Bias Corrected Average NO ₂ (0.92)	Season Adjusted (1.42)
	14/05/08 – 16/06/08	16/06/08 – 23/07/08	23/07/08 – 21/08/08	21/08/08 - 17/09/08			
	mg/m³						
WYG1	19.52	18.54	22.16	22.38	20.65	19.00	26.98
WYG2	15.1	7.99	14.53	13.29	12.73	11.71	16.63
WYG3	13.4	12.42	14.24	12.19	13.06	12.02	17.06
WYG4	9.27	12.28	13.49	12.44	11.87	10.92	15.51
WYG5	-	47.16	35.98	28.44	37.19	34.22	48.59
WYG6	26.30	22.91	28.42	19.58	24.30	22.36	31.75
WYG7	26.61	-	-	-	26.61	24.48	34.76



5.0 Construction Phase Assessment

5.1 Predicted Construction Effects

The main emissions during construction are likely to be dust and particulate matter generated during earth moving (particularly during dry months), or from construction materials. The Design Manual for Roads and Bridges considers that changes of less than 200 annual average daily traffic HGV movements are not significant to air quality. As additional construction traffic movements are not expected to exceed this criteria, emissions of traffic derived pollutants have been scoped out of the construction phase assessment. In respect of fires on site it should be noted that suitable management strategies will be in place to prevent burning of any material during the construction phase. The main potential effects of particulates/dust are:

- Visual – dust plume, reduced visibility, coating and soiling of surfaces leading to annoyance, loss of amenity, the need to clean surfaces;
- Physical and /or chemical contamination and corrosion of artefacts;
- Coating of vegetation and soil contamination;
- Health effects due to inhalation e.g. asthma or irritation of the eyes.

A number of other factors such as the amount of precipitation and other meteorological conditions will also greatly influence the amount of particulate matter generated.

Construction activities can give rise to short-term elevated dust/PM₁₀ concentrations in neighbouring areas. This may arise from vehicle movements, soiling of the public highway, demolition or wind blown stockpiles.

Particulate Matter (PM₁₀)

The UK Air Quality Standards seek to control the health implications of respirable particulate matter PM₁₀ (less than 10 micrometers in diameter). However, the majority of particles released from construction will be greater than this in size.

Construction works on site have the potential to elevate localised PM₁₀ concentrations in the area. On this basis, mitigation measures should still be taken to minimise these emissions as part of good site practice.

Dust

Particles greater than 10µm are likely to settle out relatively quickly and may cause annoyance due to their soiling capability. Mineral Policy Statement 2 indicates that 70% of dust emissions typically settle within



200m of their source and only 10% remain in the air at 400m away. There are no formal standards or criteria for nuisance caused by deposited particles. However, best practice guidance for the control of dust and emissions from construction and demolition, as produced by the Greater London Authority, suggests a deposition rate of 200mg/m²/day as a threshold for serious nuisance. This is usually only applied to long term exposure as people are generally more tolerant of dust for a short or defined period. Significant nuisance is likely when the dust coverage of surfaces is visible in contrast with adjacent clean areas, especially when it happens regularly. Severe dust nuisance occurs when the dust is perceptible without a clean reference surface.

Construction activities have the potential to suspend dust, which could result in annoyance of residents surrounding the site. Measures should be taken to minimise the emissions of dust as part of good site practice. Proposed mitigation measures are discussed later in the report.

The assessment of the construction impacts of the proposed development on the sensitive receptors is summarised in table 11. For the purposes of the determination of the magnitude, the distance of the receptor from the source has been taken to be from the parts of the site where active construction and demolition activities are expected to take place.

Table 11: Significance of Construction Phase at Relevant Receptors

Receptor	Approximate Distance from Site Boundary (m)	Sensitivity	Magnitude	Significance
21 Holly Drive	5	High	Large	Moderate Adverse
23 Toddington Park	5	High	Large	Moderate Adverse
10 Toddington Park	5	High	Large	Moderate Adverse
1 Rosamead	10	High	Large	Moderate Adverse
2 St Mary's Gardens	30	High	Medium	Moderate Adverse
35 Fitzalan Road	30	High	Medium	Moderate Adverse
Summerlea House	5	Very High	Large	Substantial Adverse
5 Paterson Wilson Road	5	High	Large	Moderate Adverse
34 Highdown Drive	5	High	Large	Moderate Adverse
19 Amberley Close	5	High	Large	Moderate Adverse
New School Receptor	30	High	Medium	Moderate Adverse
59 Highdown Drive	35	High	Medium	Moderate Adverse
150 Highdown Drive	5	High	Large	Moderate Adverse
Cornfield School	20	High	Medium	Moderate Adverse



The nature of the proposed development means that it is categorised as 'moderate to substantial adverse'. Given the semi-quantitative nature of the assessment, the confidence of the assessment is deemed as low.

Mitigation measures are considered necessary in order to manage the potential for emissions of dust and particulate from the construction phase. The measures outlined in the mitigation section are based on the recommendations of the Control of Dust and Emissions from Construction and Demolition – Best Practice Guide, Greater London Authority and London Councils, 2006. This is currently considered to be the best practice guide in the UK to managing emissions from construction activities.





6.0 Operational Phase Traffic Assessment

In the context of the proposed development, transportation is identified as the dominant emission source in the area that is likely to cause potential risk of exposure of existing residential receptors, to exceedences of the national Air Quality Objectives. Predictions of air quality at the site have been undertaken for the operational phase of the development using ADMS Roads. The following sections outline model inputs and assumptions made in assessing the significance of impacts of the surrounding ambient air quality.

The development is predicted to be complete by 2016 at the earliest. The assessment has therefore been undertaken with an assumed operational opening year of 2016.

6.1 Receptor Locations

A summary of the locations of the receptors locations is contained in Table 12 below and they are illustrated in SK01.

Table 12: Modelled Sensitive Receptor Locations

Receptor		Grid Reference	
		Easting	Northing
REC 1	Holly Cottage	503471	103869
REC 2	17 Granary Way	502949	103941
REC 3	112 Lyminster Road	502759	104048
REC 4	Hunters Lodge	502632	104113
REC 5	203 Lyminster Road	502555	104363
REC 6	1 Coombes Way	502766	103846
REC 7	2 Lyminster Road	502697	103450
REC 8	21 Holly Drive	503161	103729
REC 9	23 Toddington Park	503107	103585
REC 10	10 Toddington Park	503126	103429
REC 11	47 Colebrook Road	502498	103420
REC 12	24 Joyce Close	502162	103440
REC 13	Flat 14 Marden House	501772	103233
REC 14	58 Gloucester Road	502250	102343



REC 15	21 Arundel Road	502654	102237
REC 16	24 Connaught Road	502812	102308
REC 17	39 East Sreet	502963	102266
REC 18	1 Rosamead	503253	102361
REC 19	2 St Mary's Gardens	503234	102300
REC 20	35 Fitzalan Road	503198	102261
REC 21	Summerlea House	503224	102429
REC 22	5 Paterson Wilson Road	503156	102504
REC 23	Elm Grove Infant School*	503178	102626
REC 24	34 Highdown Drive	503126	102721
REC 25	19 Amberley Close	503112	102894
REC 26	New School Receptor*	503257	102736
REC 27	48 Horsham Road	503692	102695
REC 28	50 St Flora's Road	503558	102365
REC 29	All Saint's Church*	502682	103330
REC 30	15 Wick Street	502636	102924
REC 31	59 Highdown Drive	502986	103017
REC 32	150 Highdown Drive	503088	103217
REC 33	Cornfield Close	503216	103325
REC 34	63b Oakcroft Gardens	503616	103310
REC 35	Church*	503792	103260
REC 36	Watersmead Business Park*	503798	103423
REC 37	81 Oakcroft Gardens	503737	103149
REC 38	116 Horsham Road	503724	102927
REC 39	1 Cornwall Road	502753	102597
REC 40	Proposed Unit 1*	503188	104126
REC 41	Proposed Unit 2*	503179	103977

* Non residential receptors are marked with an asterisk



6.2 Existing and Predicted Traffic Flows

The baseline 2008 traffic and 'do minimum' and 'do something' flows in the opening year of 2016, including mean traffic speeds, have been derived from traffic data provided by Mayer Brown traffic consultants following profiling of the surrounding road network.

For the purposes of the air quality assessment only roads predicted to experience significant changes in flows have been included in the air quality model. For the purposes of the model, predicted traffic speeds have been rounded to the nearest 5 km/h due to limitations within ADMS. All of the roads within the dispersion model are illustrated in SK03.

The AADT figures used in the 'do minimum' and 'do something' air quality dispersion model are summarised in Appendix B.

6.3 Background Pollution Concentrations

Background concentrations as used within the prediction calculations were referenced from the UK National Air Quality Information Archive database based on the National Grid Co-ordinates of 1 x 1 km grid squares nearest to the development site. The data used as representative background concentrations is summarised in Table 13 below.

Table 13: Published Background Air Quality Levels ($\mu\text{g}/\text{m}^3$)

Grid Reference		2008		
Easting	Northing	NO ₂	NO _x	PM ₁₀
502500	104500	12.65	17.52	16.40
503500	104500	12.10	16.67	16.25
504500	104500	11.66	15.99	16.50
502500	103500	17.30	25.14	17.75
503500	103500	14.38	20.26	15.97
504500	103500	13.82	19.36	16.59
502500	102500	17.43	25.37	16.41
503500	102500	14.46	20.39	15.53
504500	102500	13.74	19.24	15.40
502500	104500	12.65	17.52	16.40
503500	104500	12.10	16.67	16.25



The predicted background concentrations in the Archive decrease year on year based on the predicted progressive positive influence of EU and UK air quality legislation. However, guidance published on the DEFRA online Air Quality Review and Assessment Helpdesk in September 2010 states that “there is little evidence of a consistent downward trend in either NO_x or NO₂ concentrations, that would be suggested by emission inventory estimates.”

In order to present a worst case scenario, the assessment has assumed that there will be no improvement in background air quality. As such, 2008 concentrations have been used within the operational year assessments.

6.4 Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in Annex 3 of the TG (09) guidance note and uses recent diffusion tube monitoring data to best represent this.

The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of nitrogen oxides (NO_x) at the monitoring locations. Outputs from the ADMS Roads model are provided as predicted road traffic contribution NO_x emissions. These are converted into predicted roadside contribution NO₂ exposure at the relevant receptor locations based on the updated approach to deriving NO₂ from NO_x for road traffic sources published in paragraphs 2.22 to 2.27 of Local Air Quality Management TG(09). The calculation was derived using the NO_x to NO₂ worksheet in the online LAQM tools website hosted by DEFRA.

Model verification is usually undertaken on a set of data (ideally more than six) in order to reduce the influence of inaccuracies in individual data.

Based on these results an overall adjustment factor is calculated which produces a best fit correlation between the model predictions and monitoring results. This approach ensures that the model provides the best possible representation of local traffic emissions. Table 14 and Figure 2 below indicates the correlation after model adjustments.

A primary model correction of 2.4369 was applied to the modelled road traffic NO_x concentrations before converting to NO₂. This figure demonstrates that the model was under predicting the road traffic emissions at the monitoring locations, probably due to the effects of congestion and stop-start driving behaviour in the study area. A further secondary adjustment factor of 0.9847 was also applied to the modelled road



traffic NO₂ before the total NO₂ at each of the monitoring locations was calculated. The final correlation of the monitoring and modelling results are summarised in table 14 and figure 3.

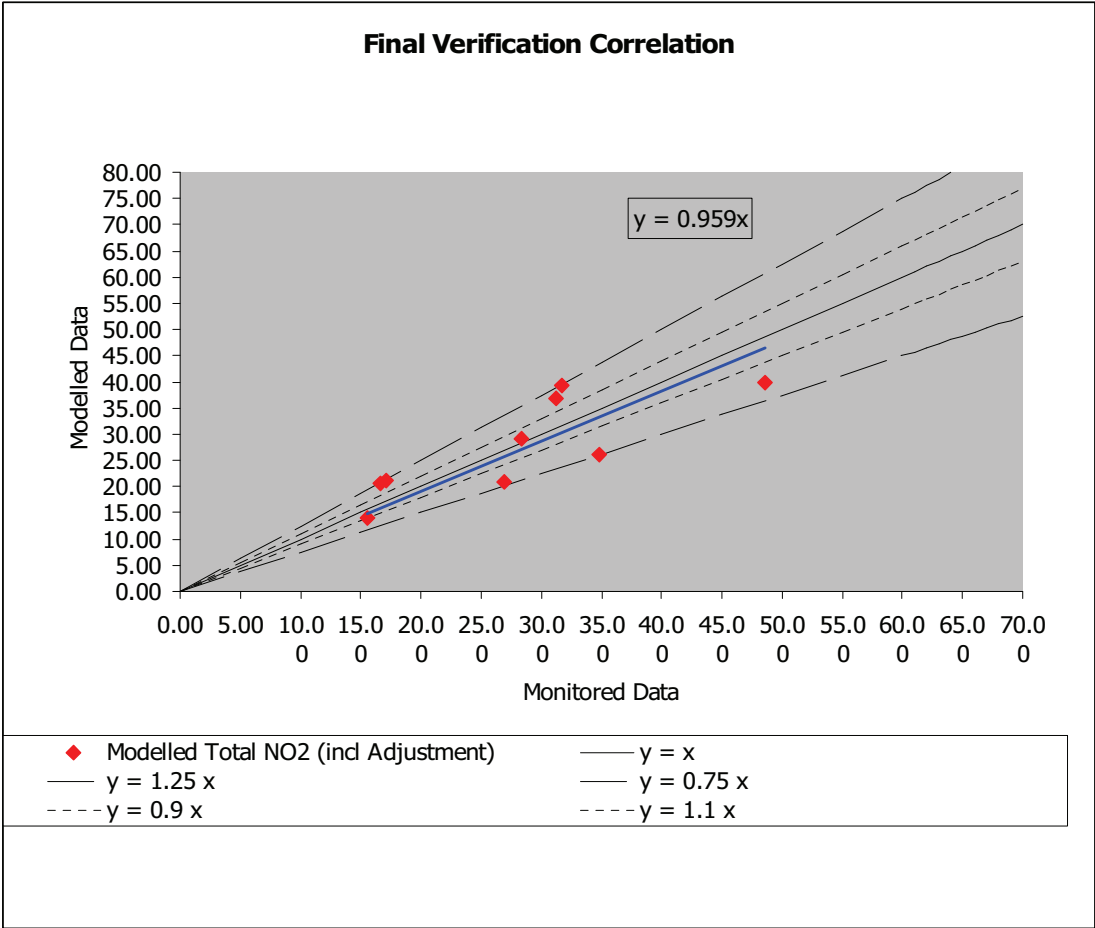
Table 14: Comparison of Modelling & Monitoring Results for NO₂

Monitoring Location	NO ₂ µg/m ³		
	Monitored NO ₂	Monitored NO ₂	Monitored NO ₂
WYG 1	26.98	21.00	22.15%
WYG 2	16.63	20.58	-23.77%
WYG 3	17.06	21.17	-24.06%
WYG 4	15.51	14.11	8.98%
WYG 5	48.59	39.97	17.74%
WYG 6	31.75	39.24	-23.59%
WYG 7	34.76	26.25	24.49%
ADC 2 Worthing Road	31.20	36.87	-18.16%
ADC 1 Terminus Road	28.40	29.23	-2.92%

The model produced data at all of the monitoring locations to within the 25% of the monitoring results. This is within the tolerance limits recommended in TG(09) and the model is therefore considered to be verified and suitably representative of local emissions and exposures.



Figure 3: Model Correlation Coefficient





6.5 Summary of Model Inputs

Table 15: Summary of ADMS Roads model Inputs

Easting	Northing	NOx
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), nitrogen dioxide (NO ₂), Ozone (O ₃) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	Shoreham 2008, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	0.5m representing a typical surface roughness for parkland and open suburban setting
Latitude	Allows the location of the model area to be set	United Kingdom = 52° .
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Small Town= 30m .
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = 0m .
Road Width	Allows the width of the road link to be specified.	Road width used depended on data obtained from OS map data for the specific road link
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	No topographical information used
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used
Road Type	Allows the effect of different types of roads to be assessed.	Urban Road settings were used
Road Speeds	Enables individual road speeds to be added for each road link	Taken from the Mayer Brown Traffic data
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons were used
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built DMRB database of traffic emission factors.	The DMRB 2003 dataset was used.
Year	Predicted DMRB emissions rates depend on the year of emission.	2008 data for the base year model validation. 2016 data for the expected development opening year
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), nitrogen dioxide (NO ₂), Ozone (O ₃) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included



6.6 ADMS Modelling Results

The ADMS Model has predicted concentrations of NO₂ at relevant receptor locations likely to be effected by the development. The model outputs are based on fully verified model results from the ADMS Roads model. The following tables summarise the atmospheric dispersion model predictions of air quality at the relevant receptor locations. Only receptors close to roads where there is predicted to be a change in emissions have been assessed. Exceedences of the AQO are highlighted in **bold**.

6.6.1 Nitrogen Dioxide

Table 16: Predicted 2016 Annual Average Concentrations of NO₂ at Existing Receptor Locations (µg/m³).

Receptor		Nitrogen Dioxide µg/m ³		
		2016 Base	2016 Development	Difference
REC 1	Holly Cottage	19.3	25.0	5.66
REC 2	17 Granary Way	22.5	27.4	4.92
REC 3	112 Lyminster Road	25.3	27.2	1.93
REC 4	Hunters Lodge	28.3	28.6	0.32
REC 5	203 Lyminster Road	17.4	17.6	0.14
REC 6	1 Coombes Way	38.6	34.9	-3.70
REC 7	2 Lyminster Road	39.4	36.1	-3.33
REC 8	21 Holly Drive	19.1	22.4	3.37
REC 9	23 Toddington Park	17.7	23.8	6.06
REC 10	10 Toddington Park	22.6	35.8	13.16
REC 11	47 Colebrook Road	23.5	23.7	0.18
REC 12	24 Joyce Close	23.3	23.6	0.28
REC 13	Flat 14 Marden House	17.5	17.7	0.22
REC 14	58 Gloucester Road	20.2	20.2	-0.06
REC 15	21 Arundel Road	19.7	18.1	-1.61
REC 16	24 Connaught Road	25.5	23.8	-1.69
REC 17	39 East Street	30.0	27.5	-2.50
REC 18	1 Rosamead	24.1	25.3	1.15
REC 19	2 St Mary's Gardens	22.7	22.1	-0.55



REC 20	35 Fitzalan Road	18.5	18.7	0.19
REC 21	Summerlea House	17.2	17.9	0.71
REC 22	5 Paterson Wilson Road	16.4	17.3	0.82
REC 23	Elm Grove Infant School*	16.7	21.2	4.49
REC 24	34 Highdown Drive	16.1	19.0	2.90
REC 25	19 Amberley Close	16.1	18.6	2.44
REC 26	New School Receptor*	16.0	17.2	1.22
REC 27	48 Horsham Road	23.9	20.9	-3.01
REC 28	50 St Flora's Road	20.7	20.9	0.22
REC 29	All Saint's Church*	31.0	28.7	-2.29
REC 30	15 Wick Street	21.6	20.2	-1.38
REC 31	59 Highdown Drive	19.4	19.8	0.37
REC 32	150 Highdown Drive	20.2	22.5	2.29
REC 33	Cornfield Close	21.8	23.9	2.06
REC 34	63b Oakcroft Gardens	27.8	28.4	0.61
REC 35	Church*	30.9	30.1	-0.73
REC 36	Watersmead Business Park*	21.1	21.5	0.41
REC 37	81 Oakcroft Gardens	21.9	20.6	-1.26
REC 38	116 Horsham Road	20.3	18.9	-1.41
REC 39	1 Cornwall Road	20.4	19.0	-1.38
REC 40	Proposed Unit 1*	16.4	26.7	10.24
REC 41	Proposed Unit 2*	20.6	30.4	9.85

* Non residential receptors are marked with an asterisk

The maximum predicted increase in the annual average exposure to nitrogen dioxide at any residential receptor is 13.16 $\mu\text{g}/\text{m}^3$ at Receptor 10, 10 Toddington Park. The maximum predicted increase at a non residential receptor is 10.24 $\mu\text{g}/\text{m}^3$ at Receptor 40, Proposed Unit 1.

The maximum predicted decrease in the annual average exposure to nitrogen dioxide at any residential receptor is -3.70 $\mu\text{g}/\text{m}^3$ at Receptor 6, 1 Coombes Way. The maximum predicted decrease at a non residential receptor is -2.29 $\mu\text{g}/\text{m}^3$ at Receptor 29, All Saints Church.



No existing residential receptor locations are predicted to exceed the annual average objective in the opening year of the development either in the do minimum or the do something scenarios.

None of the non residential receptor locations are predicted to exceed an annual average of $60\mu\text{g}/\text{m}^3$. Based on the DEFRA guidance summarised in Section 2 there are not predicted to be any exceedences of the one hour average objective for nitrogen dioxide at any receptor locations within the study area.

Based on the significance criteria outlined in section 3 the effects of the proposed scheme with reference to NO_2 are summarised in table 17.

Table 17: Nitrogen Dioxide Significance Effects at Key Receptors

	Receptor	% Change	Magnitude	Sensitivity	Significance	Impact
REC 1	Holly Cottage	29.28%	Large	Low	Slight	Adverse
REC 2	17 Granary Way	21.87%	Large	Low	Slight	Adverse
REC 3	112 Lyminster Road	7.62%	Medium	Low	Negligible	Neutral
REC 4	Hunters Lodge	1.11%	Small	Low	Negligible	Neutral
REC 5	203 Lyminster Road	0.79%	Imperceptible	Low	Negligible	Neutral
REC 6	1 Coombes Way	-9.58%	Medium	High	Moderate	Beneficial
REC 7	2 Lyminster Road	-8.44%	Medium	High	Moderate	Beneficial
REC 8	21 Holly Drive	17.66%	Large	Low	Slight	Adverse
REC 9	23 Toddington Park	34.23%	Large	Low	Slight	Adverse
REC 10	10 Toddington Park	58.09%	Large	Low	Slight	Adverse
REC 11	47 Colebrook Road	0.75%	Imperceptible	Low	Negligible	Neutral
REC 12	24 Joyce Close	1.18%	Small	Low	Negligible	Neutral
REC 13	Flat 14 Marden House	1.24%	Small	Low	Negligible	Neutral
REC 14	58 Gloucester Road	-0.29%	Imperceptible	Low	Negligible	Neutral
REC 15	21 Arundel Road	-8.15%	Medium	Low	Negligible	Neutral
REC 16	24 Connaught Road	-6.64%	Medium	Low	Negligible	Neutral
REC 17	39 East Street	-8.32%	Medium	Low	Negligible	Neutral
REC 18	1 Rosamead	4.78%	Small	Medium	Negligible	Neutral
REC 19	2 St Mary's Gardens	-2.43%	Small	Low	Negligible	Neutral
REC 20	35 Fitzalan Road	1.01%	Small	Low	Negligible	Neutral



REC 21	Summerlea House	4.13%	Small	Low	Negligible	Neutral
REC 22	5 Paterson Wilson Road	4.97%	Small	Low	Negligible	Neutral
REC 23	Elm Grove Infant School*	26.82%	Large	Low	Slight	Adverse
REC 24	34 Highdown Drive	17.94%	Large	Low	Slight	Adverse
REC 25	19 Amberley Close	15.14%	Large	Low	Slight	Adverse
REC 26	New School Receptor*	7.65%	Medium	Low	Negligible	Neutral
REC 27	48 Horsham Road	-12.58%	Large	Low	Slight	Beneficial
REC 28	50 St Flora's Road	1.05%	Small	Low	Negligible	Neutral
REC 29	All Saint's Church*	-7.41%	Medium	Medium	Slight	Beneficial
REC 30	15 Wick Street	-6.40%	Medium	Low	Negligible	Neutral
REC 31	59 Highdown Drive	1.93%	Small	Low	Negligible	Neutral
REC 32	150 Highdown Drive	11.38%	Large	Low	Slight	Adverse
REC 33	Cornfield Close	9.44%	Medium	Low	Negligible	Neutral
REC 34	63b Oakcroft Gardens	2.20%	Medium	Low	Negligible	Neutral
REC 35	Church*	-2.36%	Medium	Low	Negligible	Neutral
REC 36	Watersmead Business Park*	1.96%	Small	Medium	Negligible	Neutral
REC 37	81 Oakcroft Gardens	-5.76%	Medium	Low	Negligible	Neutral
REC 38	116 Horsham Road	-6.94%	Medium	Low	Negligible	Neutral
REC 39	1 Cornwall Road	-6.76%	Medium	Low	Negligible	Neutral
REC 40	Proposed Unit 1*	62.38%	Large	Low	Slight	Adverse
REC 41	Proposed Unit 2*	47.89%	Large	Low	Slight	Adverse

Overall the magnitude of the effects of the proposed development with respect to NO₂ is determined to be in the range 'large' to 'imperceptible'. The impact significance of the development with respect to NO₂ is in the range 'moderate beneficial' to 'slight adverse'. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'. The effects are considered to be direct, permanent, long-term, irreversible and non cumulative.



6.6.2 Particulate Matter

Table 18: Predicted 2016 Annual Average Concentrations of PM10 at Existing Receptor Locations ($\mu\text{g}/\text{m}^3$).

Receptor		Nitrogen Dioxide $\mu\text{g}/\text{m}^3$		
		2016 Base	2016 Development	Difference
REC 1	Holly Cottage	16.02	16.38	0.36
REC 2	17 Granary Way	17.84	18.12	0.28
REC 3	112 Lyminster Rd	16.99	17.13	0.14
REC 4	Hunters Lodge	17.10	17.12	0.02
REC 5	203 Lyminster Rd	16.60	16.61	0.01
REC 6	1 Coombes Way	18.36	18.18	-0.18
REC 7	2 Lyminster Rd	19.02	18.89	-0.13
REC 8	21 Holly Drive	16.04	16.26	0.21
REC 9	23 Toddington Pk	16.08	16.47	0.39
REC 10	10 Toddington Pk	16.32	17.32	0.99
REC 11	47 Colebrook Road	18.02	18.03	0.01
REC 12	24 Joyce Close	18.00	18.02	0.02
REC 13	Flat 14 Marden House	17.94	17.95	0.01
REC 14	58 Gloucester Rd	16.56	16.56	0.00
REC 15	21 Arundel Rd	16.85	16.80	-0.05
REC 16	24 Connaught Rd	16.89	16.84	-0.05
REC 17	39 East Sreet	17.23	17.15	-0.08
REC 18	1 Rosamead	15.98	16.05	0.07
REC 19	2 St Mary`s Gardens	16.06	16.03	-0.03
REC 20	35 Fitzalan Rd	15.76	15.77	0.01
REC 21	Summerlea House	15.68	15.72	0.04
REC 22	5 Paterson Wilson Rd	15.63	15.67	0.04
REC 23	Elm Grove Infant Sch*	15.65	15.87	0.22
REC 24	34 Highdown Drive	15.60	15.74	0.14
REC 25	19 Amberley Close	15.60	15.71	0.12
REC 26	New Sch Receptor*	15.59	15.65	0.06



REC 27	48 Horsham Rd	16.06	15.94	-0.12
REC 28	50 St Flora's Rd	15.90	15.92	0.02
REC 29	All Saint's Church*	18.61	18.55	-0.07
REC 30	15 Wick Street	16.71	16.67	-0.04
REC 31	59 Highdown Drive	17.84	17.86	0.03
REC 32	150 Highdown Drive	16.08	16.21	0.13
REC 33	Cornfield Close	16.16	16.29	0.14
REC 34	63b Oakcroft Gardens	16.61	16.68	0.06
REC 35	Church*	16.93	16.94	0.00
REC 36	Watersmead Bus. Park*	16.29	16.33	0.04
REC 37	81 Oakcroft Gardens	16.38	16.34	-0.04
REC 38	116 Horsham Rd	15.84	15.79	-0.05
REC 39	1 Cornwall Rd	16.73	16.68	-0.05
REC 40	Proposed 1*	16.29	16.94	0.65
REC 41	Proposed 2*	16.02	16.62	0.60

The maximum predicted increase in the annual average exposure to PM₁₀ at any residential receptor is 0.99 µg/m³ at Receptor 10, 10 Toddington Park. The maximum predicted increase at a non residential receptor is 0.65 µg/m³ at Receptor 40, Proposed Unit 1.

The maximum predicted decrease in the annual average exposure to nitrogen dioxide at any residential receptor is -0.18 µg/m³ at Receptor 6, 1 Coombes Way. The maximum predicted decrease at a non residential receptor is -0.07µg/m³ at Receptor 29, All Saints Church.

No existing residential receptor locations are predicted to exceed the annual average objective in the opening year of the development either in the do minimum or the do something scenarios.

Based on the significance criteria outlined in section 3 the effects of the proposed scheme with reference to PM₁₀ are summarised in table 19.

**Table 19: PM₁₀ Significance Effects at Key Receptors**

Receptor		% Change	Magnitude	Sensitivity	Significance	Impact
REC 1	Holly Cottage	2.26%	Small	Low	Negligible	Neutral
REC 2	17 Granary Way	1.55%	Small	Low	Negligible	Neutral
REC 3	112 Lyminster Rd	0.79%	Imperceptible	Low	Negligible	Neutral
REC 4	Hunters Lodge	0.11%	Imperceptible	Low	Negligible	Neutral
REC 5	203 Lyminster Rd	0.05%	Imperceptible	Low	Negligible	Neutral
REC 6	1 Coombes Way	-0.98%	Imperceptible	Low	Negligible	Neutral
REC 7	2 Lyminster Rd	-0.68%	Imperceptible	Low	Negligible	Neutral
REC 8	21 Holly Drive	1.34%	Small	Low	Negligible	Neutral
REC 9	23 Toddington Pk	2.43%	Small	Low	Negligible	Neutral
REC 10	10 Toddington Pk	6.09%	Medium	Low	Negligible	Neutral
REC 11	47 Colebrook Road	0.07%	Imperceptible	Low	Negligible	Neutral
REC 12	24 Joyce Close	0.09%	Imperceptible	Low	Negligible	Neutral
REC 13	Flat 14 Marden House	0.06%	Imperceptible	Low	Negligible	Neutral
REC 14	58 Gloucester Rd	0.01%	Imperceptible	Low	Negligible	Neutral
REC 15	21 Arundel Rd	-0.31%	Imperceptible	Low	Negligible	Neutral
REC 16	24 Connaught Rd	-0.32%	Imperceptible	Low	Negligible	Neutral
REC 17	39 East Sreet	-0.47%	Imperceptible	Low	Negligible	Neutral
REC 18	1 Rosamead	0.43%	Imperceptible	Low	Negligible	Neutral
REC 19	2 St Mary`s Gardens	-0.21%	Imperceptible	Low	Negligible	Neutral
REC 20	35 Fitzalan Rd	0.09%	Imperceptible	Low	Negligible	Neutral
REC 21	Summerlea House	0.26%	Imperceptible	Low	Negligible	Neutral
REC 22	5 Paterson Wilson Rd	0.28%	Imperceptible	Low	Negligible	Neutral
REC 23	Elm Grove Infant Sch	1.41%	Small	Low	Negligible	Neutral
REC 24	34 Highdown Drive	0.87%	Imperceptible	Low	Negligible	Neutral
REC 25	19 Amberley Close	0.75%	Imperceptible	Low	Negligible	Neutral
REC 26	New Sch Receptor	0.39%	Imperceptible	Low	Negligible	Neutral
REC 27	48 Horsham Rd	-0.75%	Imperceptible	Low	Negligible	Neutral
REC 28	50 St Flora`s Rd	0.12%	Imperceptible	Low	Negligible	Neutral



REC 29	All Saint`s Church	-0.36%	Imperceptible	Low	Negligible	Neutral
REC 30	15 Wick Street	-0.23%	Imperceptible	Low	Negligible	Neutral
REC 31	59 Highdown Drive	0.14%	Imperceptible	Low	Negligible	Neutral
REC 32	150 Highdown Drive	0.80%	Imperceptible	Low	Negligible	Neutral
REC 33	Cornfield Close	0.84%	Imperceptible	Low	Negligible	Neutral
REC 34	63b Oakcroft Gardens	0.39%	Imperceptible	Low	Negligible	Neutral
REC 35	Church	0.03%	Imperceptible	Low	Negligible	Neutral
REC 36	Watersmead Bus. Park	0.24%	Imperceptible	Low	Negligible	Neutral
REC 37	81 Oakcroft Gardens	-0.25%	Imperceptible	Low	Negligible	Neutral
REC 38	116 Horsham Rd	-0.31%	Imperceptible	Low	Negligible	Neutral
REC 39	1 Cornwall Rd	-0.30%	Imperceptible	Low	Negligible	Neutral
REC 40	Proposed 1	3.98%	Small	Low	Negligible	Neutral
REC 41	Proposed 2	3.72%	Small	Low	Negligible	Neutral

Overall the magnitude of the effects of the proposed development with respect to PM_{10} is determined to be in the range 'imperceptible' to 'small'. The significance of the development with respect to PM_{10} is 'negligible', as such impacts are predicted to be 'neutral'. Given the quantitative nature of the assessment and the verification of the air quality dispersion model, the confidence of the assessment is deemed to be 'high'. The effects are considered to be direct, permanent, long-term, irreversible and non cumulative.



7.0 Proposed Mitigation Measures

7.1 Mitigation of Construction Impacts (based on high risk)

Site Planning

- Erect solid barriers to the site boundary with key receptors.
- No bonfires.
- Plan site layout – machinery and dust causing activities should be located away from sensitive receptors.
- All site personnel to be fully trained.
- Trained and responsible manager on site during working times to maintain logbook and carry out site inspections.
- Hard surface site haul routes.
- Use nearby rail or waterways for transportation to/from site.
- Put in place dust monitors near to key receptors.

Construction traffic

- All vehicles to switch off engines – no idling vehicles.
- Effective vehicle cleaning and specific fixed wheel washing on leaving site and damping down of haul routes.
- All loads entering and leaving site to be covered.
- No site runoff of water or mud.
- On-road vehicles to comply to set emission standards.
- All non road mobile machinery (NRM) to use ultra low sulphur tax-exempt diesel (ULSD) where available and be fitted with appropriate exhaust after-treatment from the approved list.
- Minimise movement of construction traffic around site.
- Hard surfacing and effective cleaning of haul routes and appropriate speed limit around site.



Demolition Works

- Use water as dust suppressant.
- Cutting equipment to use water as suppressant or suitable local extract ventilation.
- Use enclosed chutes and covered skips.
- Wrap building(s) to be demolished.

Site Activities

- Minimise dust generating activities.
- Use water as dust suppressant where applicable.
- Cover, seed or fence stockpiles to prevent wind whipping.
- Re-vegetate earthworks and exposed areas.
- If applicable, ensure concrete crusher or concrete batcher has permit to operate.
-

7.2 Mitigation of Operational Impacts

No specific measures are considered as necessary to mitigate the impacts of changes in traffic emissions associated with the development.





8.0 Conclusions

An air quality assessment for a proposed relief road in North Littlehampton, West Sussex, has been undertaken based on predictions from a validated air quality dispersion model. The model has been verified using historical local air quality monitoring data collected by Arun District Council along with the results of a short term survey conducted by WYG between May and September 2008.

Following mitigation the residual effects of the construction stage have been assessed as being 'slight adverse' in significance.

The residual effects of the changes in traffic emissions associated with the operational phase have been assessed as being 'large' to 'imperceptible' in magnitude and 'slight adverse' to 'moderate beneficial' in significance.

The proposed development is not predicted to result in any exceedence of any UK Air Quality Objectives or EU Limit Values and the development is not considered to be contrary to any of the regional or local planning policies.





Appendix A – Sketches

SK01 – Monitoring Locations

SK02 – Modelled Receptor Locations

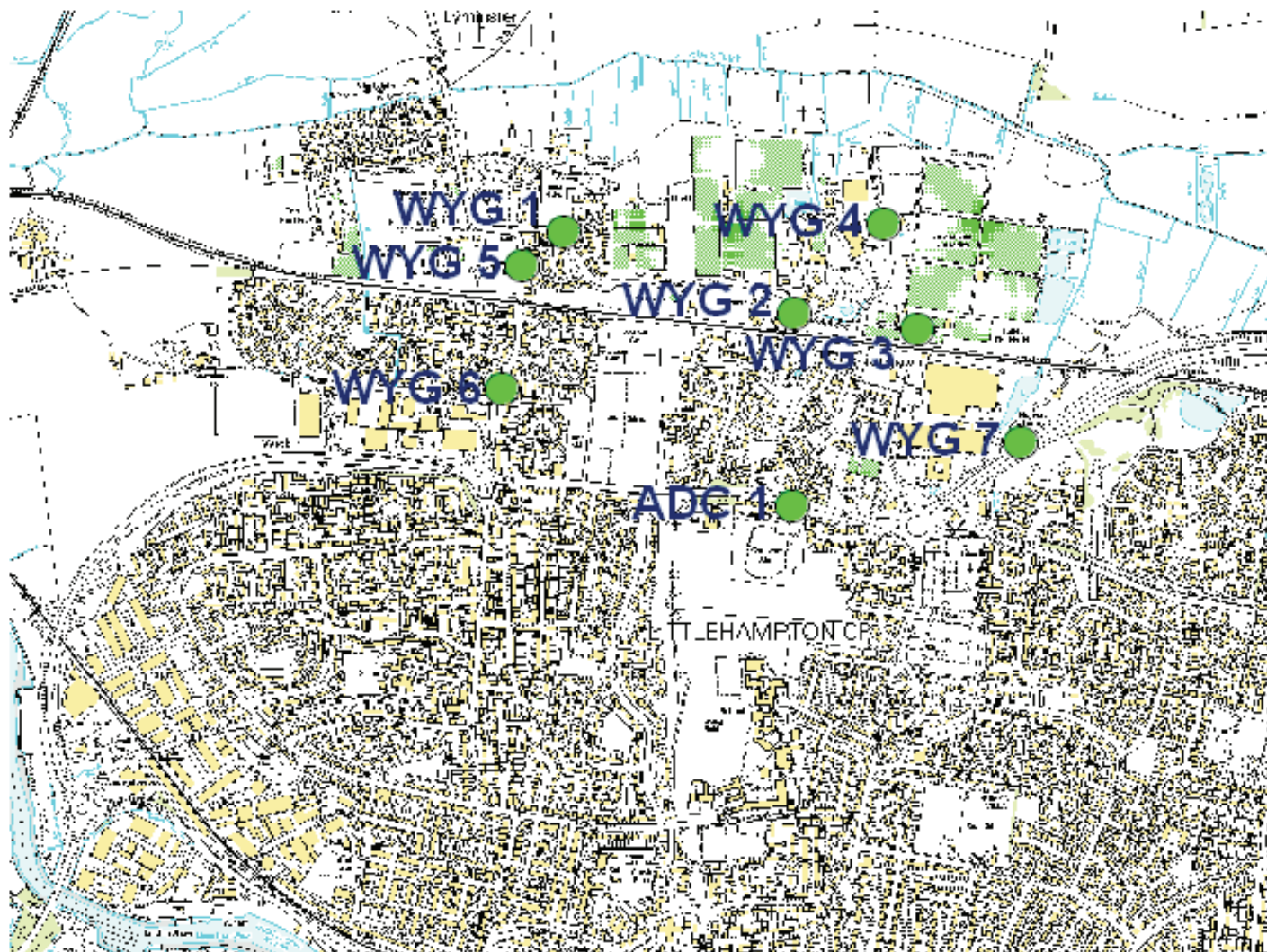
SK03 – Modelled Roads

Appendix B – Traffic Data

Table 20: AADT Flows for 2016 'do min' and 'do something' Scenarios

Link Ref	Road Name	Traffic Speed kph	Baseline 2016 (DM)		Proposed 2016 (DS)	
			LGV	HGV	LGV	HGV
1	Bridge Road	55	25890	2790	26801	2708
2	Terminus Road	40	14670	787	15214	671
3	Franciscan Way	30	15312	1188	15249	591
4	East Street S of Franciscan Way	30	7607	845	7803	830
5	East Street N of Franciscan Way	40	10047	406	12573	620
6	Fitzalan Road	40	4814	456	5119	424
7	East Street W of Fitzalan Road	50	11219	438	12351	559
8	St Flora's Road	45	4046	335	4208	368
9	Southfields Road	35	3813	355	4084	361
10	B2187 Horsham Road	25	12427	981	10499	326
11	B2187 Horsham Road North of Oakcroft Gardens	25	12031	1038	9912	362
12	B2187 Worthing Road	30	9680	1005	10346	946
13	A259	45	21988	1899	22650	1865
14	Business Site Access	45	2831	313	3022	289
15	A259 Worthing Road W of Norway Lane RB	45	24437	2924	27429	2782
16	A259 Worthing Road E of new RB	30	21540	2801	25811	2676
17	A259 Worthing Road W of new RB	30	20256	2825	20153	2158
18	A284 Wick Street N	30	10268	1578	10475	1143
19	A284 Wick Street S	45	6647	1276	6483	809
20	Clun Road	45	3423	333	3571	316
21	A284 Arundel Road	25	9572	996	8673	513
22	Cornwall Road	40	1586	34	1286	39
23	A284 Arundel Road S	45	10491	974	9114	507
24	A259 Worthing Road Western Section beyond A284	55	18774	2328	20032	2414
25	Hawthorn Road Link	25	1077	89	1123	83
26	Courtwick Road	30	5599	515	5871	490
27	Lyminster Road S of Railway	25	10885	1510	8420	643

28	Lyminster Road N of Railway	25	10924	1514	8430	643
29	Lyminster Road North of Mill Lane	60	12329	1465	12613	1485
30	Mill Lane	20	3303	391	7167	1019
31	Mill Lane W of Hearnfield Road	45	2800	1	7742	867
32	New Link Road North Section	60	0	0	15115	873
33	New Link Road South of New RB	20	0	0	8326	1426
34	Highdown Drive	40	1212	52	1028	49
35	New Link Road Central Section	45	1042	1	6663	1312
36	New Link Road S Section to Fitzalan Rd RB	40	1705	118	2151	164
37	Elm Grove Road	25	1636	132	1706	129



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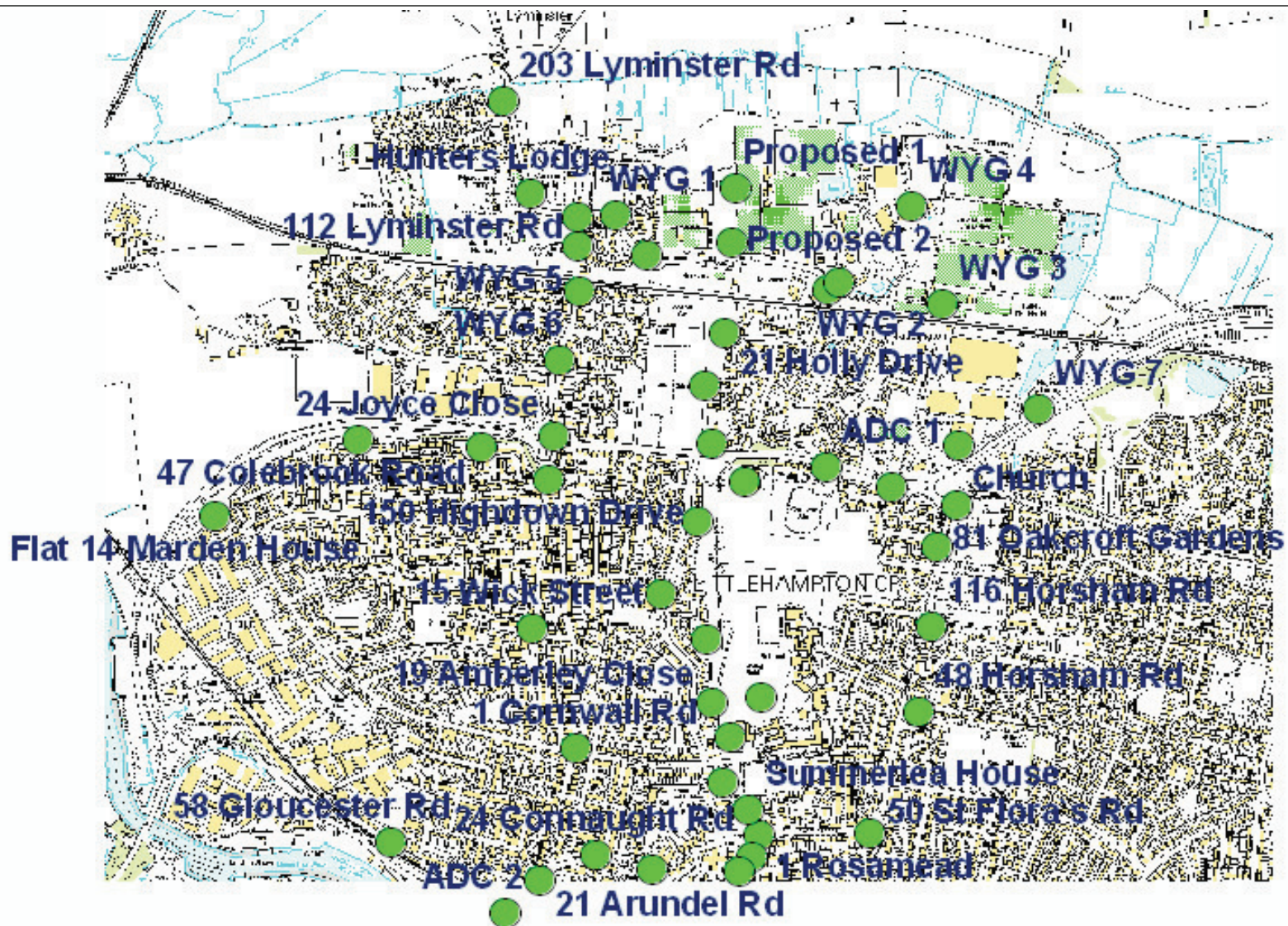


Project:
Fitzalan Link Road

Client:
Greencore Group

Drawing Title:
SK01 Air Quality Monitoring Locations

Scale at A3	Drawn By JC	Date 26.01.2011	Checked By	Date	Approved By	Date
Project No. A0	Office 35	Type 04	Drawing No. SK01	Revision 1		
APPROVAL ☐	INFORMATION ☐	TENDER ☐	CONTRACT ☐	CONSTRUCTION ☐		



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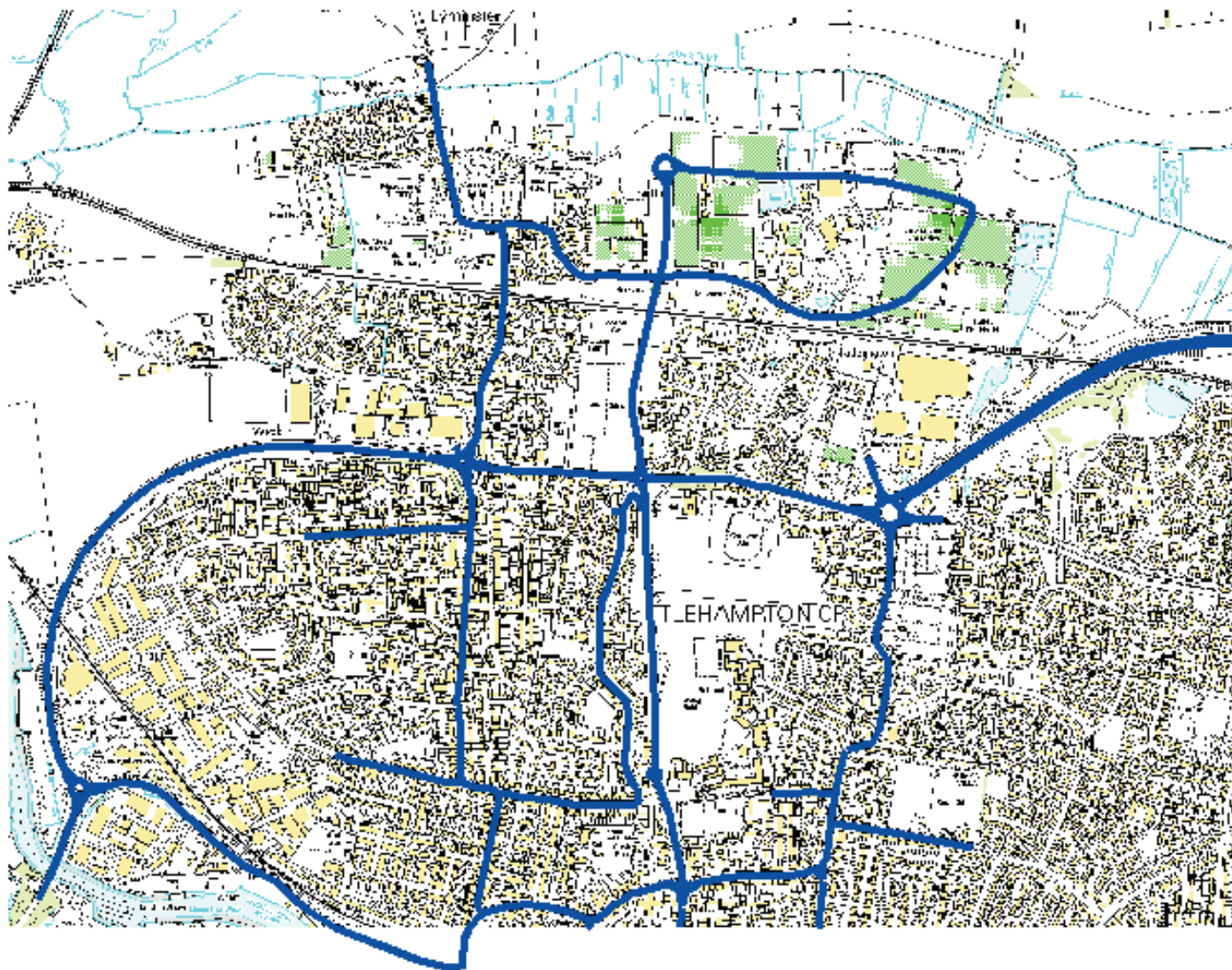
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Project:
Fitzalan Link Road

Client:
Greencore Group

Drawing Title:
SK02 Receptor Locations

Scale at A3	Drawn By JC	Date 26.01.2011	Checked By	Date	Approved By	Date
Project No. A0	Office 35	Type 04	Drawing No. SK02	Revision 1		
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Project:
Fitzalan Link Road

Client:
Greencore Group

Drawing Title:
SK03 Modelled Emissions Sources

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	26.01.2011				
Project No.	Office	Type	Drawing No.	Revision		
A0	35	04	SK03	1		
APPROVAL ☐	INFORMATION ☐	TENDER ☐	CONTRACT ☐	CONSTRUCTION ☐		