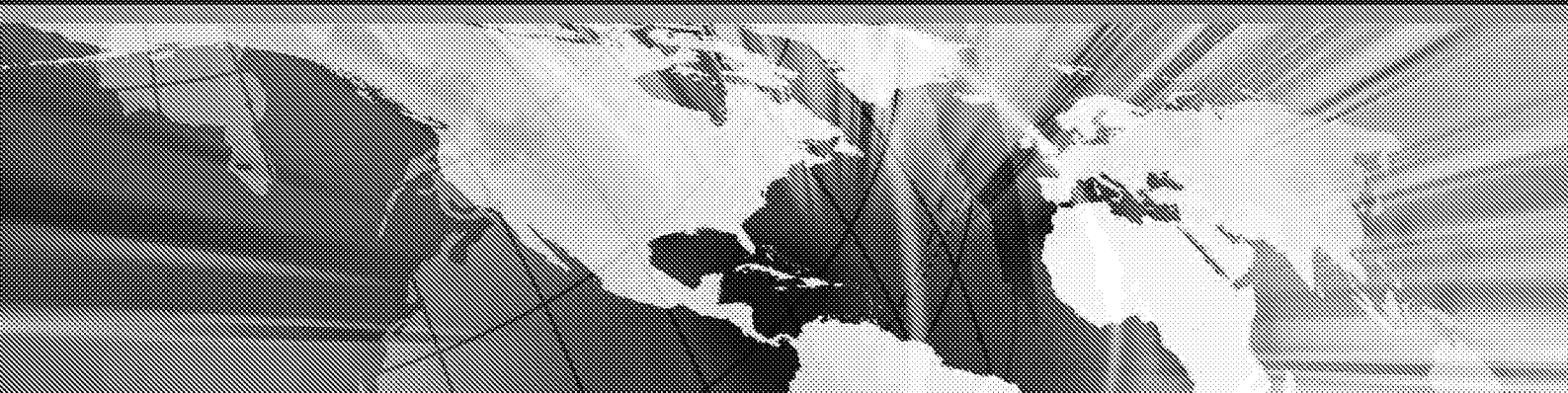


ENERGY AND CLIMATE CHANGE
ENVIRONMENT AND SUSTAINABILITY
INFRASTRUCTURE AND UTILITIES
LAND AND PROPERTY
MINING, QUARRYING AND MINERAL ESTATES
WASTE RESOURCE MANAGEMENT



GLADMAN DEVELOPMENTS LTD

LAND WEST OF ARUNDEL ROAD, ANGMERING

AIR QUALITY ASSESSMENT

FEBRUARY 2018

your earth our world



DATE ISSUED: FEBRUARY 2018
JOB NUMBER: LE14250
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GLADMAN DEVELOPMENTS LTD

LAND WEST OF ARUNDEL ROAD, ANGMERING

AIR QUALITY ASSESSMENT

FEBRUARY 2018

PREPARED BY:

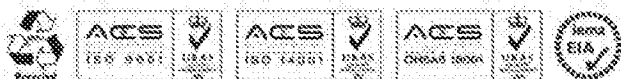
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LE14250-002

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1 INTRODUCTION

- 1.1.1 Wardell Armstrong LLP has been commissioned by Gladman Developments Ltd to undertake an air quality assessment for a proposed residential development at Land west of Arundel Road, Angmering.
- 1.1.2 The proposed development site is located to the north of Angmering, West Sussex, and comprises a parcel of land approximately 9.10 ha in size. The north of the site is bordered by a strip of open land with woodland to the north of this. Part of the north eastern section of the site is bound by Arundel Road, the majority of the eastern boundary being formed by a small piece of open land. Beyond the Arundel Road to the east is woodland and Acorns Campsite. To the south of the site is a recreation ground and sports facilities including buildings of the Angmering Sports and Social Club, with residential properties of Decoy Drive and Palmer Road to the south of the sports fields. To the west, the site boundary is formed by a strip of trees/hedgerow with open agricultural land beyond this. The south eastern section of the site is currently occupied by various commercial occupants including a garage/automotive supply business, a window supply/double glazing business, and a small caravan park.
- 1.1.3 We understand that there is a small builder's yard located to the south of the current site access road, and that all the commercial properties currently located within the site will be removed/relocated.
- 1.1.4 We understand that the development proposals are for up to 200 residential properties and associated infrastructure, over a residential development area of 6 ha.
- 1.1.5 The traffic data used in this report was based on a development of 220 residential properties. Therefore, the air quality assessment is slightly more robust.
- 1.1.6 This report details the results of the air quality assessment undertaken in support of a planning application for the proposed residential development. The report discusses the potential dust and fine particulate matter impacts associated with the construction phase; and an assessment of the potential air quality impacts of the additional road traffic generated by the proposed development. Air pollutant concentrations are considered at existing sensitive receptor locations in the vicinity of the proposed development, and also at proposed receptor locations within the development itself.
- 1.1.7 The report has been compiled using the most recent version of the Emission Factor Toolkit (version 8.0.1), which was released by DEFRA in December 2017.

2 LEGISLATION AND POLICY CONTEXT

2.1 Air Quality Legislation and National Air Quality Strategy

- 2.1.1 The Environment Act 1995 requires the UK government to prepare a National Air Quality Strategy. The UK National Air Quality Strategy (NAQS) was therefore published in March 1997 setting out policies for the management of ambient air quality. The Strategy sets objectives for eight pollutants, which may potentially occur in the UK at levels that give cause for concern. These pollutants are: nitrogen dioxide (NO₂), sulphur dioxide, carbon monoxide, lead, fine particulate matter (PM₁₀), benzene, 1,3-butadiene and ozone.
- 2.1.2 The Strategy was reviewed and a Review Report¹ and Consultation Document² were published by the Department of the Environment, Transport and the Regions (DETR) in 1999. A revised version (The Air Quality Strategy (AQS) 2000), which supersedes the 1997 Strategy, was published in January 2000. The AQS 2000 strengthens the objectives for a number of pollutants with the exception of that for particulates, which was replaced with the less stringent EU limit value.
- 2.1.3 The objectives for the eight pollutants in the Strategy provide the basis of the implementation of Part IV of the Environment Act 1995. The Air Quality Strategy objectives for each pollutant, except ozone, were given statutory status in the Air Quality (England) Regulations, 2000³ and Air Quality (England) (Amendment) Regulations 2002⁴.
- 2.1.4 In 2007 the Air Quality Strategy was revised. This latest strategy⁵ does not remove any of the objectives set out in the previous strategy or its addendum, apart from replacing the provisional 2010 objective for PM₁₀ in England, Wales and Northern Ireland with the exposure reduction approach for PM_{2.5}. The UK Government and the Devolved Administrations have now therefore set new national air quality objectives for particulate matter smaller than 2.5µm diameter (PM_{2.5}).
- 2.1.5 EU Directive 2008/50/EC⁶ came into force in June 2008 and was transposed into legislation in England on 11th June 2010 as 'The Air Quality Standards Regulations

¹ Department of the Environment, Transport and the Regions, January 1999. Report on the Review of the National Air Quality Strategy, Proposals to amend the Strategy

² Department of the Environment, Transport and the Regions 1999, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. A consultation document

³ The Air Quality (England) Regulations 2000. SI No 928

⁴ The Air Quality (Amendment) Regulations 2002

⁵ Department of Environment, Food and Rural Affairs, The Air Quality Strategy for England, Scotland, Wales and Northern Ireland. July 2007

⁶ Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe

2010⁷. This EU Directive consolidates existing air quality legislation and makes achievement of the objectives a national objective rather than a local one. It also provides a new regulatory framework for PM_{2.5}.

2.1.6 The current Air Quality Standards and Objectives, as set out in the Air Quality Standards Regulations 2010, are detailed in Table 1.

Table 1: UK Air Quality Objectives and Pollutants			
Pollutant	Objective	Averaging Period	Obligation
Nitrogen Dioxide (NO ₂)	200µg/m ³ not to be exceeded more than 18 times a year	1-hour mean	All local authorities
	40µg/m ³	Annual mean	All local authorities
Particulate Matter (PM ₁₀)	50µg/m ³ not to be exceeded more than 35 times a year	24-hour mean	All local authorities
	50µg/m ³ not to be exceeded more than 7 times a year	24-hour mean	Scotland only
	40µg/m ³	Annual mean	All local authorities
	18µg/m ³	Annual mean	Scotland only
Particulate Matter (PM _{2.5})	25µg/m ³	Annual mean	England only
	10µg/m ³	Annual mean	Scotland only
Sulphur Dioxide (SO ₂)	266µg/m ³ not to be exceeded more than 35 times a year	15-minute mean	All local authorities
	350µg/m ³ not to be exceeded more than 24 times a year	1-hour mean	All local authorities
	125µg/m ³ not to be exceeded more than 3 times a year	24-hour mean	All local authorities
Benzene (C ₆ H ₆)	16.25µg/m ³	Running annual mean	All local authorities
	5µg/m ³	Annual mean	England and Wales only
	3.25µg/m ³	Running annual mean	Scotland and Northern Ireland only
1,3-Butadiene (C ₄ H ₆)	2.25µg/m ³	Running annual mean	All local authorities
Carbon Monoxide (CO)	10mg/m ³	Maximum daily running 8-hour mean	England, Wales and Northern Ireland only
	10mg/m ³	Running 8-hour mean	Scotland only
Lead (Pb)	0.5µg/m ³	Annual mean	All local authorities
	0.25µg/m ³	Annual mean	All local authorities

⁷ Statutory Instruments 2010 No. 1001 The Air Quality Standards Regulations 2010

2.2 Local Air Quality Management Guidance

- 2.2.1 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, July 2007, establishes the framework for air quality improvements based on measures agreed at a national and international level. However, despite these measures, it is recognised that areas of poor air quality will remain and these should be dealt with through the Local Air Quality Management (LAQM) process using locally implemented measures.
- 2.2.2 LAQM legislation in the Environment Act 1995 requires local authorities to conduct periodic review and assessments of air quality. These aim to identify all those areas where the air quality objectives are being, or are likely to be, exceeded.
- 2.2.3 All authorities were required to undertake the first stage of review and assessment which concluded in September 2001. In those areas identified as having the potential to experience elevated levels of pollutants the authority was required to undertake a more detailed second stage review comprising two steps; Updating and Screening Assessments and Detailed Assessments. Where it was predicted that one or more of the air quality objectives would be unlikely to be met by the end of 2005, local authorities were required to proceed to a third stage and, if necessary, declare Air Quality Management Areas (AQMAs) and make action plans for improvements in air quality, in pursuit of the national air quality objectives.
- 2.2.4 An Evaluation Report, commissioned by the UK Government and Devolved Administrations in 2007, led to the publication of the LAQM Technical Guidance document LAQM.TG(09) in February 2009⁸. This technical guidance was subsequently updated following a consultation process, and in January 2016 the LAQM Technical Guidance document LAQM.TG(16) was published by Defra⁹.
- 2.2.5 LAQM.TG(16) presents the changes to the LAQM system across the UK. A new streamlined approach has been adopted in England and Scotland; however, Wales and Northern Ireland are still considering changes to LAQM and therefore work according to the previous regimes.

⁸ Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance Document LAQM.TG(09), February 2009

⁹ Department for Environment, Food and Rural Affairs, Local Air Quality Management Technical Guidance Document LAQM.TG(16), April 2016

- 2.2.6 The previous structure of Review and Assessment, comprising Updating and Screening Assessments and Detailed Assessments has been replaced by the introduction of an Annual Status Report (ASR) for England and an Annual Progress Report (APR) for Scotland.
- 2.2.7 The ASR replaces all other reports which previously had to be submitted as part of the LAQM system including review and assessment and action plan progress reports, updating and screening assessments and detailed assessments.
- 2.2.8 Local authorities now have the option of a fast track AQMA declaration option. This allows more expert judgement to be used and removes the need for a detailed assessment where a local authority is confident of the outcome. Detailed assessments should still be used if there is any doubt.
- 2.2.9 Examples of where the Air Quality Objectives should/should not apply are also detailed in LAQM.TG(16) and are included in Table 2 below.

Table 2: Examples of Where the Air Quality Objectives Should Apply		
Averaging Period	Objectives Should Apply at:	Objectives Should Generally Not Apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building façades of residential properties, schools, hospitals, car homes, etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade) or any other location where public exposure is expected to be short term
24-hour mean and 8-hour mean	All locations where the annual mean objectives would apply together with hotels. Gardens of residential properties ^a	Kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term
1-hour mean	All locations where the annual mean and 24 and 8-hour objectives apply. Kerbside sites (e.g. pavements of busy shopping streets). Those parts of car parks and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations to which the public might reasonably be expected to spend one hour or longer	Kerbside sites where public would not be expected to have regular access

Table 2: Examples of Where the Air Quality Objectives Should Apply		
Averaging Period	Objectives Should Apply at:	Objectives Should Generally Not Apply at:
15-minute mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer	
^a : Such locations should represent parts of the garden where relevant public exposure is likely, for example where there is seating or play areas. It is unlikely that relevant public exposure to pollutants would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied		

2.3 National Planning Policy and Guidance

- 2.3.1 The National Planning Policy Framework¹⁰, introduced in March 2012, requires that planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of AQMAs and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in AQMAs is consistent with the local air quality action plan.
- 2.3.2 The Planning Practice Guidance¹¹, updated in March 2014, states that whether or not air quality is relevant to a planning decision will depend on the proposed development and its location. Concerns could arise if the development is likely to generate air quality impacts in an area where air quality is known to be poor. They could also arise where the development is likely to adversely impact upon the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife).
- 2.3.3 Where a proposed development is anticipated to give rise to concerns about air quality an appropriate assessment needs to be carried out. Where the assessment concludes that the proposed development (including mitigation) will not lead to an unacceptable risk from air pollution, prevent sustained compliance with national objectives or fail to comply with the requirements of the Habitats Regulations, then the local authority should proceed to decision with appropriate planning conditions and/or obligations.

2.4 Arun District Council Local Air Quality Management Review and Assessment

- 2.4.1 Arun District Council (ADC) is responsible for the management of air quality in the vicinity of the proposed development site. There are currently no Air Quality

¹⁰ Department for Communities and Local Government. National Planning Policy Framework, March 2012

¹¹ Department for Communities and Local Government. Planning Practice Guidance: Air Quality, March 2014

Management Areas (AQMA) within ADC's area and as such the site is not situated in or close to any AQMA. The nearest AQMA to the site is the Grove Lodge/Lyons Farm AQMA which is located approximately 6km to the east of the site boundary, under the remit of Worthing Borough Council (WBC). The Grove Lodge/Lyons Farm AQMA has been declared for exceedance of the annual mean objective for nitrogen dioxide (NO₂).

- 2.4.2 The 2017 Air Quality Annual Status Report, the most recent LAQM report available from ADC, considered monitoring data collected for 2016. ADC does not currently operate any automatic (continuous) monitoring site across the district, but undertook non-automatic (passive) sampling of NO₂ at 15 sites during 2016. The closest roadside monitoring site (Site 2, Worthing Road, Littlehampton) is located approximately 4km south west of the proposed development site. The 2017 Annual Status Report indicates that within the district during 2016, there were no exceedances of the NO₂ annual mean objective of 40 µg/m³ at all fifteen monitoring locations.

3 ASSESSMENT METHODOLOGY

3.1 Consultation and Scope of Assessment

3.1.1 Consultation was undertaken, in a series of communications between 8th December and 3rd January 2018, with Mr Colin Giddings, Senior Environmental Health Officer at ADC. An assessment methodology was provided on 8th December which detailed the following:

- A construction phase dust assessment will be undertaken in accordance with guidance from the Institute of Air Quality Management (IAQM);
- A detailed air quality assessment will be undertaken, using the air dispersion model ADMS-Roads, to consider the potential air quality impacts during the operational phase of the proposed development;
- Meteorological data for 2016 will be obtained from the Shoreham Meteorological Recording Station, which is considered to be the most representative of conditions at the proposed development site;
- In the absence of representative background PM₁₀ and PM_{2.5} monitoring data being available for the local area, background concentrations will be obtained from the 2015-based Defra default concentration maps for the appropriate 1km x 1km grid squares;
- Diffusion tube located to the south west of the proposed development site, on Worthing Road (ADC reference Litt02), will be used for model verification.
- Predicted pollutant concentrations will be compared with the current air quality objectives as set out in the Air Quality Standards Regulations 2010. Changes in pollutant concentrations, as a result of the proposed development, will be calculated and compared against the recently published IAQM and Environmental Protection UK guidance document on planning for air quality: 'Land-Use Planning and Development Control: Planning for Air Quality' (January 2017);

3.1.2 Mr Giddings replied on 3rd January 2018, stating the proposed methodology was 'satisfactory', and that the effects of any committed developments should be included in the assessment.

3.2 Construction Phase Assessment – Dust and Fine Particulate Matter Emissions

3.2.1 To assess the impacts associated with dust and PM₁₀ releases, during the construction phase of the development, an assessment has been undertaken in accordance with IAQM guidance¹².

Step 1

3.2.2 Step 1 of the assessment is to screen the requirement for a more detailed assessment. The guidance states that an assessment will normally be required where there are existing human sensitive receptors within 350m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

3.2.3 With regards to ecological receptors, the guidance states that an assessment will normally be required where there are existing ecological receptors within 50m of the site boundary and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s).

3.2.4 As there are existing sensitive receptors locations within 350m of the site boundary, it is necessary to proceed to Step 2 of the assessment.

Step 2

3.2.5 Step 2 of the assessment determines the potential risk of dust and PM₁₀ arising in sufficient quantities to cause annoyance and/or health and/or ecological impacts. The risk is related to:

- The activities being undertaken (demolition, number of vehicles and plant etc);
- The duration of these activities;
- The size of the site;
- The meteorological conditions (wind speed, direction and rainfall);
- The proximity of receptors to the activity;
- The adequacy of the mitigation measures applied to reduce or eliminate dust; and
- The sensitivity of receptors to dust.

3.2.6 The risk of dust and PM₁₀ effects is determined using four risk categories: negligible, low, medium and high risk. A site is allocated to a risk category based upon two factors:

¹² Institute of Air Quality Management 'Guidance on the Assessment of Dust from Demolition and Construction', February 2014

- **Step 2A** – the scale and nature of the works which determines the potential dust emission magnitude as small, medium or large; and
- **Step 2B** – the sensitivity of the area to dust impacts which is defined as low, medium or high sensitivity.

3.2.7 These two factors are combined in **Step 2C** to determine the risk of dust impacts with no mitigation applied.

3.2.8 The risk of dust effects is determined for four types of construction phase activities, with each activity being considered separately. If a construction phase activity is not taking place on the site, then it does not need to be assessed. The four types of activities to be considered are:

- Demolition;
- Earthworks;
- Construction; and
- Trackout.

Step 3

3.2.9 Step 3 of the assessment determines the site-specific mitigation required for each of the activities, based on the risk determined in Step 2. Mitigation measures are detailed in guidance published by the Greater London Authority¹³, recommended for use outside the capital by LAQM guidance and the IAQM guidance document itself. If the risk is classed as negligible, no mitigation measures beyond those required by legislation will be necessary.

Step 4

3.2.10 Step 4 assesses the residual effect, with mitigation measures in place, to determine whether or not these are significant.

Existing Sensitive Receptors

3.2.11 The closest sensitive receptor locations to the proposed development are detailed in Table 3.

¹³ Greater London Authority, The Control of Dust and Emissions from Construction and Demolition: Best Practice Guidance, 2006

Table 3: Existing Dust Sensitive Receptors		
Receptor	Direction from the Site	Approximate Distance from the Site Boundary (m)
Residential property	North East	54m at closest point.
Industrial buildings	North	135m at closest point.
Industrial/commercial buildings	South	82m at closest point.
Residential properties	South	120m at closest point
Residential properties	South East	Immediately adjacent at closest point.
School buildings	South East	117m at closest point.

Existing Sensitive Receptors – Ecological Receptors

3.2.12 The proposed development is not located near to any Sites of Special Scientific Interest (SSSI). Therefore, there are no ecological receptors, or potentially dust sensitive statutory designated habitat sites, within 50m of the site and/or within 50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s). Ecological effects do not therefore need to be considered within this assessment.

3.3 Operational Phase Assessment – Road Traffic Emissions

Modelling of Road Traffic Emissions

- 3.3.1 The air dispersion model ADMS-Roads (CERC, Version 4.1) has been used to assess the potential impact of development generated traffic on air quality at existing receptor locations. In addition, pollutant concentrations have been predicted within the site at locations which are considered to be representative of the proposed residential uses.
- 3.3.2 The air dispersion model has been used to predict NO₂, PM₁₀ and PM_{2.5} concentrations, as these are the pollutants considered most likely to exceed the air quality objectives for human health.

3.3.3 Air dispersion modelling has been carried out to estimate pollutant concentrations, due to road traffic emissions, for two assessment years as follows:

- The verification and base year (2016): This is the most recent year for which meteorological data and local pollution data are available;
- An opening year of the development (2022): This is considered both without the development and with the development in place; and
- A future year of the development (2027): This is considered both without the development and with the development in place.

Road Traffic Data

3.3.4 The ADMS-Roads model requires the input of detailed road traffic flow information for those routes which will be affected by the proposed development. The traffic flow information used in the assessment is included in Appendix A.

3.3.5 Detailed traffic flow information, for use in the ADMS-Roads air dispersion model, has been provided by Croft Transport Solutions, the appointed transport consultant for the project and is based upon a proposed development of 220 residential dwellings.

3.3.6 Traffic flow information has been provided by the transport consultant as 24-hour Annual Average Daily Traffic (AADT) flows, with HGV percentages, for the following links:

- A27;
- Arundel Road;
- Water Lane;
- A529 New Road;
- B2140;
- Roundstone Bypass; and
- A280.

3.3.7 Air quality modelling has been carried out to predict pollutant concentrations, due to road traffic emissions, for a total of five scenarios:

- Scenario 1: 2016 Verification and Base Year;
- Scenario 2: 2022 Opening Year (Without Development);
- Scenario 3: 2022 Opening Year (With Development);
- Scenario 4: 2027 Future Year (Without Development); and
- Scenario 5: 2027 Future Year (With Development).

3.3.8 The following committed developments have been included in the traffic data for the opening year and future year scenarios:

- Application reference no. A/122/12 – 138 residential units off Roundstone Lane;
- Application reference no. A/144/15/PL – 246 residential units off Roundstone Lane; and
- Application reference no. A/27/16/PL – 53 bed care home off Water Lane.

Meteorological Data

3.3.9 The meteorological data used in the air quality modelling has been obtained from ADM Limited. Meteorological data has been obtained for 2016 from the Shoreham Meteorological Recording Station. This is located approximately 14 km from the proposed development site and is considered to be the most representative of the conditions at the proposed development, due to its relative location.

3.3.10 The meteorological data provides hourly wind speed and direction information. The wind rose for the Shoreham Meteorological Recording Station is included in Appendix B.

Existing Sensitive Receptor Locations

3.3.11 Representative existing sensitive receptor locations (ESR 1 to ESR 14) have been considered in the air quality assessment.

3.3.12 Details of these are given in Table 4, and their locations are shown on drawing LE14250-002.

Table 4: Existing Sensitive Receptor Locations				
Receptor	Address	Grid Reference		Receptor Type
		Eastings	Northing	
ESR 1	New Road	506234	103139	Residential
ESR 2	Teulon Ct, East Preston	506518	103114	Residential
ESR 3	Station Road	506529	103298	Residential
ESR 4	7 Loxwood, East Preston	507896	103184	Residential
ESR 5	107 Old Worthing Road, East Preston	507902	103135	Residential
ESR 6	Anns Cottage, Angmering	506825	104305	Residential

Table 4: Existing Sensitive Receptor Locations				
Receptor	Address	Grid Reference		Receptor Type
		Easting	Northing	
ESR 7	Upstairs Flat, Arundel Road	506806	104361	Residential
ESR 8	Red Admirals, 24 Water Lane	506884	104451	Residential
ESR 9	66B Arundel Road	506740	105230	Residential
ESR 10	10 Arundel Road	506713	105514	Residential
ESR 11	A27, Angmering	506692	105656	Residential
ESR 12	10 Arundel Road	506718	105618	Residential
ESR 13	225 Arundel Road	504734	105828	Residential
ESR 14	4 Darlington Walk	506472	103137	Residential

Proposed Sensitive Receptor Locations

3.3.13 Proposed sensitive receptor locations (PR 1 and PR 2) have been selected within the proposed development site.

3.3.14 Pollutant concentrations at the proposed receptor locations have been predicted for scenarios 3 and 5 only (as detailed in paragraph 3.3.7). It is only necessary to consider the 'with development' scenarios for the proposed receptor locations as they will not experience any 'without development' conditions. It is not therefore necessary to consider the changes in pollutant concentrations at the proposed receptor locations.

3.3.15 Details of the proposed sensitive receptor locations are provided in Table 5, and their locations are shown on drawing TBC.

Table 5: Proposed Sensitive Receptor Locations			
Receptor Point	Location	Grid Reference	
		Easting	Northing
PR 1	North of the proposed site access road, close to Arundel Road	506716	105447
PR 2	South of the proposed site access road, close to Arundel Road	506713	105490

Model Validation, Verification and Adjustment

3.3.16 LAQM.TG(16) recognises that model validation generally refers to detailed studies that have been carried out by the model supplier or a regulatory agency. The ADMS-Roads model has been validated by the supplier CERC.

3.3.17 Model verification is used to check the performance of the model at a local level. The verification of the ADMS-Roads air dispersion model is achieved by modelling concentration(s) at existing monitoring location(s) in the vicinity of the proposed development and comparing the modelled concentration(s) with the measured concentration(s).

3.3.18 ADC operates a roadside NO₂ monitoring location along the road network for which traffic information is available.

3.3.19 Bias-adjusted 2016 monitoring data was provided by ADC, as this is the most recent full year for which monitoring data is available. The monitoring data that has been used in the model verification procedure is detailed in Table 6.

Table 6: NO ₂ Monitoring Data for 2016 Used for Verification Purposes				
Monitoring Location Reference	Type	Grid Reference		2016 Bias Adjusted NO ₂ Annual Average Concentration (µg/m ³)
		Easting	Northing	
Litt02	Diffusion Tube	503439	103364	24.4
*NO ₂ monitoring data provided by ADC				

3.3.20 There are no representative roadside PM_{2.5} or PM₁₀ monitoring locations along the road network for which traffic flow information is available. It has not therefore been possible to undertake verification of PM_{2.5} or PM₁₀ concentrations.

3.3.21 Further details of the model verification can be found within Appendix C.

3.4 Information Sources

3.4.1 The following sources of information have been used in the preparation of this report:

- Arun District Council, 2017 Annual Air Quality Status Report;
- Meteorological data for 2016 from the Shoreham Meteorological recording station, obtained from ADM Limited; and
- Traffic flow information, provided by Croft Transport Solutions.

4 ASSESSMENT OF SIGNIFICANCE CRITERIA

4.1 Construction Phase Assessment – Dust and Fine Particulate Matter Emissions

4.1.1 The IAQM guidance document¹⁴ details criteria for assessing the sensitivity of an area to dust soiling and health effects of PM₁₀ are summarised in Tables 7 to 9 below.

4.1.2 The guidance then goes on to provide significance criteria for the classification of dust soiling and human health effects from demolition, earthworks, construction activities and trackout, as summarised in Tables 10 to 12 below.

Sensitivity of the Area – Human Receptors

4.1.3 The sensitivity categories for different types of receptors, to both dust soiling effects and the health effects of PM₁₀, are described in Table 7.

Table 7: Sensitivity Categories for Human Receptors		
Sensitivity Category	Dust Soiling Effects	Health Effects of PM ₁₀
High	Users can reasonably expect to enjoy a high level of amenity; Appearance, aesthetics or value of a property would be diminished; Examples include dwellings, museums and other culturally important collections, medium and long term car parks and car show rooms.	Locations where members of the public are exposed over a period of time relevant to the air quality objective for PM ₁₀ ; Examples include residential properties, hospitals, schools, and residential care homes.
Medium	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; The appearance, aesthetics or value of their property could be diminished; People or property wouldn't reasonably be expected to be continuously present or regularly for extended periods of time; Examples include parks and places of work.	Locations where people are exposed as workers and exposure is over a period of time relevant to the air quality objective for PM ₁₀ ; Examples include office and shop workers but will generally not include workers occupationally exposed to PM ₁₀ .

¹⁴ Institute of Air Quality Management 'Guidance on the Assessment of Dust from Demolition and Construction', February 2014

Table 7: Sensitivity Categories for Human Receptors		
Sensitivity Category	Dust Soiling Effects	Health Effects of PM ₁₀
Low	Enjoyment of amenity would not reasonably be expected; Property would not be diminished in appearance, aesthetics or value; People or property would expected to be present only for limited periods of time; Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	Locations where human exposure is transient; Examples include public footpaths, playing fields, parks and shopping streets.

4.1.4 Based upon the category of receptor sensitivity, the sensitivity of the area to dust soiling effects is determined using the criteria detailed in Table 8.

Table 8: Sensitivity of the Area to Dust Soiling Effects on People and Property					
Receptor Sensitivity	Number of Receptors	Distance from Source (m)			
		<20m	<50m	<100m	<350m
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

4.1.5 Based upon the category of receptor sensitivity, the sensitivity of the area to the health effects of PM₁₀ is determined using the criteria detailed in Table 9.

Table 9: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from Source (m)				
			<20m	<50m	<100m	<200m	<350m
High	>32µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low

Table 9: Sensitivity of the Area to Human Health Impacts							
Receptor Sensitivity	Annual Mean PM ₁₀ Concentration	Number of Receptors	Distance from Source (m)				
			<20m	<50m	<100m	<200m	<350m
	24-28µg/m ³	1-10	High	Medium	Low	Low	Low
		>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
	<24µg/m ³	1-10	Medium	Low	Low	Low	Low
		>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
	<24µg/m ³	1-10	Low	Low	Low	Low	Low
		>10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
Medium	>32µg/m ³	>10	High	Medium	Low	Low	Low
		1 - 10	Medium	Low	Low	Low	Low
	28-32µg/m ³	>10	Medium	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	24-28µg/m ³	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
	<24µg/m ³	>10	Low	Low	Low	Low	Low
		1 - 10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Risk of Dust Impacts

- 4.1.6 The risk of dust being generated by demolition activities at the site is determined using the criteria in Table 10.

Table 10: Risk of Dust Impacts - Demolition			
Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible

4.1.7 The risk of dust being generated by earthworks and construction activities at the site is determined using the criteria in Table 11.

Table 11: Risk of Dust Impacts – Earthworks and Construction			
Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

4.1.8 The risk of dust being generated by trackout from the site is determined using the criteria in Table 12.

Table 12: Risk of Dust Impacts – Trackout			
Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

4.2 Operational Phase Assessment – Road Traffic Emissions

Assessing the Impact of a Proposed Development on Human Health

4.2.1 Guidance has been prepared by Environmental Protection UK (EPUK) and the IAQM with relation to the assessment of the air quality impacts of proposed developments and their significance¹⁵.

4.2.2 The impact of a development is usually assessed at specific receptors, and takes into account both the long term background concentrations, in relation to the relevant Air Quality Assessment Level (AQAL) at these receptors, and the change with the development in place.

4.2.3 The impact descriptors for individual receptors are detailed in Table 13.

¹⁵ Environmental Protection UK and the Institute of Air Quality Management, Land-Use Planning and Development Control: Planning for Air Quality, May 2015

Table 13: Impact Descriptors for Individual Receptors				
Long Term Average Concentration at Receptor in Assessment Year*	Percentage Change in Concentration Relative to Air Quality Assessment Level (AQAL)*			
	1%	2-5%	6-10%	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial
*Percentage pollutant concentrations have been rounded to whole numbers, to make it easier to assess the impact. Changes of 0% (i.e. less than 0.5% or 0.2µg/m ³) should be described as Negligible				

Determining the Significance of Effects

- 4.2.4 Impacts on air quality, whether adverse or beneficial, will have an effect on human health that can be judged as either 'significant' or 'not significant'.
- 4.2.5 Once the impact of the proposed development has been assessed for the individual impacts, the overall significance is determined using professional judgement. This takes into account a number of factors such as:
- The existing and future air quality in the absence of the development;
 - The extent of the current and future population exposure to the impacts; and
 - The influence and validity of any assumptions adopted when undertaking the prediction of impacts.
- 4.2.6 A discussion of the impacts of the proposed development, and their significance, is included in section 6 and 7 of this report, respectively.

5 BASELINE SITUATION

5.1 Operational Phase Assessment – Road Traffic Emissions

Background Air Pollutant Concentrations

- 5.1.1 The ADMS assessment needs to take into account background concentrations upon which the local, traffic derived pollution is superimposed. The data may be derived through long term ambient measurements at background sites, remote from immediate sources of air pollution, or alternatively from the default concentration maps which have been provided for use by Defra with the revised LAQM.TG(16) guidance.
- 5.1.2 There are no representative NO_x, NO₂, PM₁₀ and PM_{2.5} background monitoring locations in the vicinity of the proposed development. Background NO_x, NO₂, PM₁₀ and PM_{2.5} concentrations have therefore been obtained from the 2015-based Defra default concentration maps, for the appropriate grid squares¹⁶.
- 5.1.3 The background pollutant concentrations used in this assessment are detailed in Table 14.

Table 14: Background NO_x, NO₂, PM₁₀ and PM_{2.5} Concentrations Obtained from the 2015-Based Defra Default Concentration Maps (Annual Mean Concentration in µg/m³)				
Receptors	Pollutant			
	Oxides of Nitrogen (NO_x)	Nitrogen Dioxide (NO₂)	Particulate Matter (PM₁₀)	Particulate Matter (PM_{2.5})
2016 Background Concentrations				
ESR 1, ESR 2, ESR 3 and ESR 14 (506500, 103500)	13.22	9.96	12.71	8.25
ESR 4 and ESR 5 (507500, 103500)	13.19	9.95	12.72	8.30
ESR 6, ESR 7 and ESR 8 (506500, 104500)	11.63	8.82	13.25	8.60
ESR 9, ESR 10, ESR 11 and ESR 12 (506500, 105500)	12.80	9.68	12.81	8.20
ESR 13 (504500, 105500)	12.53	9.49	13.87	8.77
2022 Background Concentrations				
ESR 1, ESR 2, ESR 3 and ESR 14 (506500, 103500)	10.85	8.28	12.46	8.00
ESR 4 and ESR 5 (507500, 103500)	10.75	8.21	12.47	8.05
ESR 6, ESR 7 and ESR 8 (506500, 104500)	9.65	7.40	12.98	8.35

¹⁶ Defra Local Air Quality Management webpages (<http://laqm.defra.gov.uk/review-and-assessme7.89nt/tools/background-maps.html>)

Table 14: Background NO _x , NO ₂ , PM ₁₀ and PM _{2.5} Concentrations Obtained from the 2015-Based Defra Default Concentration Maps (Annual Mean Concentration in µg/m ³)				
Receptors	Pollutant			
	Oxides of Nitrogen (NO _x)	Nitrogen Dioxide (NO ₂)	Particulate Matter (PM ₁₀)	Particulate Matter (PM _{2.5})
ESR 9, ESR 10, ESR 11 and ESR 12 (506500, 105500)	10.29	7.89	12.54	7.93
ESR 13 (504500, 105500)	10.11	7.75	13.60	8.51
2027 Background Concentrations				
ESR 1, ESR 2, ESR 3 and ESR 14 (506500, 103500)	9.23	7.10	12.38	7.90
ESR 4 and ESR 5 (507500, 103500)	9.05	6.97	12.39	7.95
ESR 6, ESR 7 and ESR 8 (506500, 104500)	8.32	6.42	12.89	8.25
ESR 9, ESR 10, ESR 11 and ESR 12 (506500, 105500)	8.60	6.64	12.44	7.83
ESR 13 (504500, 105500)	8.45	6.54	13.50	8.41

Modelled Baseline Concentrations

5.1.4 The baseline assessment (i.e. scenarios 1) has been carried out for the existing sensitive receptors considered. The NO₂, PM₁₀ and PM_{2.5} concentrations are detailed in Table 15 and are also included in Appendix D.

Table 15: Predicted NO ₂ , PM ₁₀ and PM _{2.5} concentrations at Existing Sensitive Receptor Locations for 2016 Base Year Scenario			
Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	NO ₂ (Adjusted)*	PM ₁₀ (Unadjusted)	PM _{2.5} (Unadjusted)
	Scenario 1: 2016	Scenario 1: 2016	Scenario 1: 2016
ESR 1	18.68	13.83	8.91
ESR 2	21.34	14.11	9.08
ESR 3	13.94	13.19	8.53
ESR 4	24.31	14.27	9.23
ESR 5	17.59	13.61	8.82
ESR 6	16.38	14.14	9.13
ESR 7	11.31	13.53	8.77

Table 15: Predicted NO ₂ , PM ₁₀ and PM _{2.5} concentrations at Existing Sensitive Receptor Locations for 2016 Base Year Scenario			
Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	NO ₂ (Adjusted)*	PM ₁₀ (Unadjusted)	PM _{2.5} (Unadjusted)
	Scenario 1: 2016	Scenario 1: 2016	Scenario 1: 2016
ESR 8	11.11	13.52	8.76
ESR 9	11.66	13.04	8.34
ESR 10	12.03	13.08	8.36
ESR 11	22.82	14.38	9.14
ESR 12	15.77	13.52	8.62
ESR 13	21.25	15.27	9.61
ESR 14	21.49	14.14	9.09
* NO ₂ concentrations obtained by inputting predicted NO _x concentrations into the NO _x to NO ₂ calculator ¹⁷ in accordance with LAQM.TG(16)			

Scenario 1: 2016 Verification and Base Year

- 5.1.5 The 2016 baseline annual mean NO₂ concentrations (adjusted) are predicted to range from 11.11 to 24.31 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.
- 5.1.6 The 2016 baseline annual mean PM₁₀ concentrations (unadjusted) are predicted to range from 13.04 to 15.27 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.
- 5.1.7 The 2016 baseline annual mean PM_{2.5} concentrations (unadjusted) are predicted to range from 8.34 to 9.61 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

¹⁷ NO_x to NO₂ Calculator, Defra Local Air Quality Management web pages (<http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html>)

6 IMPACT ASSESSMENT

6.1 Construction Phase Assessment – Dust and Fine Particulate Matter Emissions

6.1.1 The main activities involved with the construction phase of works are as follows:

- **Demolition** which in this case involves the removal of an existing residential property on the site;
- **Earthworks** which may be required prior to the construction phase of works.

Sources of dust can include:

- Cleaning the site;
- Stripping and stockpiling of topsoil and subsoil;
- Ground excavation;
- Bringing in, tipping and spreading materials on site;
- Stockpiling materials;
- Levelling ground;
- Trenching;
- Road construction; and
- Vehicle movements on site roads;
- **Construction** which will involve the construction of individual building access roads, the car parking areas and the residential buildings themselves; and
- **Trackout** which is defined as the transport of dust and dirt by vehicles travelling from a construction site on to the public road network. This may occur through the spillage of dusty materials onto road surfaces or through the transportation of dirt by vehicles that have travelled over muddy ground on the site. This dust and dirt can then be deposited and re-suspended by other vehicles.

Step 2A

6.1.2 Step 2A of the construction phase dust assessment has defined the potential dust emission magnitude from demolition, earthworks, construction and trackout in the absence of site specific mitigation.

6.1.3 Examples of the criteria for the dust emission classes are detailed in the IAQM guidance.

Step 2B

- 6.1.4 Step 2B of the construction phase dust assessment has defined the sensitivity of the area, taking into account the significance criteria detailed in Tables 7 to 11, for demolition, earthworks, construction and trackout. The sensitivity of the area to each activity is assessed for potential dust soiling, human health effects and ecological effects.
- 6.1.1 For demolition, there are currently between 0 and 10 receptor locations (mainly residential) within 200m of where demolition will take place, which is the north east corner of the proposed development site.
- 6.1.2 For earthworks and construction, there are currently between 0 and 10 receptor locations (residential) within 0-50m of where these activities may take place, which is assumed to be the site boundary for the purposes of this assessment.
- 6.1.3 The routing of construction vehicles is unknown at this stage. Therefore, for the purposes of this assessment, worst case routing scenarios have been assumed for assessment of potential trackout impacts at nearby receptor locations.
- 6.1.4 For trackout, there are between 10 and 100 receptor locations (mainly residential) within 20m of where trackout may occur for a distance of up to 500m from the site entrance (assuming construction vehicles travel southwards on Arundel road and Station road towards the A259).

Step 2C

- 6.1.5 Step 2C of the construction phase dust assessment has defined the risk of impacts from each activity. The dust emission magnitude is combined with the sensitivity of the surrounding area.
- 6.1.6 The risk of dust impacts from each activity, with no mitigation in place, has been assessed in accordance with the criteria detailed in Tables 10 to 12.

Summary

- 6.1.7 Table 16 details the results of Step 2 of the construction phase assessment for human receptors.

Table 16: Construction Phase Dust Assessment (Step 2) – Human Receptors				
	Activity			
	Demolition	Earthworks	Construction	Trackout
Step 2A				
Dust Emission Magnitude	Small ^a	Large ^b	Large ^c	Medium ^d
Step 2B				
Sensitivity of Closest Receptors	High	High	High	High
Sensitivity of Area to Dust Soiling Effects	Low	Medium	Medium	High
Sensitivity of Area to Human Health Effects	Low ^e	Low ^e	Low ^e	Low ^e
Step 2C				
Dust Risk: Dust Soiling	Negligible	Medium Risk	Medium Risk	Medium Risk
Dust Risk: Human Health	Negligible	Low Risk	Low Risk	Low Risk
a. Total building volume estimated to be <20,000m³. b. Total site area estimated to be more than 10,000m². c. Total building volume estimated to be more than 100,000m³. d. Number of construction phase vehicles estimated to be between 10 and 50 movements per day. e. Background annual mean PM₁₀ concentration is taken from the LAQM Defra default concentration maps, for the appropriate grid square for 2016, as detailed in Table 16.				

6.2 Operational Phase Assessment – Road Traffic Emissions

Existing Sensitive Receptor Locations 2022 Opening Year

- 6.2.1 The impact assessment has been carried out for the representative existing sensitive receptor locations. Tables 17 - 19 show the changes in pollutant concentrations for the 2022 Opening Year, for both the 'Without Development' and 'With Development' scenarios. The NO₂, PM₁₀ and PM_{2.5} concentrations are also included in Appendix D.

Table 17: Predicted NO ₂ Concentrations at Existing Sensitive Receptor Locations for the 2022 Opening Year 'Without Development' and 'With Development' Scenarios			
Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	14.19	14.21	0.05
ESR 2	16.21	16.26	0.13
ESR 3	11.00	11.08	0.20
ESR 4	19.02	19.12	0.25

Table 17: Predicted NO₂ Concentrations at Existing Sensitive Receptor Locations for the 2022 Opening Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 5	13.73	13.77	0.10
ESR 6	12.74	13.05	0.78
ESR 7	9.13	9.26	0.32
ESR 8	9.00	9.04	0.10
ESR 9	9.24	9.35	0.27
ESR 10	9.46	9.54	0.20
ESR 11	16.71	16.81	0.25
ESR 12	11.94	12.04	0.25
ESR 13	15.61	15.69	0.20
ESR 14	16.13	16.16	0.08
NO₂ concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO₂ calculator¹⁸ in accordance with LAQM.TG(16) * Adjustment factor, derived from verification procedure, has been applied to modelled concentration			

Table 18: Predicted PM₁₀ Concentrations at Existing Sensitive Receptor Locations for the 2022 Opening Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	13.56	13.56	0.01
ESR 2	13.85	13.86	0.02
ESR 3	12.93	12.94	0.03
ESR 4	14.07	14.09	0.04
ESR 5	13.37	13.38	0.02
ESR 6	13.86	13.91	0.12
ESR 7	13.26	13.28	0.05
ESR 8	13.25	13.25	0.02

¹⁸ NO_x to NO₂ Calculator, Defra Local Air Quality Management web pages (<http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html>)

Table 18: Predicted PM₁₀ Concentrations at Existing Sensitive Receptor Locations for the 2022 Opening Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 9	12.76	12.78	0.04
ESR 10	12.79	12.81	0.03
ESR 11	14.02	14.03	0.04
ESR 12	13.20	13.22	0.04
ESR 13	14.91	14.92	0.03
ESR 14	13.86	13.87	0.02

Table 19: Predicted PM_{2.5} Concentrations at Existing Sensitive Receptor Locations for the 2022 Opening Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	8.61	8.61	0.01
ESR 2	8.77	8.77	0.02
ESR 3	8.26	8.27	0.03
ESR 4	8.94	8.95	0.04
ESR 5	8.55	8.55	0.01
ESR 6	8.83	8.86	0.11
ESR 7	8.50	8.51	0.05
ESR 8	8.49	8.50	0.01
ESR 9	8.06	8.07	0.04
ESR 10	8.08	8.08	0.03
ESR 11	8.75	8.76	0.04
ESR 12	8.30	8.31	0.04
ESR 13	9.24	9.24	0.03
ESR 14	8.78	8.78	0.01

Scenario 2: 2022 Opening Year, Without Development

- 6.2.2 The 2022 opening year 'without development' annual mean NO₂ concentrations (adjusted) are predicted to range from 9.00 to 19.02 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.
- 6.2.3 The 2022 opening year 'without development' annual mean PM₁₀ concentrations (unadjusted) are predicted to range from 12.76 to 14.91 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.
- 6.2.4 The 2022 opening year 'without development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to range from 8.06 to 9.24 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

Scenario 3: 2022 Opening Year, With Development

- 6.2.5 The 2022 opening year 'with development' annual mean NO₂ concentrations (adjusted) are predicted to range from 9.04 to 19.12 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.
- 6.2.6 The 2022 opening year 'with development' annual mean PM₁₀ concentrations (unadjusted) are predicted to range from 12.78 to 14.92 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.
- 6.2.7 The 2022 opening year 'with development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to range from 8.07 to 9.24 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

Assessment of Impact

- 6.2.8 Using the descriptors detailed in Table 15, the impact of the proposed development can be assessed at each of the existing sensitive receptors considered.
- 6.2.9 The impact on NO₂ concentrations in 2022 is detailed in Table 20.

Table 20: Impact on NO ₂ Concentrations in 2022			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 5	<0.5%*	<75%	Negligible
ESR 6	1%	<75%	Negligible
ESR 7 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

6.2.10 The impact on PM₁₀ concentrations in 2022 is detailed in Table 21.

Table 21: Impact on PM ₁₀ Concentrations in 2022			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

6.2.11 The impact on PM_{2.5} concentrations in 2022 is detailed in Table 22.

Table 22: Impact on PM _{2.5} Concentrations in 2022			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

Proposed Sensitive Receptor Locations

6.2.12 Air pollutant concentrations have also been modelled for proposed receptor locations, for the 2022 'with development' scenario, as detailed in Table 23. The NO₂, PM₁₀ and PM_{2.5} concentrations are also included in Appendix D.

Table 23: Predicted NO ₂ , (Adjusted), PM ₁₀ and PM _{2.5} (Unadjusted) Concentrations at Proposed Sensitive Receptor Locations for 2022 'With Development' Scenario			
Proposed Receptor Location	Calculated Annual Mean Concentrations (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}
PR 1	9.34	12.78	8.07
PR 2	9.39	12.78	8.07

Scenario 3: 2022 Opening Year, With Development

- 6.2.13 The 2022 opening year 'with development' annual mean NO₂ concentrations (adjusted) are predicted to be 9.34 and 9.39 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.
- 6.2.14 The 2022 opening year 'with development' annual mean PM₁₀ concentrations (unadjusted) are predicted to be 12.78 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.
- 6.2.15 The 2022 opening year 'with development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to be 8.07 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

Existing Sensitive Receptor Locations 2027 Future Year

- 6.2.16 The impact assessment has been carried out for the representative existing sensitive receptor locations. Tables 24 - 26 show the changes in pollutant concentrations for the 2027 Future Year, for both the 'Without Development' and 'With Development' scenarios. The NO₂, PM₁₀ and PM_{2.5} concentrations are also included in Appendix D.

Table 24: Predicted NO ₂ Concentrations at Existing Sensitive Receptor Locations for the 2027 Future Year 'Without Development' and 'With Development' Scenarios			
Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	11.13	11.14	0.02
ESR 2	12.54	12.57	0.08
ESR 3	8.94	8.99	0.13
ESR 4	14.33	14.40	0.18
ESR 5	10.71	10.74	0.07
ESR 6	10.08	10.28	0.50
ESR 7	7.60	7.68	0.20
ESR 8	7.51	7.54	0.08
ESR 9	7.56	7.63	0.18
ESR 10	7.71	7.76	0.13

Table 24: Predicted NO₂ Concentrations at Existing Sensitive Receptor Locations for the 2027 Future Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 11	12.68	12.74	0.15
ESR 12	9.39	9.46	0.18
ESR 13	11.90	11.95	0.12
ESR 14	12.42	12.45	0.07
NO₂ concentrations obtained by inputting predicted NO_x concentrations into the NO_x to NO₂ calculator¹⁹ in accordance with LAQM.TG(16) * Adjustment factor, derived from verification procedure, has been applied to modelled concentration			

Table 25: Predicted PM₁₀ Concentrations at Existing Sensitive Receptor Locations for the 2027 Future Year 'Without Development' and 'With Development' Scenarios

Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	13.52	13.52	0.01
ESR 2	13.83	13.84	0.02
ESR 3	12.86	12.88	0.03
ESR 4	14.04	14.05	0.04
ESR 5	13.32	13.33	0.02
ESR 6	13.80	13.85	0.12
ESR 7	13.17	13.19	0.05
ESR 8	13.16	13.17	0.02
ESR 9	12.67	12.69	0.04
ESR 10	12.71	12.72	0.03
ESR 11	13.97	13.99	0.04
ESR 12	13.13	13.15	0.04
ESR 13	14.86	14.87	0.03
ESR 14	13.83	13.84	0.02

¹⁹ NO_x to NO₂ Calculator, Defra Local Air Quality Management web pages (<http://laqm.defra.gov.uk/tools-monitoring-data/no-calculator.html>)

Table 26: Predicted PM _{2.5} Concentrations at Existing Sensitive Receptor Locations for the 2027 Future Year 'Without Development' and 'With Development' Scenarios			
Receptor	Calculated Annual Mean Concentrations (µg/m ³)		
	Without Development	With Development	Percent Change Relative to AQAL
ESR 1	8.52	8.53	0.01
ESR 2	8.70	8.70	0.02
ESR 3	8.17	8.18	0.03
ESR 4	8.86	8.86	0.03
ESR 5	8.46	8.46	0.01
ESR 6	8.74	8.77	0.11
ESR 7	8.40	8.41	0.04
ESR 8	8.39	8.40	0.01
ESR 9	7.96	7.97	0.04
ESR 10	7.98	7.98	0.03
ESR 11	8.66	8.67	0.03
ESR 12	8.21	8.22	0.04
ESR 13	9.15	9.15	0.03
ESR 14	8.70	8.70	0.01

Scenario 4: 2027 Future Year, Without Development

6.2.17 The 2027 future year 'without development' annual mean NO₂ concentrations (adjusted) are predicted to range from 7.51 to 14.33 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.

6.2.18 The 2027 future year 'without development' annual mean PM₁₀ concentrations (unadjusted) are predicted to range from 12.67 to 14.86 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.

6.2.19 The 2027 future year 'without development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to range from 7.96 to 9.15 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

Scenario 5: 2027 Future Year, With Development

- 6.2.20 The 2027 future year 'with development' annual mean NO₂ concentrations (adjusted) are predicted to range from 7.54 to 14.40 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.
- 6.2.21 The 2027 future year 'with development' annual mean PM₁₀ concentrations (unadjusted) are predicted to range from 12.69 to 14.87 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.
- 6.2.22 The 2027 future year 'with development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to range from 7.97 to 9.15 µg/m³ for the fourteen existing sensitive receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

Assessment of Impact

- 6.2.23 Using the descriptors detailed in Table 15, the impact of the proposed development can be assessed at each of the existing sensitive receptors considered.
- 6.2.24 The impact on NO₂ concentrations in 2027 is detailed in Table 27.

Table 27: Impact on NO ₂ Concentrations in 2027			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 5	<0.5%*	<75%	Negligible
ESR 6	1%	<75%	Negligible
ESR 7 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

- 6.2.25 The impact on PM₁₀ concentrations in 2028 is detailed in Table 28.

Table 28: Impact on PM ₁₀ Concentrations in 2027			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

6.2.26 The impact on PM_{2.5} concentrations in 2027 is detailed in Table 29.

Table 29: Impact on PM _{2.5} Concentrations in 2027			
Proposed Receptor Location	Percentage Change	Annual Mean Concentration in Relation to AQAL	Impact
ESR 1 – ESR 14	<0.5%*	<75%	Negligible
* Changes of less than 0.5% should be described as negligible			

Proposed Sensitive Receptor Locations

6.2.27 Air pollutant concentrations have also been modelled for proposed receptor locations, for the 2027 'with development' scenario, as detailed in Table 30. The NO₂, PM₁₀ and PM_{2.5} concentrations are also included in Appendix D.

Table 30: Predicted NO ₂ , (Adjusted), PM ₁₀ and PM _{2.5} (Unadjusted) Concentrations at Proposed Sensitive Receptor Locations for 2027 'With Development' Scenario			
Proposed Receptor Location	Calculated Annual Mean Concentrations (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}
PR 1	7.63	12.69	7.97
PR 2	7.66	12.69	7.97

Scenario 5: 2027 Future Year, With Development

6.2.28 The 2027 future year 'with development' annual mean NO₂ concentrations (adjusted) are predicted to be 7.63 and 7.66 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean objective concentration for NO₂ (40µg/m³) is not predicted to occur.

6.2.29 The 2027 future year 'with development' annual mean PM₁₀ concentrations (unadjusted) are predicted to be 12.69 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean objective concentration for PM₁₀ (40µg/m³) is not predicted to occur.

6.2.30 The 2027 future year 'with development' annual mean PM_{2.5} concentrations (unadjusted) are predicted to be 7.97 µg/m³ for the two proposed receptor locations considered. Exceedance of the annual mean target concentration for PM_{2.5} (25µg/m³) is not predicted to occur.

7 ASSESSMENT OF SIGNIFICANCE

7.1 Operational Phase Assessment – Road Traffic Emissions

7.1.1 The significance of the overall effects of the proposed development has been assessed. This assessment is based on professional judgement and takes into account a number of factors, including:

- Baseline pollutant concentrations in 2016, 2022 and 2027 are all below the relevant annual mean objectives;
- Taking into account the results of the air quality impact assessment, the assessment predicts a negligible impact on concentrations of NO₂, PM₁₀ and PM_{2.5} at all fourteen existing sensitive receptor locations, with the development in place; and
- All pollutant concentrations within the proposed development site are predicted to be well below the relevant annual mean objectives.

7.1.2 Based on the above factors, in accordance with the EPUK/IAQM guidance, the effect of the proposed development on human health is considered to be 'not significant'.

8 MITIGATION MEASURES

8.1 Construction Phase Assessment – Dust and Fine Particulate Matter Emissions

Step 3

8.1.1 During the construction phase the implementation of effective mitigation measures will substantially reduce the potential for nuisance dust and particulate matter to be generated.

8.1.2 Step 2C of the construction phase assessment identified that:

- The risk of dust soiling effects is classed as negligible for demolition and medium for earthworks, construction and trackout; and
- The risk of human health effects is classed as negligible for demolition and low for earthworks, construction and trackout;

8.1.3 This assumes that no mitigation measures are applied, except those required by legislation. Site specific mitigation measures do not need to be recommended if the risk category is negligible.

8.1.4 The risk of dust soiling and human health effects is not negligible for all the activities, aside from demolition, therefore site specific mitigation will need to be implemented for earthworks, construction and trackout stages to ensure dust effects from these activities will be 'not significant'.

8.1.5 A best practice dust mitigation plan will be written and implemented for the site. This will set out the practical measures that could be incorporated as part of a best working practice scheme. This will take into account the recommendations included within the IAQM guidance, which may include but are not limited to:

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- Protection of surfaces and exposed material from winds until disturbed areas are sealed and stable;
- Dampening down of exposed stored materials, which will be stored as far from sensitive receptors as possible;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;

- Avoidance of activities that generate large amounts of dust during windy conditions;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- Avoid dry sweeping of large areas;
- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Ensuring that all vehicles will be sheeted when loaded;
- Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport;
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable);
- Confining vehicles to areas of the site where appropriate dust control measures can be in operation;
- Minimisation of vehicle movements and limitation of vehicle speeds – the slower the vehicle speeds, the lower the dust generation;
- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever the site size and layout permits; and
- Access gates to be located at least 10m from receptors, where possible.

8.1.6 All dust and air quality complaints should be recorded and appropriate measures be taken to identify causes and reduce emissions in a timely manner. Exceptional incidents which cause dust and/or emissions, and the action taken to resolve the situation, should be recorded in a log book and made available to ADC on request.

8.1.7 It is recognised that the final design solutions will be developed with the input of the Contractor to maximise construction efficiencies, to use modern construction techniques and sustainable materials and to incorporate the particular skills and experience offered by the appointed contractor.

Step 4

8.1.8 Step 4 of the construction phase dust assessment has been undertaken to determine the significance of the dust effects arising from earthworks, construction and trackout associated with the proposed development.

- 8.1.9 The implementation of effective mitigation measures during the construction phase, such as those detailed in Step 3, will substantially reduce the potential for nuisance dust and particulate matter to be generated and any residual impact should be 'not significant'.

8.2 Operational Phase Assessment – Road Traffic Emissions

Existing Sensitive Receptor Locations

- 8.2.1 An air quality assessment has been undertaken to consider the potential impact of development-generated vehicles on air quality at fourteen existing sensitive human receptor locations.
- 8.2.2 Pollutant concentrations in 2022 and 2027 with the development in place, are below the relevant annual mean objectives at all fourteen receptor locations considered.
- 8.2.3 Taking into consideration the results of the impact assessment, it is predicted that the development will have a negligible impact on concentrations of NO₂, PM₁₀ and PM_{2.5} at all fourteen existing sensitive receptors considered in 2022 and 2027. Air quality effects are therefore considered to be 'not significant'.

Proposed Sensitive Receptor Locations

- 8.2.4 The assessment has also predicted pollutant concentrations at two proposed receptor locations within the proposed residential development site. These receptors are situated to the north and south of the site access, close to Arundel Road.
- 8.2.5 Predicted NO₂, PM₁₀ and PM_{2.5} concentrations are below the annual mean air quality objectives/target concentrations, for 2022 and 2027, at the proposed sensitive receptor locations considered. Air quality effects within the site are, therefore, considered to be 'not significant'.

Damage Cost Calculation and Recommendations for Mitigation

- 8.2.6 In accordance with the Air Quality and Emissions Mitigation Guidance for Sussex Authorities (2013), mitigation measures will be required and an air pollution damage cost assessment has been carried out.
- 8.2.7 It is considered that the damage cost assessment provides a basis for quantifying the financial commitment required for offsetting potential development-generated emissions and is suggested for use within the 2015 IAQM/EPUK guidance. The air pollution damage cost assessment utilises the current DEFRA Emission Factor Toolkit

(version 8.0.1), available on the Defra website²⁰, to estimate the annual link emissions associated with the additional development generated vehicles over a 5-year period.

8.2.8 The calculation attributes a monetary value to those emissions using the Interdepartmental Group on Costs and Benefits²¹ (IGCB) Damage Cost Guidelines. The total number of trips in a 24-hour period, generated by the proposed development, was included within the damage cost assessment to determine the transport related emissions.

8.2.9 The total trip generation (i.e. trips generated by the proposed development) in a 24-hour period is 1079 vehicles. The average trip length is assumed to be 10km and the average speed as 50kph. The calculation was undertaken for both NO_x and particulate matter (PM) emissions, as these are the major pollutants associated with road traffic emissions. The IGCB gives a central estimated cost (2015) of £58,125/tonne for PM. For NO_x, the IGCB gives a central estimated cost (2015) of £21,044/tonne when PM is also valued²².

8.2.10 2027 is the anticipated year of completion for the proposed development, therefore 2027 has been used in the EFT when calculating the damage costs.

8.2.11 The results of the calculation are detailed in Table 31.

Table 31: Damage Cost Calculation Undertaken Using EFT and by Taking into Account the IGCB Damage Cost Figures		
Step	NO_x	PM₁₀
Emission calculation using EFT spreadsheet	626.43 kg/yr	120.48 kg/yr
Conversion into tonnes per annum	0.6264 tonnes/yr	0.1205 tonnes/yr
IGCB air quality damage costs per tonne	NO _x (Central Estimate): £21,044	PM ₁₀ (Central Estimate): £58,125
Calculation of air quality damage per year	£13,182.55	£7,002.76
Calculation of air quality damage over 5 year period	£65,912.75	£35,013.80

²⁰ Defra Local Air Quality Management website (<http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html>)

²¹ Defra, Interdepartmental Group on Costs and Benefits (<https://www.gov.uk/air-quality-economic-analysis#damage-costs-approach>)

²² Defra, Damage costs by location and source

(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/460398/air-quality-economic-analysis-damagecost.pdf)

8.2.12 The total damage cost of both NO_x and PM₁₀ for the proposed development over a five-year period is £100,927. The input and output data for the damage cost calculation can be seen in Figures 1 and 2, respectively.

Select Pollutants ☒ NO _x ☐ CO ₂ ☒ PM ₁₀ ☐ PM _{2.5}		Select Outputs ☐ Air Quality Modelling (g/km/s) ☐ Breakdown by Vehicle ☐ Emissions Rates (g/km) ☐ Source Apportionment ☒ Annual Link Emissions ☐ PM by Source		Additional Outputs ☐ Euro Compositions ☐ NO _x Annual Emissions Euro Split ☐ Output % Contributions from Euro Classes ☐ PM ₁₀ Annual Emissions Euro Split ☐ Primary NO ₂ Fraction ☐ PM _{2.5} Annual Emissions Euro Split							
Please Select from the Following Options: <table border="1"> <tr> <td>Area</td> <td>England (not London)</td> </tr> <tr> <td>Year</td> <td>2027</td> </tr> <tr> <td>Traffic Format</td> <td>Basic Split</td> </tr> </table> Select 'Basic Split' or 'Detailed Option 1 to 3' or 'Alternative Technologies' above		Area	England (not London)	Year	2027	Traffic Format	Basic Split	Export Outputs ☐ Save Output to New Workbook File Name: Arundel Road			
Area	England (not London)										
Year	2027										
Traffic Format	Basic Split										
SourceID	Road Type	Traffic Flow	%HDV	Speed(kph)	No of Hours	Link Length (km)					
LE14250	Urban (not London)	1079	0	50	24	10					

Figure 1: Damage Cost Calculation Inputs

Source Name	Pollutant Name	All Vehicles (Annual Emissions (kg/yr except CO2 tonnes/yr))
LE14250	NO _x	626.43
LE14250	PM ₁₀	120.48
	Tonnes	0.6264
		0.1205
Nox	£21,044	13,182.55
PM10	£58,125	7,002.76
5 years	Nox	65,912.75
	PM10	35,013.80
	Total	100,927

Figure 2: Damage Cost Calculation Outputs

Mitigation Strategies

8.2.13 Based on professional judgement, it is considered that mitigation measures should be employed. Mitigation measures could include:

- EV recharging infrastructure within the development (wall mounted or free standing in-garage or off-street points);
- Car club provision or support to local car club/eV car club;
- Designation of parking spaces for low emission vehicles;
- Support local walking and cycling initiatives;

- Contribution to low emission vehicle refueling infrastructure;
- Low emission bus service provision or waste collection services; and,
- Bike/e-bike hire schemes;

8.2.14 It is considered that the mitigation measures implemented should be equivalent to the value determined by the damage cost calculation (£100,927) and should focus on mitigating elevations in NO₂ and PM₁₀ concentration, as a result of development-generated traffic.

9 CONCLUSIONS

9.1 Construction Phase Assessment – Dust and Fine Particulate Matter Emissions

- 9.1.1 The construction phase assessment has been undertaken to determine the risk and significance of dust effects from earthworks, construction and trackout associated with the proposed development, in accordance with guidance published by the IAQM.
- 9.1.2 The risk of dust soiling effects is classed as negligible for demolition, and medium for earthworks, construction and trackout. The risk of human health is classed as negligible for demolition, and low for earthworks, construction and trackout.
- 9.1.3 With site specific mitigation measures in place, such as those detailed in Section 8 of this report, the significance of dust effects from earthworks, construction and trackout is considered to be 'not significant'.

9.2 Operational Phase Assessment – Road Traffic Emissions

Existing Sensitive Receptor Locations

- 9.2.1 An air quality assessment has been undertaken to consider the potential impact of development-generated vehicles on air quality at fourteen existing sensitive human receptor locations.
- 9.2.2 Pollutant concentrations in 2022 and 2027, with the development in place, are below the relevant annual mean objectives at all fourteen receptor locations considered.
- 9.2.3 The assessment predicts that the development will have a negligible impact on concentrations of NO₂, PM₁₀ and PM_{2.5} at all fourteen existing sensitive receptors considered in 2022 and 2027.

Proposed Sensitive Receptor Locations

- 9.2.4 The assessment has predicted pollutant concentrations at two proposed receptor locations within the proposed residential development site.
- 9.2.5 Predicted NO₂, PM₁₀ and PM_{2.5} concentrations are below the annual mean air quality objectives/target concentrations, for 2022 and 2027, at the proposed sensitive receptor locations considered. Air quality effects within the site are, therefore, considered to be not significant.

Mitigation Strategies

- 9.2.6 In accordance with the Air Quality and Emissions Mitigation Guidance for Sussex Authorities (2013), mitigation measures will be required and an air pollution damage cost assessment has been carried out.
- 9.2.7 It is considered that the damage cost assessment provides a basis for quantifying the financial commitment required for offsetting potential development generated emissions and is suggested for use within the 2015 IAQM/EPUK guidance. The total combined damage cost of NO_x and PM₁₀ for the proposed development over a five-year period is £100,927.
- 9.2.8 It is considered that the mitigation measures implemented should be equivalent to the value determined by the damage cost calculation and should focus on mitigating elevations in NO₂ and PM₁₀ concentration, as a result of development-generated traffic.
- 9.2.9 It is also considered that the implementation of the mitigation measures, such as those detailed in section 8 of this report, should be used in order to assist with reducing any potential impacts of the proposed development.

Summary

- 9.2.10 The assessment has demonstrated that the proposed development will not lead to an unacceptable risk from air pollution, or to any breach in national objectives. There are no material reasons in relation to air quality why the proposed scheme should not proceed, subject to appropriate planning conditions.

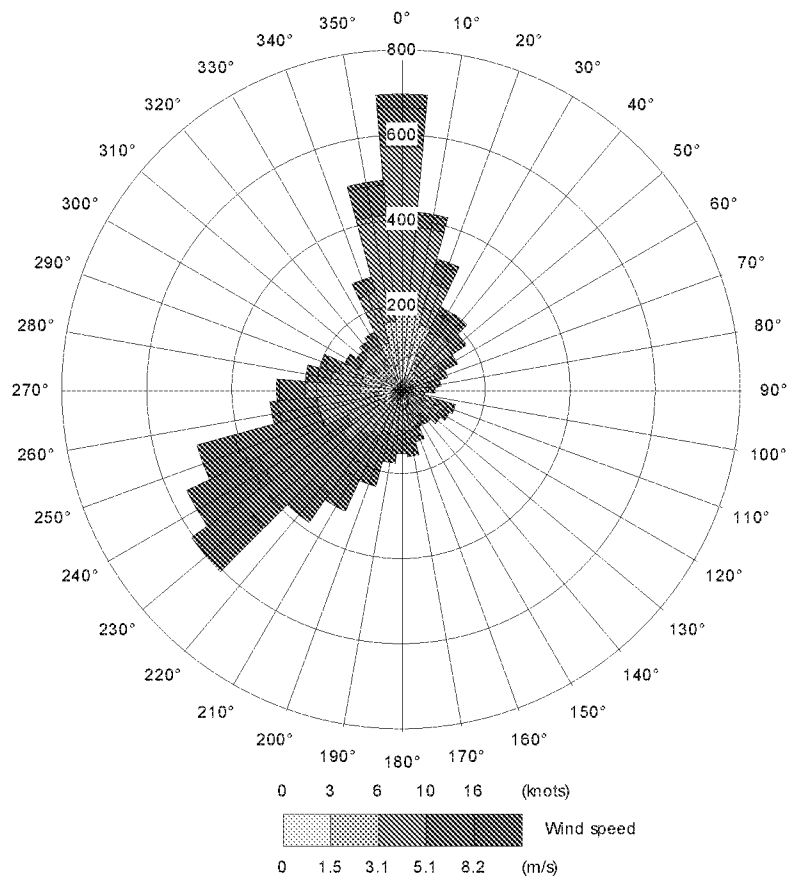
**Appendix A:
Traffic Flow Information
Used in the Air Quality Assessment**

24 Hour Annual Average Daily Traffic (AADT) Flows, Provided by Croft Transport Solutions

Link Name	Speed Limit (kph)	HGV%	Scenario 1: 2016 Verification and Base Year	Scenario 2: 2022 Opening Year Without Development	Scenario 3: 2022 Opening Year With Development	Scenario 2: 2027 Future Year Without Development	Scenario 3: 2027 Future Year With Development
			Vehicles	Vehicles	Vehicles	Vehicles	Vehicles
A27	96	3.81	29020	31130	31437	32990	33298
Arundel Road (north of site access)	48	2.26	2082	2347	2811	2480	2944
Arundel Road (south of site access)	48	1.64	5035	5449	6064	5772	6387
Water Lane (north of Arundel Road)	48	1.17	8011	8742	8807	9255	9320
Water Lane (south of Arundel Road)	48	1.42	9140	9892	10442	10478	11028
A529 New Road	64	3.15	37748	40994	41091	43413	43510
B2140	48	0.66	7152	7705	7726	8163	8184
Roundstone Bypass (east of Station Road)	64	1.67	28938	31501	31933	33356	33788
A280 (south of Water Lane)	64	2.89	8952	9632	9632	10206	10206

**Slow down and queueing sections, where appropriate, have been modelled at 20-25kph*

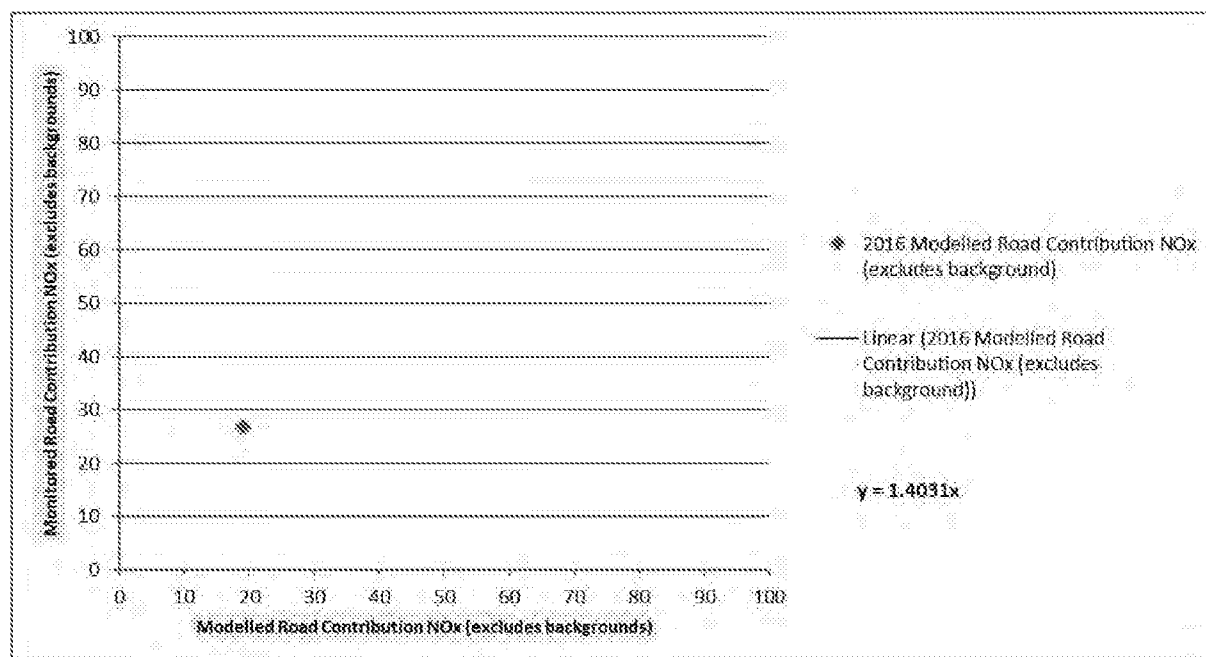
Appendix B:
2016 Wind Rose for Birmingham
Meteorological Recording Station



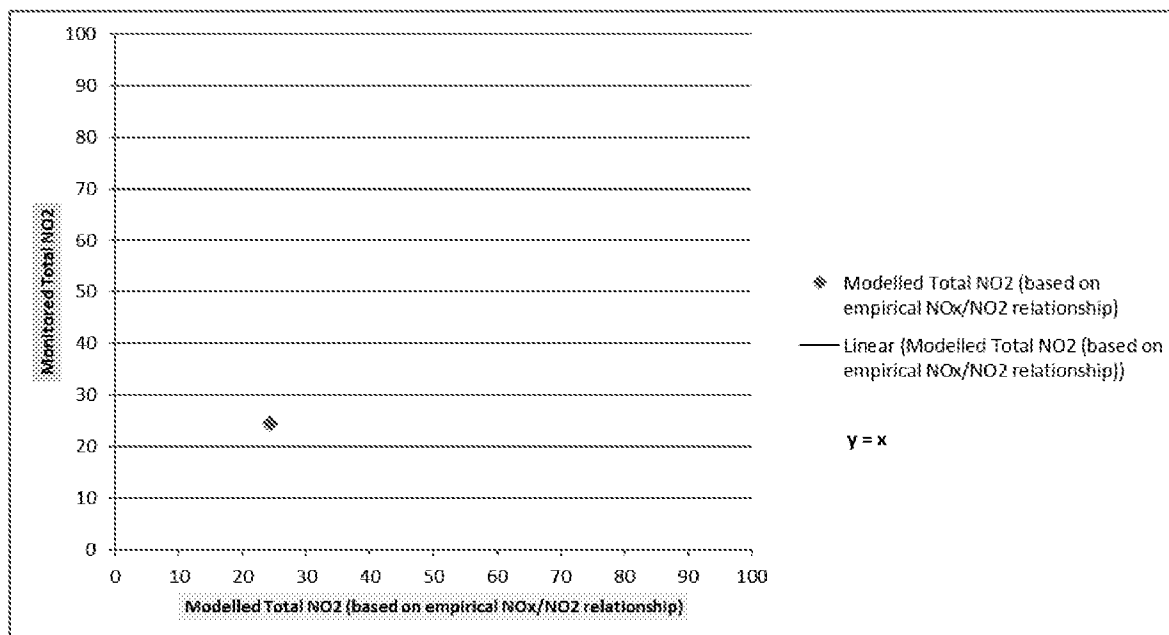
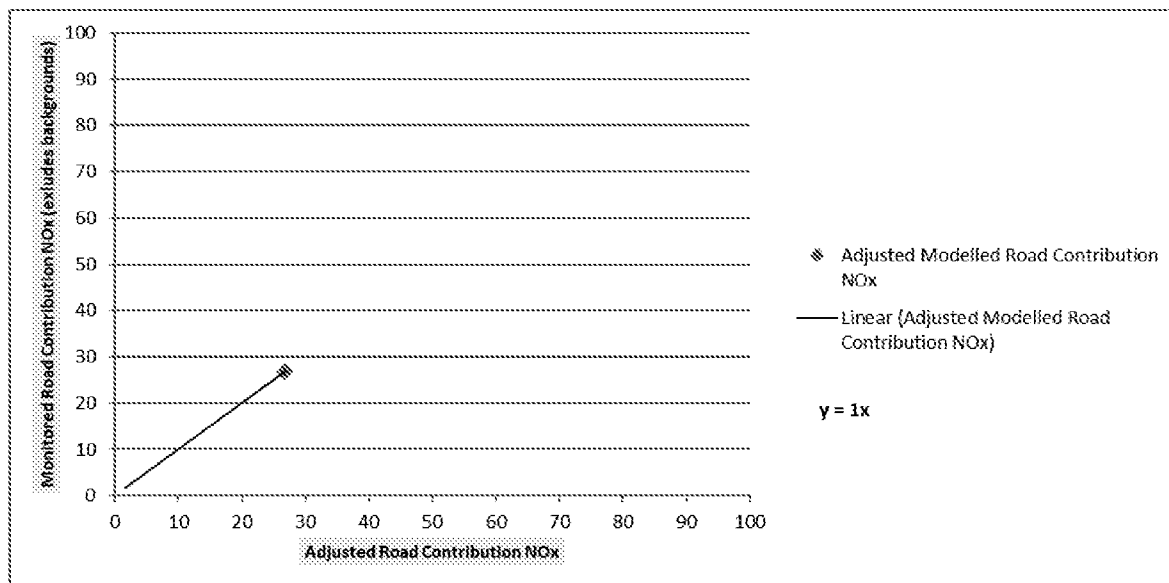
Appendix C:
Model Verification Procedure

Adjustment Factor

Address	2016 Monitored Total NO2	2016 Monitored Total NOx	2016 Background NO2	2016 Background NOx	Monitored Road Contribution NO2 (total - background)	Monitored Road Contribution NOx (excludes background)	Modelled Road Contribution NOx (excludes background)
U18802	24.40	41.02	15.69	14.29	13.71	26.73	19.05



Address	Ratio of Monitored Road Contribution NOx / Modelled Road Contribution NOx	Adjustment Factor for Modelled Road Contribution	Adjusted Modelled Road Contribution NOx	Adjusted Modelled Total NOx (including background NOx)	Modelled Total NO2 (based on empirical NOx / NO2 relationship)	Monitored Total NO2	% Difference [(modelled - monitored) / monitored] x 100
U18802	1.40	1.4031	26.73	41.02	24.40	24.40	0.00



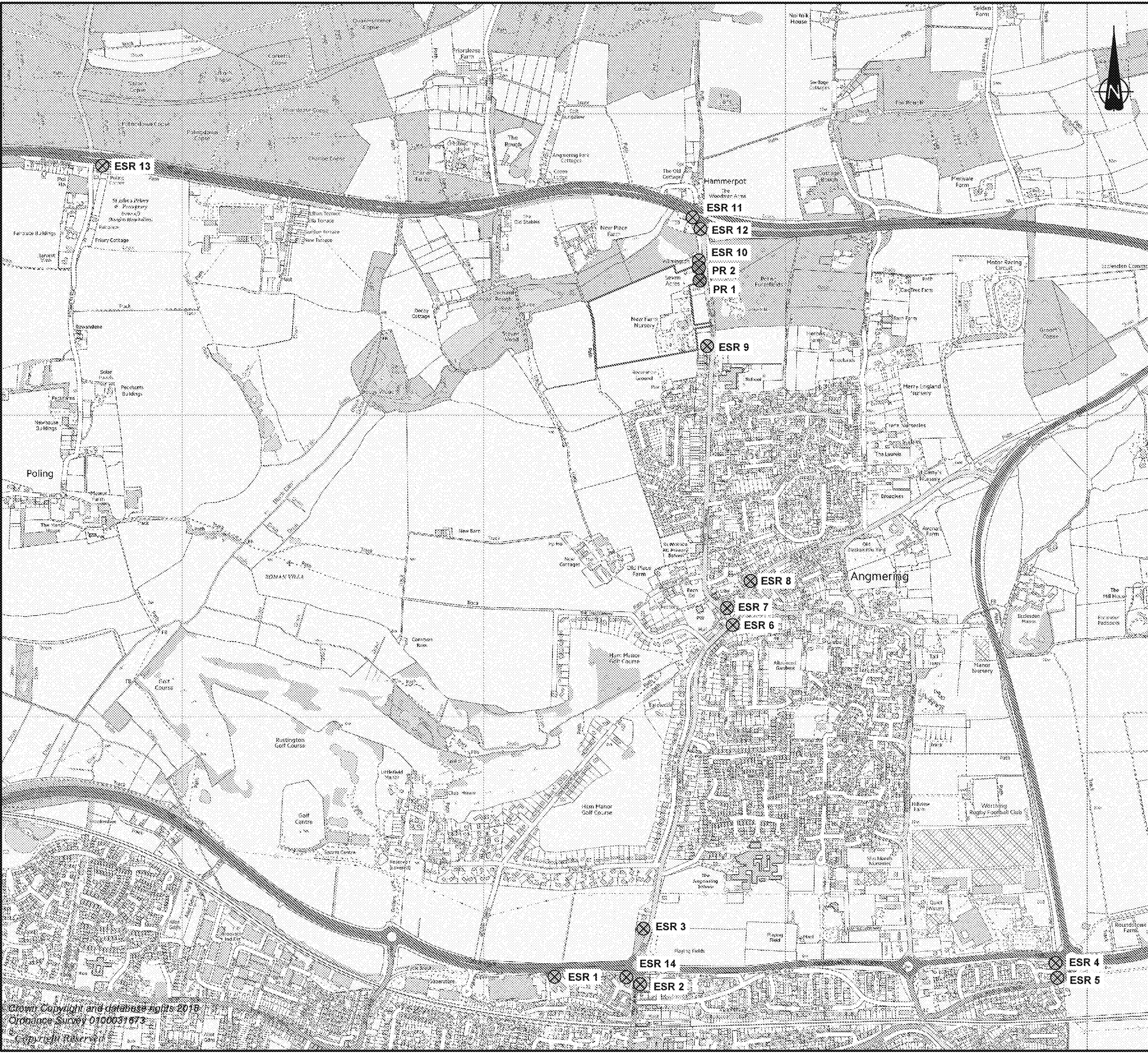
Appendix D:
Air Quality Assessment Results

Annual Mean NO_x, NO₂, (Adjusted) PM₁₀ and PM_{2.5} (Unadjusted) Concentrations in µg/m³

Receptor	Scenario 1: 2016 Verification and Base Year				Scenario 2: 2022 Opening Year, Without Development				Scenario 3: 2022 Opening Year, With Development				Scenario 4: 2027 Future Year, Without Development				Scenario 5: 2027 Future Year, With Development			
	NO _x	NO ₂	PM ₁₀	PM _{2.5}	NO _x	NO ₂	PM ₁₀	PM _{2.5}	NO _x	NO ₂	PM ₁₀	PM _{2.5}	NO _x	NO ₂	PM ₁₀	PM _{2.5}	NO _x	NO ₂	PM ₁₀	PM _{2.5}
ESR 1	29.78	18.68	13.83	8.91	21.83	14.19	13.56	8.61	21.87	14.21	13.56	8.61	16.74	11.13	13.52	8.52	16.76	11.14	13.52	8.53
ESR 2	35.08	21.34	14.11	9.08	25.71	16.21	13.85	8.77	25.79	16.26	13.86	8.77	19.44	12.54	13.83	8.70	19.49	12.57	13.84	8.70
ESR 3	20.62	13.94	13.19	8.53	15.84	11.00	12.93	8.26	15.98	11.08	12.94	8.27	12.63	8.94	12.86	8.17	12.73	8.99	12.88	8.18
ESR 4	41.18	24.31	14.27	9.23	31.23	19.02	14.07	8.94	31.44	19.12	14.09	8.95	22.96	14.33	14.04	8.86	23.09	14.40	14.05	8.86
ESR 5	27.62	17.59	13.61	8.82	20.97	13.73	13.37	8.55	21.04	13.77	13.38	8.55	16.00	10.71	13.32	8.46	16.05	10.74	13.33	8.46
ESR 6	25.84	16.38	14.14	9.13	19.50	12.74	13.86	8.83	20.08	13.05	13.91	8.86	15.10	10.08	13.80	8.74	15.47	10.28	13.85	8.77
ESR 7	16.21	11.31	13.53	8.77	12.79	9.13	13.26	8.50	13.03	9.26	13.28	8.51	10.47	7.60	13.17	8.40	10.62	7.68	13.19	8.41
ESR 8	15.83	11.11	13.52	8.76	12.56	9.00	13.25	8.49	12.63	9.04	13.25	8.50	10.31	7.51	13.16	8.39	10.36	7.54	13.17	8.40
ESR 9	16.45	11.66	13.04	8.34	12.76	9.24	12.76	8.06	12.95	9.35	12.78	8.07	10.28	7.56	12.67	7.96	10.41	7.63	12.69	7.97
ESR 10	17.13	12.03	13.08	8.36	13.15	9.46	12.79	8.08	13.30	9.54	12.81	8.08	10.55	7.71	12.71	7.98	10.64	7.76	12.72	7.98
ESR 11	38.24	22.82	14.38	9.14	26.85	16.71	14.02	8.75	27.03	16.81	14.03	8.76	19.92	12.68	13.97	8.66	20.04	12.74	13.99	8.67
ESR 12	24.21	15.77	13.52	8.62	17.74	11.94	13.20	8.30	17.94	12.04	13.22	8.31	13.68	9.39	13.13	8.21	13.81	9.46	13.15	8.22
ESR 13	35.12	21.25	15.27	9.61	24.79	15.61	14.91	9.24	24.93	15.69	14.92	9.24	18.48	11.90	14.86	9.15	18.58	11.95	14.87	9.15
ESR 14	35.40	21.49	14.14	9.09	25.54	16.13	13.86	8.78	25.61	16.16	13.87	8.78	19.21	12.42	13.83	8.70	19.25	12.45	13.84	8.70
PR 1									12.94	9.34	12.78	8.07					10.40	7.63	12.69	7.97

PR 2									13.03	9.39	12.78	8.07					10.46	7.66	12.69	7.97
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Drawing
LE14250-001



DO NOT SCALE FROM THIS DRAWING

KEY

- SITE BOUNDARY
- ESR EXISTING SENSITIVE RECEPTOR LOCATION
- PR PROPOSED RECEPTOR LOCATION

A First Issue 11-01-18 DR MB MW

REVISION DETAILS DATE DRN CHKD APPD

CLIENT Gladman Developments

PROJECT Arundel Road Angmering

DRAWING TITLE Existing and Proposed Sensitive Receptor Locations

DRG No. LE14250-002 REV A

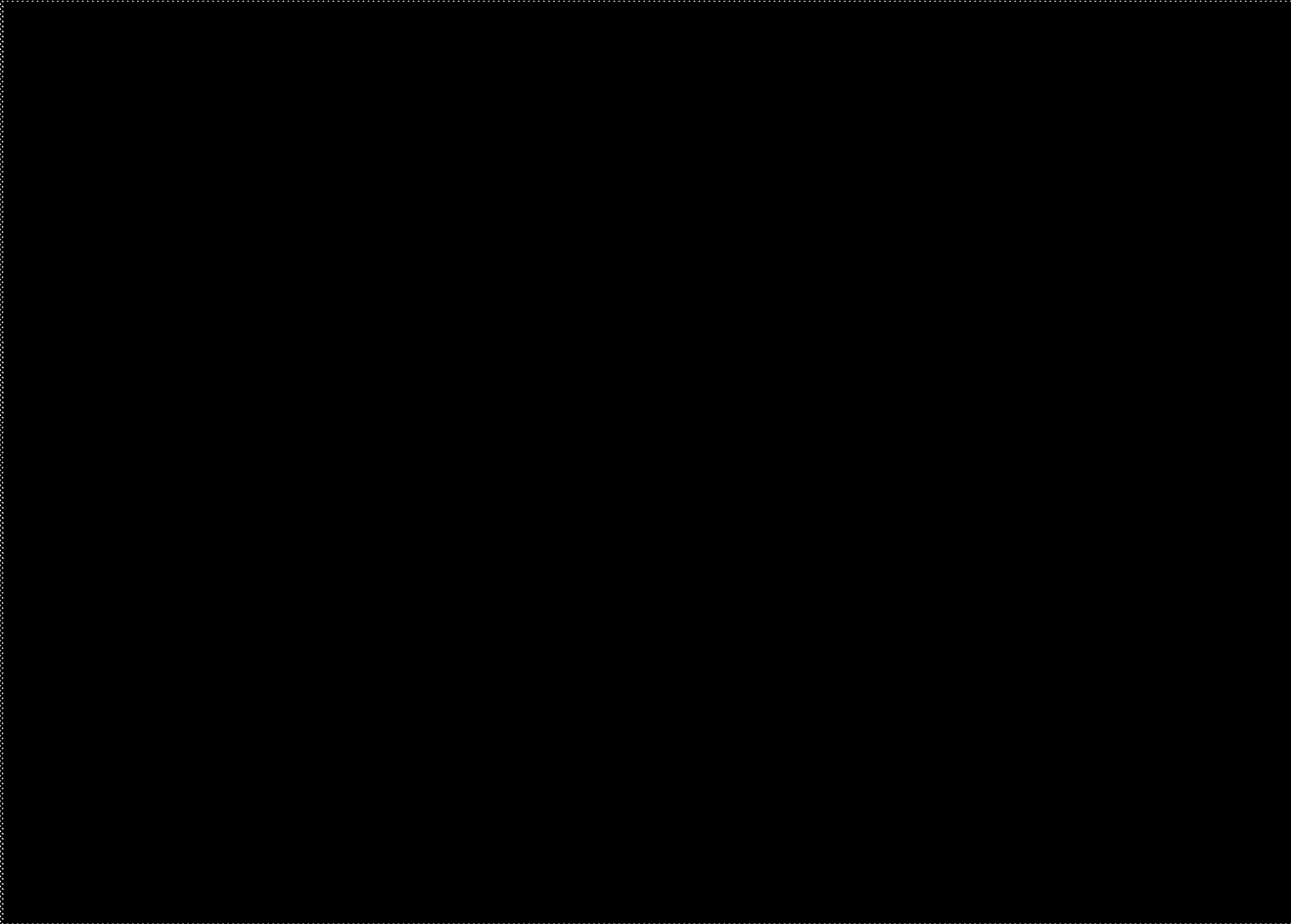
DRG SIZE A3 SCALE 1:1250 DATE 09-01-18

DRAWN BY DR CHECKED BY MB APPROVED BY MW

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