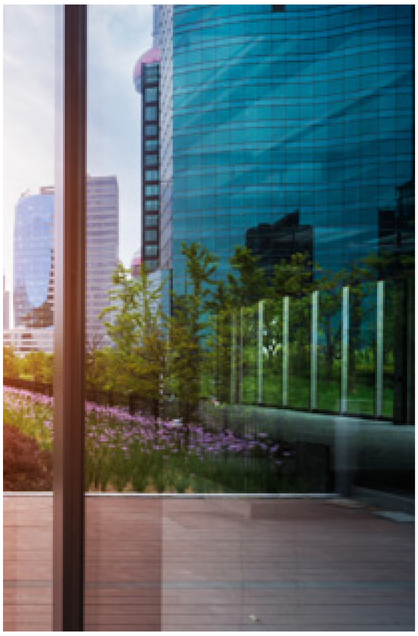
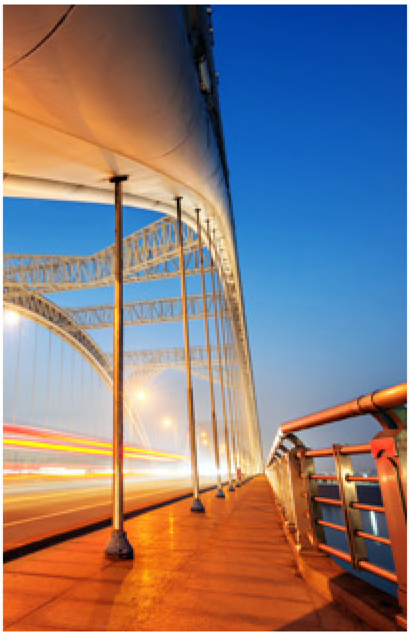
11. Air Quality

Appendix 11.1

FORT HALSTEAD AIR QUALITY ASSESSMENT



Fort Halstead

Air Quality Assessment

19 September 2019

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015 and BS OHSAS 18001:2007)

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Comments

Comments

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Executive Summary

Planning permission is sought for the proposed redevelopment of the former Defence, Science and Technology Laboratory and land surrounding Fort Halstead. The Development would be mixed-use comprising a business area (Use Classes B1 and B2), 750 residential units, a village centre (Use Classes A1-A3, B1a, D1 and D2), and use of the Fort Area and bunkers as an historic interpretation centre (Use Class D1).

An Air Quality Assessment of changes in local air quality during the construction and operational phases was undertaken.

The main likely effects on local air quality during construction relates to dust. A range of measures to minimise or prevent dust generated from construction activities would be implemented throughout the works. Therefore, it is considered that likely residual effects due to dust emissions would be not significant.

It is anticipated the effect of construction vehicles and construction plant on air quality would not be significant in the context of existing local road traffic emissions and background air quality conditions.

The Development would generate traffic which would potentially change local air quality in terms of particulate matter (as PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2) concentrations. However, following completion of the Development, and considering uncertainty in future nitrogen oxide (NO_x) and NO_2 reductions, the Development is predicted not to have a significant effect on NO_2, and particulates concentrations within, and surrounding the Site. Therefore, the overall effect of the completed Development on air quality is not significant.

Air quality concentrations for NO_2 and particulates at the Site are below the Air Quality Strategy Objectives for the protection of health. Therefore, the effect of introducing sensitive receptors (residential/school) to the Site is **not significant**.

1. Introduction

1.1. Waterman Infrastructure & Environment Limited (hereafter referred to as 'Waterman') has been commissioned by Merseyside Pension Fund (hereafter referred to as 'the Applicant') to undertake an air quality assessment for the redevelopment of the former Defence, Science and Technology Laboratory and land surrounding Fort Halstead (hereafter referred to as the 'Site' as indicated by **Figure 1**).

1.2. The Site is 74.49 hectares in area and located within the Sevenoaks District Council (SDC) administrative boundary. The Site is located within an area dominated by farmland and scattered villages, most notably the villages of Halstead, Knockholt and Knockholt Pound. Residential properties are also located along Crow Drive and Star Hill Road immediately to the north-east and south-west of the Site, respectively. The majority of the Site is currently occupied by the Defence Science and Technology Laboratory (DSTL).

1.3. The Site is subject to the following development proposals (hereafter referred to as the 'Development'): the demolition of buildings and development of a mixed-use development comprising a business area (Use Classes B1 and B2), 750 residential units, a village centre (Use Classes A1-A3, B1a, D1 and D2), use of the Fort Area and bunkers as an historic interpretation centre (Use Class D1) with ancillary workshop space, and works associated with the development including roads, landscaping, security fencing, formal and informal open space, pedestrian, cyclist and public transport infrastructure, utilities infrastructure, sustainable urban drainage system, cycle and car parking (with all matters reserved); and detailed approval for two access points at Otford Lane/Crow Drive and Star Hill.

1.4. SDC have declared 8 Air Quality Management Areas (AQMA) for exceedances of the annual mean nitrogen dioxide (NO_2) Air Quality Strategy (AQS) Objective and 1 AQMA for excedences of the daily mean particulate matter (as PM_{10}) AQS Objective within the District. The Site does not lie within an AQMA although at its closest point, AQMA 2 is approximately 90m from the boundary of the Site.

1.5. This air quality assessment provides a review of the existing air quality at and surrounding the Site and assesses the potential effect of the Development on local air quality during construction and once completed and operational. Consideration is given to the impact of emissions from construction activities and the completed and operational Development on existing sensitive receptors surrounding the Site and at the proposed residential receptors on the Site. The most significant pollutant during construction relates to the creation of nuisance dust and emissions from construction vehicles and construction plant. A qualitative assessment has been undertaken based on relevant air quality guidance.

1.6. The most significant pollutants associated with road traffic emissions, in relation to human health, are NO_2 and particulate matter (PM_{10} and $PM_{2.5}$), and therefore the assessment focuses on these pollutants.

1.7. Section 2 of this report gives a summary of legislation, planning policy, and guidance relevant to air quality. Section 3 provides details of the assessment methodology and Section 4 sets out the baseline conditions at and around the Site. The results of the assessments are presented in Section 5 and Section 6. Section 7 describes any required mitigation measures. A summary of the findings and conclusions of the assessment is given in Section 8. This air quality assessment is supported by Appendix A: Air Quality Assessment Detailed Methodology.

2. Air Quality Legislation and Planning Policy

National Legislation

2.1. Air Pollutants at high concentrations can have adverse effects on the health of humans and ecosystems. European Union (EU) legislation on air quality forms the basis for UK legislation and policy on air quality.

2.2. The EU framework Directive 2008/50/EC[1] on ambient air quality assessment and management came into force in May 2008 and was implemented by member states including the UK, by June 2010. The Directive aims to protect human health and the environment by avoiding, reducing or preventing harmful concentrations of air pollutants.

Air Quality Standards Regulations, 2010

2.3. The Air Quality Standards Regulations[2] implement Limit Values prescribed by the EU Framework Directive 2008/50/EC. The Limit Values are legally binding and the Secretary of State, on behalf of the UK Government, is responsible for their implementation.

The UK Air Quality Strategy, 2007

2.4. The current UK Air Quality Strategy (UK AQS) was published in July 2007[3] and sets out new objectives for local planning authorities (LPA) in undertaking their Local Air Quality Management (LAQM) duties. The 2007 UK AQS introduced a national level policy framework for exposure reduction for fine particulate matter. Objectives in the UK AQS are in some cases more onerous than the Limit Values set out within the relevant EU Directives and the Air Quality Standards Regulations 2010. In addition, objectives have been established for a wider range of pollutants.

2.5. The European Union (EU) also sets Limit Values for NO_2, PM_{10} and $PM_{2.5}$[4], which have been adopted by the UK[5]. The Limit Value for NO_2 is the same numerical level but the target date differs. Achievement of these values is a national obligation rather than a local obligation. In the UK, only monitoring and modelling carried out by Defra and Central Government meets the specification required to assess compliance with the Limit Values.

2.6. Further, Defra and Central Government does not recognise local authority monitoring or local modelling studies when determining the likelihood of the Limit Values being exceeded. As such the Limit Values have not been considered further in this air quality assessment.

2.7. The UK AQS objectives of air pollutants relevant to this assessment are summarised in **Table 1**.

1 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe.
2 Defra, (2010) The Air Quality Standards (England) Regulations.
3 Department of the Environment, Food and Rural Affairs (Defra), (2007). 'The Air Quality Strategy for England, Scotland, Wales & Northern Ireland'.
4 Council Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe
5 Defra, (2010) The Air Quality Standards (England) Regulations.

Table 1: Summary of Relevant UK AQS Objectives

Pollutant	Objective		Date by Which Objective to be Met
	Concentration	Measured as	
Nitrogen Dioxide (NO_2)	200µg/m^3	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40µg/m^3	Annual Mean	31/12/2005
Particulate Matter (PM_{10}) [(a)]	50µg/m^3	24 hour mean not to be exceeded more than 35 times per year	31/12/2004
	40µg/m^3	Annual Mean	31/12/2004
Particulate Matter ($PM_{2.5}$) [(b)]	Target of 15% reduction in concentrations at urban background locations	Annual Mean	Between 2010 and 2020
	25µg/m^3	Annual Mean	01/01/2020

Note: (a) Particulate matter with a mean aerodynamic diameter less than 10 microns (or micrometres – µm)
(b) Particulate matter with a mean aerodynamic diameter less than 2.5 microns

The Environmental Act, 1995

2.8. Under Part IV of the Environment Act 1995[6], local authorities are required to review and assess air quality in their area by way of a staged process. Should this process suggest that any of the AQS objectives (as defined in **Table 1**) will not be met by the target dates, the local authority must consider the declaration of an AQMA and the subsequent preparation of an Air Quality Action Plan (AQAP) to improve the air quality in that area in pursuit of the objectives.

2.9. SDC has designated a 9 AQMAs within the District, which includes the entire length of the M25 and M26 motorways. Details of SDC's AQAP and a summary of SDC's review and assessment of air quality is provided later in this report.

National Planning Policy

National Planning Policy

National Planning Policy Framework, 2018

2.10. The revised National Planning Policy Framework (NPPF)[7,] published in February 2019, sets out the Government's planning policies for England and how these should be applied.

2.11. Paragraph 103 states "*The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions and improve air quality and public health. However, opportunities to maximise sustainable transport solutions will vary between urban and rural areas, and this should be taken into account in both plan-making and decision-making*"

6 Office of the Deputy Prime Minister (ODPM), 1995, 'The Environment Act' 1995.
7 Department for Communities and Local Government, 2019, 'National Planning Policy Framework'. DCLG, London.

2.12. Paragraph 181 states *"Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan."*

Local Planning Policy

Sevenoaks District Council, Core Strategy Development Plan Document, 2011

2.13. SDC's Core Strategy was adopted in February 2011[8] to plan for the future development of the District up to 2026. Policy SP 2: Sustainable Development of the adopted Core Strategy seeks:

"*The design and location of new development will take account of the need to improve air quality in accordance with the District's Air Quality Action Plan. Development on areas of poor air quality or development that may have an adverse impact on air quality will be required to incorporate mitigation measures to reduce impact to an acceptable level. New development on areas of poor air quality will be required to incorporate measures in the design and orientation that demonstrate an acceptable environment will be created for future occupiers. Permission will be refused when unacceptable impacts cannot be overcome by mitigation.*"

Sevenoaks District Council, Allocations and Development Management Plan, 2015

2.14. There are no policies specific to air quality within SDC's adopted Allocations and Development Management Plan[9].

Kent Downs, Kent Downs Area of Outstanding Natural Beauty Management Plan 2014 – 2019, 2014

2.15. The Site is located within the Kent Downs Area of Outstanding Natural Beauty; although the main access to the Site from the A224 lies outside the AONB boundary. The Kent Downs AONB Management Plan[10] sets out a vision and clear aims and policies. The policies provided in the plan recognise and reflect the pressure from growth and development in the Kent Downs AONB. This includes securing mitigation measures to take advantage of the opportunities generated by this growth and to prevent a harmful impact on the AONB. Policy GNR5 states:

"*threats to the conservation of the natural resources of soil, water and air will be opposed.*"

8 Sevenoaks District Council (2011): Core Strategy Adopted Version, February 2011.
9 Sevenoaks District Council (2015): Allocations and Development Management Plan.
10 Kent Downs (2014), Kent Downs Area of Outstanding Natural Beauty Management Plan 2014 – 2019

Guidance

Department for Environment, Food and Rural Affairs, Clean Air Strategy,2019

2.16. Published in January 2019 the Clean Air Strategy[11] sets out a coherent framework and national action to improve air quality throughout the UK.

2.17. The Strategy is underpinned by new national powers to control major sources of air pollution, in line with the risk they pose to public health and the environment, plus new local powers to act in areas with an air pollution problem. The Strategy also supports the creation of Clean Air Zones to lower emissions from all sources of air pollution, backed up with clear enforcement mechanisms.

UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations, 2017

2.18. The UK Government was required by the High Court to release a new Air Quality Plan[12] to meet the NO_2 Limit Value in the shortest timescale as possible. This document was adopted on the 26 July 2017.

2.19. The plan focuses on reducing concentrations of NO_x and NO_2 around road vehicle emissions within the shortest possible time. With the principal aims to:

a. reduce emissions of NOx from the current road vehicle fleet in problem locations now; and

b. accelerate road vehicle fleet turnover to cleaner vehicles to ensure that the problem remains addressed and does not move to other locations.

2.20. The other aims include reducing background concentrations of NO_x from:

- Other forms of transport such as rail, aviation and shipping;
- Industry and non-road mobile machinery; and
- Buildings, both commercial and domestic, and other stationary sources.

2.21. The Plan provides measures to reduce NO_x and NO_2 concentrations in the UK, such measures include:

- Require Local Authorities to implement chosen measures to achieve statutory NO_2 limit values within the shortest possible time;
- Highways England action to improve air quality on the Strategic Road network in England, including network of charge points and other innovative solutions;
- More stringent laboratory testing requirements for statutory type approval of new light duty vehicles;
- New real driving emissions requirement to address real world NO_x emissions for light passenger and commercial vehicles;
- Lorry emissions technology checks at roadside;

11 Defra (2019) Clean Air Strategy, 2019
12 Defra (2017) UK Plan for Tackling Roadside Nitrogen Dioxide Concentrations Detailed Plan July 2017

- Additional funding to accelerate uptake of low emission buses, including new buses and retrofitting older buses supported by a new accreditation scheme;
- Additional funding to accelerate the uptake of electric taxis;
- Additional funding to accelerate uptake of hydrogen vehicles and infrastructure;
- Regulatory changes to support the take up of alternatively fuelled light commercial vehicles;
- Exploring the appropriate tax treatment for diesel vehicles;
- Call for evidence on updating the existing HGV Road User Levy;
- Call for evidence on use of red diesel;
- Ensure wider environmental performance is apparent to consumers when purchasing cars;
- Updating Government procurement policy;
- Call for evidence on a new Aviation Strategy;
- New emissions standards for non-road mobile machinery;
- New measures to tackle NO_x emissions from Medium Combustion Plants; and
- New measures to tackle NO_x emissions from generators.

2.22. The above measures do not provide any actions which are relevant to the operation or design of the Development.

2.23. A recent High Court ruling[13] on 21st February 2018, stated the UK Governments air quality improvement plan adopted on 31st July 2017 was unlawful as '*it does not contain measures sufficient to ensure substantive compliance with the 2008 Directive and the English Regulations*'. The UK government '*must ensure steps are taken to achieve compliance as soon as possible, by the quickest route possible and by a means that makes that outcome likely*'.

2.24. The judgement stated that the government must produce a supplementary plan, setting out requirements for feasibility studies to be undertaken in 33 Local Authority Areas. SDC is not one of the local authorities that is required to undertake a feasibility study.

Planning Practice Guidance, 2014

2.25. The Government's online Planning Practice Guidance[14] (PPG) states that air quality concerns are more likely to arise where development is proposed within an area of existing poor air quality, or where it would adversely impact upon the implementation of air quality strategies and / or action plans.

2.26. The PPG notes that when deciding whether air quality is relevant to a planning application, considerations would include whether the development would lead to:

- significant effects on traffic, such as volume, congestion, vehicle speed, or composition;
- the introduction of new point sources of air pollution, such as furnaces, centralised boilers and Combined Heat and Power (CHP) plant; and
- exposing occupants of any new developments to existing sources of air pollutants and areas with poor air quality.

13 https://www.judiciary.gov.uk/judgments/the-queen-on-the-application-of-clientearth-no-3-claimant-v-secretary-of-state-for-environment-food-and-rural-affairs-and-othrs/
14 DCLG (2014), 'Planning Practice Guidance: Air Quality (ID 32)' (06 March 2014).

Environmental Protection UK & Institute of Air Quality Management Guidance; Land- use Planning & Development Control: Planning for Air Quality 2017

2.27. Environmental Protection UK (EPUK) and the Institute of Air Quality Management (IAQM) Guidance[15] provides guidance for air quality considerations within local development control processes; promoting a consistent approach to the treatment of air quality issues.

2.28. The EPUK and IAQM guidance explains how development proposals could adopt good design principals to reduce emissions and contribute to better air quality. The guidance also provides a method for screening the need for an air quality assessment and a consistent approach for describing the effects at individual receptors.

2.29. The EPUK and IAQM Guidance advises that:

"In arriving at a decision about a specific proposed development the local planning authority is required to achieve a balance between economic, social and environmental considerations. For this reason, appropriate consideration of issues such as air quality, noise and visual amenity is necessary. In terms of air quality, particular attention should be paid to:

- *Compliance with national air quality objectives and of EU Limit Values;*
- *Whether the development will materially affect any air quality action plan or strategy;*
- *The overall degradation (or improvement) in local air quality; or*
- *Whether the development will introduce new public exposure into an area of existing poor air quality.*"

Institute of Air Quality Management: Guidance on the Assessment of Dust from Demolition and Construction v1.1, 2016

2.30. The IAQM Construction Dust Guidance[16] provides guidance to consultants and Environmental Health Officers (EHOs) on how to assess air quality effects from construction related activities. The guidance provides a risk based approach based on the potential dust emission magnitude of the site (small, medium or large) and the sensitivity of the area to dust effects. The importance of professional judgement is noted throughout the guidance. The guidance recommends that once the risk class of the site has been identified, the appropriate level of mitigation measures are implemented to ensure that the construction activities have no significant effects.

Sevenoaks District Council, Air Quality Action Plan, 2009

2.31. The SDC air quality action plan[17] was published in 2009. The action plan is primarily aimed at reducing NO_2 within SDC, however initiatives within the plan will have a positive effect on the reduction of other air pollutants including particulate emissions, by reducing emissions from road vehicle and non-road sources, and by educating and raising awareness of the impact of travel and the availability of alternatives relevant to promoting behavioural change.

15 Environmental Protection UK & Institute of Air Quality Management (IAQM) (2017), 'Land-use Planning & Development Control: Planning for Air Quality.' January 2017. IAQM, London

16 Institute of Air Quality Management (2016) 'Guidance on the Assessment of dust from demolition and construction v1.1.'

17 Sevenoaks District Council (2009). Air Quality Action Plan 2009

3. Assessment Methodology and Significance

Assessment Methodology

3.1. This air quality assessment was undertaken using a variety of information and procedures as follows:

- Review of SDC's air quality Review and Assessment statutory reports published as part of the LAQM regime to determine baseline conditions around the Site;
- Review of the local area to identify potentially sensitive receptor locations that could be affected by changes in air quality arising from the construction works and the operation of the Development;
- Review and use of traffic flow data supplied by Peter Brett Associates (PBA);
- Dispersion modelling of pollutant emissions using the ADMS-Roads model[18] to predict the likely pollutant concentrations at the Site in terms of traffic emissions generated. The NO_2 from NO_x Calculator available from the LAQM Support website[19] has been applied to derive the road-related NO_2 concentrations from the modelled NO_x concentrations;
- Comparison of the predicted air pollutant concentrations with monitored concentrations from three urban background diffusion tubes set up by Waterman for a monitoring study and the adjustment of modelled results where necessary (model verification details are provided in **Appendix A: Air Quality Assessment Detailed Methodology**);
- Comparison of the predicted air pollutant concentrations with the UK AQS objectives;
- Determination of the likely significant effects of construction works and activities, and consideration of the environmental management controls likely to be employed during the works;
- Determination of the likely significant effects of the operational phase of the Development on air quality, based on the application of the EPUK/IAQM guidance significance criteria to the modelled results; and
- Identification of mitigation measures, where appropriate.

3.2. Emissions of total NO_x from motor vehicle exhausts comprise nitric oxide (NO) and nitrogen dioxide (NO_2). NO oxidises in the atmosphere to form NO_2. The most significant pollutants associated with road traffic emissions in relation to human health are NO_2 and PM_{10}. SDC have declared AQMAs for annual mean NO_2 and 24-hour mean PM_{10}, attributable to road traffic emissions. This assessment therefore focuses on NO_2 and particulate matter (PM_{10} and $PM_{2.5}$).

Construction Phase Assessment Methodology

Dust Emissions

3.3. The assessment of the construction activities in relation to dust has been based on the IAQM's '*Guidance on the Assessment of Dust from Demolition and Construction*' and the following:

- Consideration of planned construction activities and their phasing; and
- A review of the sensitive uses in the area immediately surrounding the Site.

18 Cambridge Environmental Research Consultants Ltd, ADMS-Roads, January 2018, Version 4.1.1.
19 AEA, NOx to NO2 Calculator, http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php Version 6.1, October 2017.

3.4. The IAQM guidance identifies receptors within 350m of the Site boundary, and within 50m of construction routes would be sensitive to emissions and nuisance dust from construction activities. **Figure 2** shows the area surrounding the Site, where sensitive receptors could be affected by nuisance dust, considering the IAQM guidance.

3.5. Following the IAQM guidance, construction activities can be divided into the following four distinct activities:

- Demolition – any activity involved in the removal of an existing building;
- Earthworks – the excavation, haulage, tipping and stockpiling of material, but may also involve levelling the site and landscaping;
- Construction – any activity involved with the provision of a new structure; and
- Trackout – the movement of vehicles from unpaved ground on a site, where they can accumulate mud and dirt, onto the public road network where dust might be deposited.

3.6. The IAQM guidance considers three separate dust effects, with the proximity of sensitive receptors being taken into consideration for:

- annoyance due to dust soiling;
- potential effects on human health due to significant increase in exposure to PM_{10}; and
- harm to ecological receptors.

3.7. A summary of the process which has been undertaken for the dust assessment of construction activities as set out in the IAQM guidance is presented in **Table 2**.

Table 2: Summary of the Guidance for Undertaking a Construction Dust Assessment

Step		Description
1	Screen the Need for a Detailed Assessment	Simple distance-based criteria are used to determine the requirement for a detailed dust assessment. An assessment will normally be required where there are 'human receptors' within 350m of the boundary of the site and / or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance or 'ecological receptors' within 50m of the boundary of the site and/or within 50m of the route(s) used by construction vehicles on public highway, up to 500m from the site entrance.
2	Assess the Risk of Dust Effects	The risk of dust arising in sufficient quantities to cause annoyance and/or health or ecological effects should be determined using three risk categories: low, medium and high based on the following factors: • the scale and nature of the works, which determines the risk of dust arising (i.e. the magnitude of potential dust emissions) classed as small, medium or large; and • the sensitivity of the area to dust effects, considered separately for ecological and human receptors (i.e. the potential for effects) defined as low, medium or high.
3	Site Specific Mitigation	Determine the site-specific measures to be adopted at the site based on the risk categories determined in Step 2 for the four activities. For the cases where the risk is 'insignificant' no mitigation measures beyond those required by legislation are required. Where a local authority has issued guidance on measures to be adopted these should be taken into account.
4	Determine Significant Effects	Following Steps 2 and 3, the significance of the potential dust effects should be determined, using professional judgement, taking into account the factors that define the sensitivity of the surrounding area and the overall pattern of potential risks.

Construction Vehicle Exhaust and Plant Emissions

3.8. IAQM's guidance on assessing construction impacts states that:

"*Experience of assessing the exhaust emissions from on-site plant (also known as non-road mobile machinery or NRMM) and site traffic suggests that they are unlikely to make a significant effect on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed. For site plant and on-site traffic, consideration should be given to the number of plant/vehicles and their operating hours and locations to assess whether a significant effect is likely to occur. For site traffic on the public highway, if it cannot be scoped out, then if should be assessed using the same methodology and significance criteria as operational traffic impacts*".

3.9. Given the size of the Site (74.49ha) and the average number of two way construction related Heavy Duty Vehicles (HDV) movements at 85 per day, in accordance with IAQM's guidance, it is considered that a quantitative assessment of the exhaust emissions from construction plant and traffic is not required, and a qualitative assessment is appropriate.

Completed Development

ADMS Model

3.10. The likely effects on local air quality from traffic movements generated from the completed and operational Development have been assessed using the atmospheric dispersion model ADMS-Roads. **Appendix A** presents the details of the dispersion modelling.

3.11. For the purposes of modelling, traffic data for the relevant local road network, has been provided by Peter Brett Associates. Further details are provided in **Appendix A**. The year 2018 has been used to assess the baseline. The year 2030 was used for the 'without Development' and 'with Development' scenarios, as the anticipated year of completion of the Development.

3.12. The ADMS-Roads dispersion model predicts how emissions from roads and small-scale industrial sources combine with local background pollution levels, taking account of meteorological conditions, to affect local air quality. The model has been run for the completion year, using background data and vehicle emission rates for 2030 as inputs. For the verification assessment (referred to later in this report), background data and vehicle emission rates for 2013 have been used. Pollutant concentrations have been modelled at locations representative of nearby and on-Site sensitive receptors.

3.13. Full details of the dispersion modelling study, including the road traffic data used in the assessment, are presented within **Appendix A**.

Model Uncertainty

3.14. Analyses of historical monitoring data by Defra[20] have identified a disparity between actual measured NO_x and NO_2 concentrations and the expected decline associated with emission forecasts which form the basis of air quality modelling as described above. The reason relates to the on-road performance of certain vehicles compared to calculations based on Euro emission standards which inform emission forecasts.

3.15. The note 'Projecting NO_2 Concentrations'[21] published by Defra provides alternative approaches that can be followed in air quality assessments, in relation to the modelling of future NO_2 concentrations, considering that future NO_x/NO_2 road-traffic emissions and background concentrations may not reduce as previously expected. This includes the use of revised background pollution maps, alternative projection factors and revised vehicle emission factors. However, the Defra note does not form part of statutory guidance and no prescriptive method is recommended for use in an air quality assessment.

3.16. This air quality assessment has been based on current guidance, i.e. using existing forecast emission rates and background concentrations to the completion year of 2030, which assumes a progressive reduction compared to the baseline year 2018. However, in addition, a sensitivity analysis has been undertaken based on no future NO_x and NO_2 reductions by 2030 (i.e. considering the likely significant effect of the Development against the baseline 2018 conditions,

20 http://laqm.defra.gov.uk/faqs/faqs.html.
21 Defra, 2012, Local Air Quality Management: Note on Projecting NO_2 Concentrations.

assuming no reduction in background concentrations or road-traffic emissions rates between 2018 and 2030). The sensitivity approach presented in this air quality assessment is now typically agreed and accepted by local authorities as being robust and provides a clear method to account for the uncertainty in future NO_X and NO_2 concentrations in air quality assessments. The results of this sensitivity analysis, which represent a more conservative assessment scenario, are presented later in this report.

Background Pollutant Concentrations

3.17. To estimate the total concentrations due to the contribution of any other nearby sources of pollution, background pollutant concentrations need to be added to the modelled concentrations. Full details of the background pollution data used within the air quality assessment are included in **Appendix A**

Model Verification

3.18. Model verification is the process of comparing monitored and modelled pollutant concentrations and, if necessary, adjusting the modelled results to reflect actual measured concentrations, to improve the accuracy of the modelling results. The model has been verified by comparing the 2013 predicted annual mean NO_2 concentrations, with the 2013 monitored concentration from three diffusion tubes used for a monitoring study undertaken at the site. These include DT5: Crow Drive, DT7 Harrow Inn, Knockholt; and DT8 A224 Polhill Road further details are provided in **Appendix B**.

Potentially Sensitive Receptors

3.19. The approach adopted by the UK AQS is to focus on locations at, and close to, ground level where members of the public (in a non-workplace area) are likely to be exposed over the averaging time of the objective in question (i.e. over 1-hour, 24-hour or annual periods). Objective exceedances principally relate to annual mean NO_2 and PM_{10}, and 24-hour mean PM_{10} concentrations, so that associated potentially sensitive locations relate mainly to residential properties and other sensitive locations (such as schools) where the public may be exposed for prolonged periods.

3.20. **Table 3** presents existing sensitive receptors selected due to their proximity to the road network likely to be affected by the Development. **Table 3** also presents future sensitive receptor locations which are representative of sensitive uses proposed within the Development itself. The future sensitive receptor locations represent areas of the Development that would likely be exposed to the worst-case air quality conditions, i.e. the lower residential floor levels of buildings within the Development that would be closest to road traffic. The location of the selected existing and future receptors assessed are presented in **Figure 1**.

Table 3: Selected Receptor Locations

ID	Receptor Location	Receptor Type	OS Grid Reference	Height Above Ground (m)
1	Keeper Cottage, Star Hill Road	Existing residential	549659, 158590	0
2	Star Hill Road Cottages	Existing residential	549443, 158519	0
3	Leesfield, Knockholt	Existing residential	548778, 159528	0

ID	Receptor Location	Receptor Type	OS Grid Reference	Height Above Ground (m)
4	14 Fort Road, Halstead	Existing residential	550154, 159715	0
5	High Field Farm, Crow Drive, Halstead	Existing residential	550267, 160050	0
6	Corner Cottage, Old London Road, Knockholt	Existing residential	548272, 159783	0
7	20 Main Road, Knockholt	Existing residential	548070, 159554	0
8	Knockholt Road, Halstead	Existing residential	548565, 160488	0
9	Halstead Community Primary School	Existing school	548892, 161072	0
10	Halstead Hall, Shoreham Lane, Halstead	Existing residential	548830, 161174	0
11	Hunters Retreat, Shoreham Lane	Existing residential	549686, 161446	0
12	Finnart, Otford Lane, Halstead	Existing residential	549409, 160576	0
13	Morants Court Road, Dunton Green	Existing residential	550544, 157934	0
14	Pilgrims Way West	Existing residential	551490, 159240	0
15	On Site: Proposed Residential 1	Future residential	550089, 159633	0
16	On Site: Proposed Community Use	Future community use	549819, 159212	0
17	On Site: Proposed Residential 2	Future residential	549393, 159052	0
18	On Site: Proposed Primary School	Future Primary School	550098,159352	0

Limitations and Assumptions

3.21. For the purposes of the assessment of dust nuisance during demolition and construction works it has been assumed activities would be carried out at the boundary of the Development to provide a worst-case assessment.

3.22. Currently there is no methodology to assess and determine the impact of a development against the EU Limit Values. In addition, compliance with the EU Limit Values is a UK Government's responsibility given that national measures (such as vehicle scrappage schemes and increased diesel fuel prices) would be required to meet compliance. As such the effect of the Development has been assessed against the UK AQS objectives rather than the EU Limit values. To demonstrate that the Development has a positive influence on air quality a summary of measures which are likely to lead to a benefit to air quality have been outlined.

3.23. The overall conclusions of the air quality assessment are based on consistent (i.e. the same) vehicle emission rates from 2018 to the opening year of the development (2030). This approach is conservative as the air quality assessment does not take account of older vehicles being replaced by the newest vehicles with lower emissions.

3.24. The limitations with regards to the air quality model are discussed in **Appendix A** and where necessary appropriate model refinement, including a model verification, has been undertaken.

Significance Criteria

Demolition and Construction

3.25. The significance of effects of construction activities on air quality have been assessed based on professional judgement and with reference to the criteria set out in the IAQM guidance. Appropriate site-specific mitigation measures that would need to be implemented to minimise any adverse effect have also been considered. Details of the assessor's experience and competence to undertake the dust assessment is provided in **Appendix A**.

3.26. The assessment of the risk of dust effects arising from each of the construction activities, as identified by the IAQM guidance, is based on the magnitude of potential dust emission and the sensitivity of the area. The risk category matrix for each of the activity types, taken from the IAQM guidance, are presented in **Table 4** to **Table 7**. Examples of the magnitude of potential dust emissions for each construction activity and factors defining the sensitivity of an area are provided in **Appendix A**.

Table 4: Risk Category from Demolition Activities

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

Table 5: Risk Category from Earthworks Activities

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

Table 6: Risk Category from Construction Activities

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

Table 7: Risk Category from Trackout Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

3.27. The risk category determined for each of the construction activity types is used to define the appropriate and Site-specific mitigation measures that should be applied. The IAQM guidance recommends that significance is only assigned to the effect after considering mitigation because it assumes that all actions to avoid or reduce the environmental effects are an inherent part of the Development, and that, in the case of demolition / construction, mitigation measures (secured through planning conditions, legal requirements or required by regulations) would ensure that likely significant adverse residual effects will not occur.

3.28. In addition to the above, the classification system provided in **Table 8** was used to inform the assessment dust generated by the demolition and construction activities associated with the Development prior to mitigation measures being applied.

Table 8: Pre-Mitigation Significance Criteria for Demolition and Construction Assessment

Significance Criteria	Definition
Adverse Impact of Major Significance	Receptor is less than 20m from a construction or demolition site.
Adverse Impact of Moderate Significance	Receptor is 20m to 200m from a construction or demolition site
Adverse Impact of Minor Significance	Receptor is between 200m and 350m from a construction or demolition site
Insignificant	Receptor is over 350m from any construction or demolition site

3.29. IAQM outlines that experience of implementing mitigation measures for construction activities demonstrates that total mitigation is normally possible such that likely residual impacts would not be 'significant'.

Construction Plant and Vehicle Exhaust Emissions

3.30. The significance of the effects from construction vehicle exhaust and construction plant emissions on air quality were based professional judgement.

Completed and Operational Development

3.31. The EPUK / IAQM guidance provides an approach to assigning the magnitude of changes because of a development as a proportion of a relevant assessment level, followed by examining this change in the context of the new total concentration and its relationship with the assessment criterion to provide a description of the impact at selected receptor locations.

3.32. **Table 9** presents the IAQM framework for describing the impacts (the change in concentration of an air pollutant) at individual receptors. The term Air Quality Assessment Level (AQAL) is used to include air quality objectives or limit values, where these exist.

Table 9: Impact Descriptors for Individual Receptors

Long term average Concentration at receptor in assessment year	% 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

Note: AQAL may be an air quality objective, EU limit value, or an Environment Agency 'Environmental Assessment Level (EAL)'

The table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers. Changes of 0% (i.e. less than 0.5%) are described as Negligible.

The table is only to be used with annual mean concentrations

3.33. The approach set out in the EPUK / IAQM guidance provides a method for describing the impact magnitude at individual receptors only. The guidance outlines that this change may have an effect on the receptor depending on the severity if the impact and other factors that may need to be considered. The assessment framework for describing impacts can be used as a starting point to make a judgement on significance of effect. However, whilst there may be 'slight', 'moderate' or 'substantial' impacts described at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances.

3.34. Following the approach to assessing significance outlined in the EPUK / IAQM guidance, the significance of likely residual effects of the completed Development on air quality has been established through professional judgement and the consideration of the following factors:

- The geographical extent (local, district or regional) of effects;
- Their duration (temporary or long term);
- Their reversibility (reversible or permanent);
- The magnitude of changes in pollution concentrations;
- The exceedance of standards (e.g. AQS objectives); and
- Changes in pollutant exposure.

4. Baseline Conditions

Sevenoaks District Council Review and Assessment Process

4.1. SDC completed its first round of Review and Assessment of air quality in 1999. This found that the national air quality objectives for CO, C_6H_6, C_4H_6, lead and sulphur dioxide (SO_2) were not at risk of being exceeded. However, NO_2 and PM_{10} objectives were being exceeded along the M20, M25, M26, A20 (T), A21 and at the junction of the A25 and A224 at Riverhead by the specified target dates, specifically the annual mean NO_2 and 24-hour mean PM_{10} objectives. The exceedances were as a result of elevated NO_2 and PM_{10} levels from vehicles and consequently, SDC declared AQMAs for NO_2 annual mean and PM_{10} 24-hour mean along these routes in 2002.

4.2. An Air Quality Further Assessment in 2004[22] confirmed the exceedances of the annual mean NO_2 objectives within the designated AQMAs but found that within the AQMAs designated for exceedances of the PM_{10} objective the concentrations were substantially smaller than previously identified. Consequently, the 24-hour mean PM_{10} AQMA was revoked in 2005 for all areas, apart from a section of the M25, which was separately declared as an AQMA and overlaps with the AQMA that covers the entire length of the M25.

4.3. The AQMAs in 2005 included the following:

- AQMA 1: M20 – from Junction 3 of the M25 to the District boundary of Tonbridge and Malling Borough Council;
- AQMA 2: M25 – Country border with Surrey to District border with Dartford, including Junctions 3, 4 and 5 and the extension of Junction 5 to connect with the A25 at Bessel's Green. At its closest point, AQMA 2 is approximately 90m from the boundary of the Site;
- AQMA 3: M26 – from Junction 5 of the M25 to the District boundary of Tonbridge and Malling Borough Council;
- AQMA 4: A20 (T) Swanley Bypass – from Junction 3 of the M25 to the Borough boundary of the London Borough of Bromley;
- AQMA 5: A25 Riverhead – between its northern and southern junctions with the A224; and
- AQMA 6: M25 – Junction 5 to Kent / Surrey border.

4.4. SDC undertook an Air Quality Further Assessment in 2006[23], and identified a further five areas outside of the above designated AQMAs for exceedances of annual mean NO_2. Subsequently, in 2007 the following four AQMAs were designated (it is noted that there is no AQMA 7):

- AQMA 8: B2173 Swanley – London Road (east); High Street; Bartholomew Way and parts of central town area;
- AQMA 9: A25 Seal – High Street;
- AQMA 10: A225 Sevenoaks – High Street and part of London Road;

22 Sevenoaks District Council (2004): Air Quality Further Assessment
23 Sevenoaks District Council (2006): Air Quality Further Assessment

- AQMA 11: A25 Westerham – High Street; Market Square; Vicarage Hill; London Road (A233); and
- AQMA 12: A25 Sevenoaks – Bat and Ball junction with A225.

4.5. In addition, the following AQMAs were extended:

- AQMA 5: part of London Road, Riverhead and London Road, Dunton Green (extends AQMA 5 to join AQMA 3); and
- AQMA 1: to include part of the A20 Farningham.

4.6. An Air Quality Further Assessment completed in 2008[24] concluded that the following AQMAs should be modified:

- AQMA 10: to include the properties surrounding the London Road and Pembroke Road junction; and
- AQMA 5: extended to cover the properties where exceedances were predicted to the west of the London Road and Maidstone Road (Bradbourne Vale) roundabout (London Road, Riverhead).

4.7. The Air Quality Review and Assessment from SDC completed in 2011[25], included the following proposed modifications:

- AQMAs 5, 9, 11 and 12: to amalgamate the four exiting AQMAs along the A25 into a single corridor and extend the Riverhead AQMA;
- AQMA 12: to include the hourly NO_2 objective.

4.8. The Air Quality Review and Assessment from SDC completed in 2017, which has declared that, Westerham High street (A233), and A25 Sevenoaks Bat and Ball junction with A225, are no longer AQMAs. However, listed under a new AQMA 13 is the entire length of the A25 from the border with Tonbridge and Mailing in the east and Tandridge in the West, this includes the previous AQMA 11. Additionally, another AQMA has been identified on the junction of London Road and Birchwood Road, Swanley, listed AQMA 14[26]. There are currently 9 AQMAs declared by SDC, the Site is not located within an AQMA, although at its nearest point AQAM 2 is located approximately 90m east of the Site.

Sevenoaks District Council's Local Monitoring

4.9. SDC currently undertakes NO_2 and PM_{10} monitoring at 3 locations within the District using automatic monitors and at fifty locations using NO_2 diffusion tubes.

4.10. The closest automatic monitor to the Site is the Greatness park monitor, approximately 4.5km south-east of the Site and classified as an urban background site. The results for the Greatness Park monitoring location are presented in **Table 10.**

Table 10: Annual Mean Concentrations at the Greatness Park Automatic Monitor

Pollutant	AQS Objective	2015	2016	2017	2018
NO_2	Annual Mean (40µg/m^3)	17	17	16	15
	200ug/m^3 as a 1 hour mean, not to be exceeded more than 18 times a year	0	0	0	0
PM_{10}	Annual Mean (40µg/m^3)	21	18	18	19
	50ug/m^3 as a 24 hour mean, not to be exceeded more than 35 times a year	2	0	4	1

24 Sevenoaks District Council (2008): Air Quality Further Assessment
25 Sevenoaks District Council (2011): Air Quality Further Assessment
22 Sevenoaks District Council (2017): Air Quality Annual Status Report

Source: SDC Annual Status Report 2018 and www.londonair.org.uk

4.11. The monitoring results in **Table 10** indicate that the NO_2 objectives for annual mean and 1-hour mean were met in all years from 2015 to 2018. The PM_{10} objectives for annual mean and 24-hour mean were also met between 2015 and 2018.

4.12. NO_2 is currently measured at fifty diffusion tube locations. The results for the two roadside NO_2 diffusion tube locations nearest the Site are presented in **Table 11.**

Table 11: Measured concentrations at the nearest SDC diffusion tubes closest to the site.

ID	Location	Classification	Distance to site (km)	2014	2015	2016	2017	2018
DT54	57 London Road	Roadside	2.8	38.1	35.6	36.0	33.8	32.3
DT43	Miners Arms	Roadside	2.9	33.9	28.0	34.1	29.5	28.1

Source: SDC Annual Status Report, 2018

4.13. The monitoring results in **Table 11** indicate that the annual mean NO_2 concentrations did not exceed the annual mean objective of 40µg/m^3 at both diffusion tubes between 2014 and 2018.

Waterman Diffusion Tube Study

4.14. A six-month NO_2 diffusion tube monitoring exercise was undertaken by Waterman on and immediately surrounding the Site beyond the wider Survey Area (see **Figure 3**) between July 2014 and January 2015. Details of this monitoring exercise are presented in **Appendix B,** and a summary of the results are presented in **Table 12**. Following a review of the monitoring undertaken by SDC concentrations have remained relatively constant and therefore it is considered that the monitoring remains valid and has been used to verify the air quality modelling study.

Table 12: Site-Specific Monitoring Results

Site ID	Site Location	Site Classification	Estimated 2013 Annual Mean (µg/m^3)
1	On Site (Star Hill Road Site entrance)	Roadside	15.1
2	On Site (centre of the Site)	Urban Background	17.6
3	On Site (Crow Drive / Crow Road near security entrance)	Urban Background	18.0
4	On Site (Lennard-Jones Road)	Urban Background	18.1
5	Crow Drive (adjacent to helipad)	Roadside	20.2
6	Harrow Road	Roadside	17.7
7	Harrow Inn	Roadside	24.1
8	A224 Polhill Road	Roadside	37.6

4.15. As indicated by **Table 12**, the monitored estimated annual mean NO_2 concentrations are below the annual mean objective value of 40µg/m^3 at all locations on the Site. The highest concentration is measured at the Crow Drive / Crow Road diffusion tube. Based on the six months air quality exercise, the annual mean NO_2 concentrations monitored across the Site are considered to be good.

4.16. As indicated by **Table 12**, the monitored estimated annual mean NO_2 concentrations are below the annual mean objective value of 40µg/m^3 at all locations monitored surrounding the Site. The highest concentration is measured at the A224 Polhill Road diffusion tube. This indicates that the greatest source of potential air quality pollution at and around the Site is generated by traffic using the A224 Polhill Road.

5. Construction Phase Effects

Nuisance Dust

5.1. Construction activities in relation to the Development have the potential to affect local air quality through Demolition, Earthworks, Construction and trackout activities. A description of these activities is presented in Section 3: Assessment Methodology and Significance.

5.2. As discussed in Section 1: Introduction, the Site is located within an area dominated by farmland and scattered villages, residential properties and by the Defence Science and Technology Laboratory (DSTL). The location of the Site and the receptors within each distance from the Site is presented in **Figure 2**.

5.3. As there are sensitive residential receptors within 350m of the boundary of the Site and within 50m of the routes that would be used by construction vehicles on the public highway. The site does not lie within or adjacent to any sites designated at European, national or local level on the basis of the ecological importance. It is considered that a detailed assessment is required to determine the likely dust effects, as recommended by the IAQM guidance on construction dust. Results of this assessment are provided for each main activity (Demolition, Earthworks, Construction and Trackout) below.

Demolition

5.4. The total building volume to be demolished could exceed 50,000m^3 and the demolition activities would occur less than 10m above ground. Based on this and considering the criteria in the IAQM guidance, the potential dust emissions during demolition works would be of **large** magnitude.

Earthworks

5.5. The area of the Site is 74.49hectares (ha), or 744,900m^2. Based on the size of the Site and considering the criteria in the IAQM guidance, the potential dust emissions during earthworks activities were considered in the worst case to be of **large** magnitude.

Construction

5.6. The estimate for the total volume of buildings to be constructed could exceed 100,000m^3. Based on this and considering the criteria in the IAQM guidance, the potential dust emissions during construction activities would be of **large** magnitude.

Trackout

5.7. PBA have estimated that the number of outward HDV trips would be 42 per day (Monday to Saturday). Based on this and considering the criteria in the IAQM guidance, the potential for dust emissions due to trackout activities would be of **medium** magnitude.

Sensitivity of the Area

5.8. The sensitivity of the area to each main activity has been assessed based on the number and distance of the nearest sensitive receptors to the activity, and the sensitivity of these receptors to dust soiling and human health.

Sensitivities of People to Dust Soiling Effects

5.9. There are estimated to be between 10-100 high sensitive receptor within 50m of the Site. On this basis (as set out in Table 2 of the IAQM guidance) the sensitivity of the area to dust soiling is **medium**.

Sensitivities of People to the Health Effects of PM_{10}

5.10. The Defra background PM_{10} concentration for the Site is 14.7µg/m^3 in 2018 (see Appendix A, Table A5 and the 2018 annual mean at the Greatness Park Automatic Monitor is 19.0µg/m^3. On this basis (as set out in Table 2 of the IAQM guidance) the sensitivity of the area to human health is **low**.

Sensitivities of Receptors to Ecological Effects

5.11. The site does not lie within or adjacent to any sites designated at European, national or local level on the basis of the ecological importance. The sensitivity of the area to ecological impacts is therefore considered to be **low**.

Dust Risk Summary

5.12. The dust risk categories, based on the potential magnitude of dust emissions and the sensitivity of the area to dust, are presented in **Table 12**.

Table 13: Summary of Risk

Potential Effect	Risk			
	Demolition	Earthworks	Construction	Track out
Dust Soiling	High Risk	Medium Risk	Medium Risk	Low Risk
Human Health	Medium Risk	Low Risk	Low Risk	Low Risk
Ecological	Medium Risk	Low Risk	Low Risk	Low Risk

5.13. The Site is considered **high risk** to dust soiling impacts consequently, mitigation would be required to ensure that adverse impacts be minimised, reduced and, where possible, eliminated.

Construction Vehicle and Plant Emissions

5.14. Construction vehicles and plant operating on the Site would have the potential to increase local air pollutant concentrations, particularly in respect of NO_2 and particulate matter (both PM_{10} and $PM_{2.5}$).

5.15. As above, the number of HDV construction vehicles entering and egressing Site is predicted to be 85 (two-way) on the busiest days. As such, based on the IAQM guidance it is considered that the likely impact of construction vehicles entering and egressing the Site on air quality would be **insignificant** during the demolition and construction period.

5.16. Emissions from plant operating on the Site would be very small in comparison to the emissions from traffic movements on the roads adjacent to the Site. It is therefore considered that even in the absence of mitigation, the likely impact on local air quality would be **insignificant**

6. Operational Phase Effects

Traffic

6.1. Effects on local air quality associated with the completed and operational Development would be likely to result from changes to traffic flows associated with the Development.

Nitrogen Dioxide

6.2. The results of the ADMS-Roads air quality modelling of operational traffic (based on current guidance, i.e. with reduced emission rates and background concentration to the completion year of 2030) for NO_2 are presented in **Table 13**.

Table 14: Results of the ADMS Modelling at Sensitive Receptors (NO2) (µg/m³)

ID	Receptor Location	2018 Baseline	2030 Without Development	2030 With Development	2030 Change
1	Keeper Cottage, Star Hill Road	16.4	9.5	9.8	0.3
2	Star Hill Road Cottages	17.4	9.9	10.5	0.6
3	Leesfield, Knockholt	16.4	9.5	9.9	0.4
4	14 Fort Road, Halstead	17.7	10.7	11.0	0.3
5	High Field Farm, Crow Drive, Halstead	17.8	10.3	10.4	0.1
6	Corner Cottage, Old London Road, Knockholt	17.1	9.8	10.1	0.3
7	20 Main Road, Knockholt	15.8	9.3	9.3	0.0
8	Knockholt Road, Halstead	15.0	8.9	8.9	0.0
9	Halstead Community Primary School	15.0	8.9	9.0	0.1
10	Halstead Hall, Shoreham Lane, Halstead	15.4	9.1	9.1	0.0
11	Hunters Retreat, Shoreham Lane	17.4	10.0	10.1	0.1
12	Finnart, Otford Lane, Halstead	15.2	9.0	9.1	0.1
13	Morants Court Road, Dunton Green	21.6	11.7	11.9	0.2
14	Pilgrims Way West	19.8	10.9	11.0	0.1
15	On Site: Proposed Residential 1			10.1	
16	On Site: Proposed Community Use			11.1	
17	On Site: Proposed Residential 2			10.8	
18	On Site: Proposed Primary School			9.6	

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 13.

6.3. The results in **Table 13** indicate that for 2018, the NO_2 annual mean concentrations is predicted to meet the annual mean NO_2 objective at all existing sensitive receptor locations considered. The highest concentration is 21.6 µg/m³ predicted at Receptor 13.

6.4. As discussed in **Appendix A**, the 1-hour mean AQS objective for NO_2 is unlikely to be exceeded at a roadside location where the annual mean NO_2 concentration is less than 60µg/m³. As shown in **Table 13**, the predicted NO_2 annual mean concentrations in 2018 are below 60µg/m³ at all existing sensitive receptors modelled and therefore the 1-hour mean objective is met at these locations.

6.5. In 2030, both 'without' and 'with' the Development, all existing sensitive receptors modelled are predicted to be below the NO_2 annual mean objective. Therefore, the 1-hour mean objective is also predicted to be met at these locations.

6.6. Using the impact descriptors outlined in **Table 9**, the Development is predicted to result in a 'negligible' impact for annual mean NO_2 concentrations at all existing sensitive receptors modelled. Given that all the NO_2 annual mean concentrations are below 60µg/m^3, it is considered that the Development would also have a 'negligible' impact on hourly NO_2 concentrations.

6.7. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors (all predicted to be below the annual and 1-hour mean objectives), it is considered that the effect of the Development on NO_2 concentrations would be **not significant**.

6.8. NO_2 concentrations for locations within the Development are below the relevant objectives in 2030. As such, it is considered that for NO_2 the effect of introducing sensitive uses (residential/school) to the Site is **not significant**.

Particulate Matter (PM_{10} and $PM_{2.5}$)

6.9. The results of the ADMS-Roads air quality modelling of operational traffic for PM_{10} and $PM_{2.5}$ are presented in **Table 14**.

Table 15: Results of the ADMS Modelling at Sensitive Receptors (PM_{10} and $PM_{2.5}$)

ID	PM_{10} Annual Mean (µg/m^3)				PM_{10} - Number of Days >50µg/m^3				$PM_{2.5}$ Annual Mean (µg/m^3)			
	2018 Baseline	2030 Without Development	2030 With Development	2030 Change	2018 Baseline	2030 Without Development	2030 With Development	2030 Change	2018 Baseline	2030 Without Development	2030 With Development	2030 Change
1	19.4	18.8	18.9	0.1	2	2	2	0	10.3	9.8	9.9	0.1
2	19.6	19.0	19.3	0.3	2	2	2	0	9.0	8.6	8.7	0.1
3	19.4	18.8	19.0	0.2	2	2	2	0	8.9	8.5	8.6	0.1
4	19.6	19.3	19.5	0.2	2	2	2	0	9.2	8.9	9.0	0.1
5	19.6	19.2	19.2	0.0	2	2	2	0	9.3	8.8	8.9	0.1
6	19.5	18.9	19.1	0.2	2	2	2	0	9.2	8.7	8.8	0.1
7	19.3	18.7	18.7	0.0	2	1	1	0	9.0	8.6	8.6	0.0
8	19.2	18.5	18.5	0.0	2	1	1	0	8.9	8.4	8.4	0.0
9	19.2	18.5	18.5	0.0	2	1	1	0	10.3	10.1	10.1	0.0
10	19.2	18.6	18.6	0.0	2	1	1	0	9.0	9.1	9.1	0.0
11	19.5	19.0	19.0	0.0	2	2	2	0	8.9	10.1	10.1	0.0
12	19.2	18.6	18.6	0.0	2	1	1	0	9.2	8.4	8.4	0.0
13	20.1	19.7	19.7	0.0	3	2	2	0	9.3	9.0	9.0	0.0

ID	PM_{10} Annual Mean (µg/m³)				PM_{10} - Number of Days >50µg/m³				$PM_{2.5}$ Annual Mean (µg/m³)			
	2018 Baseline	2030 Without Development	2030 With Development	2030 Change	2018 Baseline	2030 Without Development	2030 With Development	2030 Change	2018 Baseline	2030 Without Development	2030 With Development	2030 Change
14	19.9	19.3	19.4	0.1	3	2	2	0	9.2	8.8	8.8	0.0
15			19.0				2				9.1	
16			19.4				2				9.3	
17			19.3				2				10.3	
18			18.8				2				10.0	

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 14.

6.10. As shown in **Table 14**, the annual mean concentrations of PM_{10} are predicted to be well below the objective of 40µg/m³ in 2018 and in 2320, both ‘without’ and ‘with’ the Development, at all the existing sensitive receptors modelled. The maximum predicted concentration is 20.1 µg/m³ at Receptor 13 in 2018. Using the impact descriptors outlined in **Table 9**, the Development is predicted to result in a ‘negligible’ impact at all existing sensitive receptors modelled.

6.11. The results in **Table 14** indicate that in 2018 and in 2030, both ‘without’ and ‘with’ the Development, all existing sensitive receptors are predicted to be below the 24-hour mean PM_{10} objective value of 35 days exceeding 50µg/m³.

6.12. The results in **Table 14** indicate that in 2018 and in 2030, both ‘without’ and ‘with’ the Development, all existing sensitive receptors are predicted to be below the annual mean $PM_{2.5}$ objective value of 25µg/m³. The maximum predicted concentration is 10.3 µg/m³ at Receptors 1 and 9 in 2018.

6.13. Using the impact descriptors outlined in **Table 9**, the Development is predicted to result in a ‘negligible’ impact at all existing sensitive receptors. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors modelled, it is considered that the effect of the Development on local air quality would be not significant.

6.14. PM_{10} and $PM_{2.5}$ concentrations for locations within the Development are below the relevant objectives in 2030. As such, it is considered that for PM_{10} and $PM_{2.5}$ the effect of introducing residential uses to the Site is **not significant**.

Nitrogen Dioxide Sensitivity Analysis Results

6.15. The results of the sensitivity analysis in relation to NO_2 (i.e. considering the potential impact of the Development against the 2018 baseline conditions) are presented in **Table 15**.

Table 16: Results of the ADMS Assessment for 2030 Assuming No Improvement in NO_x and NO_2

(µg/m³)

ID	Receptor Location	Without Development	With Development	Change
1	Keeper Cottage, Star Hill Road	16.9	17.7	0.8
2	Star Hill Road Cottages	18.1	19.8	1.7
3	Leesfield, Knockholt	16.9	18.0	1.1
4	14 Fort Road, Halstead	20.2	21.2	1.0
5	High Field Farm, Crow Drive, Halstead	19.1	19.6	0.5
6	Corner Cottage, Old London Road, Knockholt	17.8	18.8	1.0
7	20 Main Road, Knockholt	16.3	16.4	0.1
8	Knockholt Road, Halstead	15.2	15.2	0.0
9	Halstead Community Primary School	15.2	15.3	0.1
10	Halstead Hall, Shoreham Lane, Halstead	15.7	15.8	0.1
11	Hunters Retreat, Shoreham Lane	18.3	18.6	0.3
12	Finnart, Otford Lane, Halstead	15.5	15.6	0.1
13	Morants Court Road, Dunton Green	23.5	23.9	0.4
14	Pilgrims Way West	20.9	21.3	0.4
15	On Site: Proposed Residential 1		18.6	
16	On Site: Proposed Community Use		21.2	
17	On Site: Proposed Residential 2		20.4	
18	On Site: Proposed Primary School		17.1	

Note: For accuracy, the changes arising from the Development have been calculated using the exact output from the ADMS-Road model rather than the rounded numbers within Table 14

6.16. The overall predicted concentrations for the Development, presented in **Table 14**, are higher than those presented in **Table 13** for 2030 due to higher background concentrations and vehicle emissions rates in 2018 than 2030.

6.17. The results in **Table 15** show that the NO_2 annual mean concentrations are predicted to be below the objective value of 40µg/m³, 'without' and 'with' the Development, at all sensitive receptors modelled. The predicted annual mean NO_2 concentrations are therefore below 60µg/m³ at all sensitive receptors modelled, both 'without' and 'with' the Development, when assuming no improvement to NO_x and NO_2. The 1-hour mean objective is therefore likely to be met at these locations.

6.18. Using the impact descriptors outlined in **Table 9**, the Development is predicted to result in a 'negligible' impact at all existing sensitive receptors. All the NO_2 annual mean concentrations are below 60µg/m³, and so it is considered that the Development would have a 'negligible' impact on hourly NO_2 concentrations.

6.19. Using professional judgement, based on the severity of the impact and the concentrations predicted at the existing sensitive receptors (all predicted to be below the annual and 1-hour mean objectives), it is considered that the effect of the Development on NO_2 concentrations, when assuming no improvements to NO_x and NO_2, would be **not significant**.

6.20. Concentrations on the Development Site itself are below the AQS objective, therefore it is considered that, when assuming no improvements to NO_x and NO_2, the effect of introducing residential uses to the Site is **not significant**.

7. Mitigation Measures and Residual Effects

Construction

Nuisance Dust

7.1. In line with best practice on construction sites a range of environmental management controls would be implemented. The controls, with reference to the IAQM guidance relating to high risk sites, are set out in **Table 16**.

7.2. Such measures are routinely and successfully applied to major construction projects throughout the UK and are proven to reduce significantly the potential for adverse nuisance dust effects associated with the various stages of construction work. It is considered that the residual effects would remain as per the likely effect and would be **not significant**.

Table 17: Construction Phase Mitigation Measures

Communications
Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
Display the head or regional office contact information
Site Management
Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
Make the complaints log available to the local authority when asked.
Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book
Monitoring
Carry out regular site inspections to monitor compliance with the Dust Management Plan, record inspection results, and make the inspection log available to the local authority when asked
Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions
Preparing and maintaining the site
Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible
Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site
Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period
Avoid sit runoff of water and mud
Keep site fencing, barriers and scaffolding clean using wet methods.

Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover
Cover, seed or fence stockpiles to prevent wind whipping
Operating vehicle/machinery and sustainable travel
Ensure all vehicles switch off engines when stationary – no idling vehicles
Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable
Operations
Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems
Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate
Use enclosed chutes and conveyors and covered skips
Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate
Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Waste Management
Avoid bonfires and burning of waste materials
Demolition
Ensure effective water suppression is used during demolition operations
Avoid explosive blasting, use appropriate manual or mechanical alternatives
Bag and remove any biological debris or damp down such material before demolition
Earthworks
Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable
Only remove the cover in small areas during work and not all at once
Construction
Avoid scabbling (roughening of concrete surfaces) if possible
Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a process, in which case ensure that appropriate additional control measures are in place
Trackout
Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary.
Avoid dry sweeping of large areas.
Ensure vehicles entering and leaving sites are covered to prevent escape of materials
Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
Record all inspections of haul routes and any subsequent action in a site log book.
Install hard surfaced haul routes, which are regularly damped down with fixed or

mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable)
Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
Access gates to be located at least 10m from receptors where possible

Construction Vehicle and Plant Emissions

7.3. Taking account of existing concentrations at the Site, the likely effect of any emissions from construction vehicles and construction plant is **not significant** and no further mitigation is required.

Completed Development

7.4. As identified above, the Development is predicted to have a negligible impact on local air quality and therefore the effect of the Development would be not significant. Accordingly, mitigation measures would not be required in terms of air quality and therefore the likely residual effect of the Development on air quality would remain **not significant**.

7.5. It is considered that the effect of introducing sensitive uses (residential/school) to the Site is **not significant** and no further mitigation measures are required to make the Site suitable for the proposed uses.

8. Summary and Conclusions

8.1. The main likely effects on local air quality during construction relates to dust. A range of measures to minimise or prevent dust generated from construction activities would be implemented as a matter of best practice throughout the works. Therefore, it is considered that likely residual effects due to fugitive emissions would be **not significant**.

8.2. It is anticipated the effect of construction vehicles and construction plant on air quality would be **not significant** in the context of existing local road traffic emissions.

8.3. Computer modelling has been carried out to predict the impact of future traffic-related exhaust emissions. The effect of the Development on local air quality has been predicted for existing sensitive receptor locations surrounding the Site. Following completion of the Development and considering uncertainty in future NO_x and NO_2 reductions, the Development is predicted to have a negligible impact on NO_2, PM_{10} and $PM_{2.5}$ concentrations, at all existing receptors considered. The overall effect of the Development on air quality is therefore considered to be **not significant**.

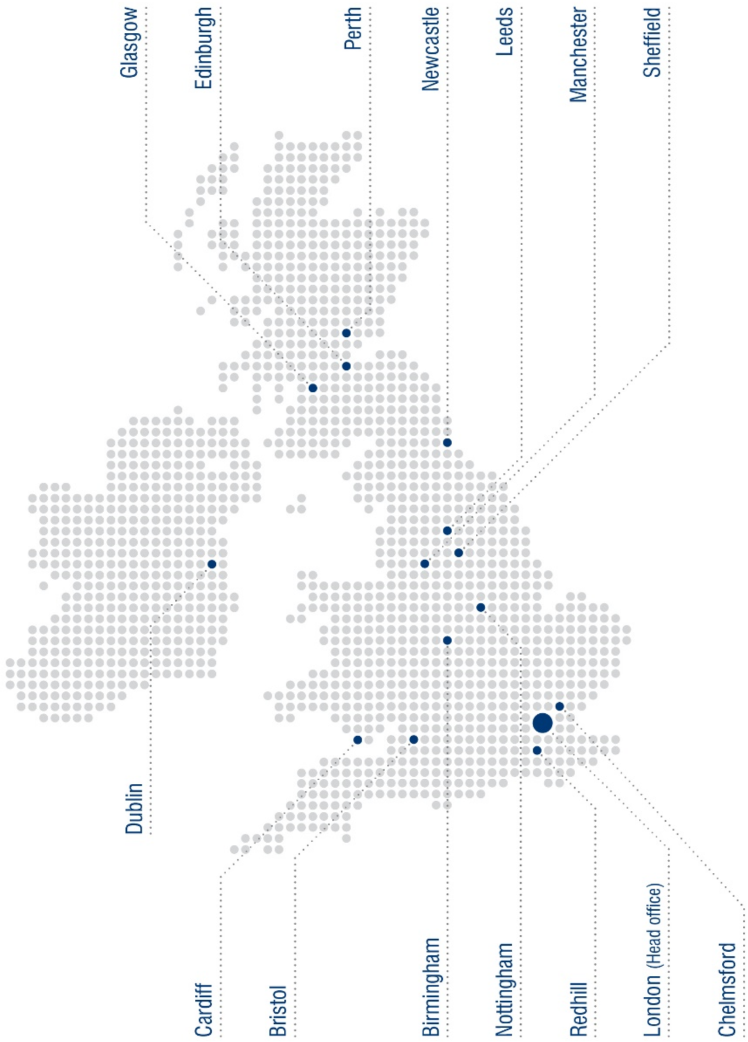
8.4. Air quality concentrations for NO_2 and particulates at the Site are below the relevant Air Quality Strategy Objectives for the protection of health. Therefore, the effect of introducing residential receptors to the Site is **not significant**.

APPENDICES

Appendix A Air Quality Assessment Detailed Methodology

Appendix B Air Quality Monitoring Study

UK and Ireland Office Locations



Annex A: Air Quality Assessment Detailed Methodology

1.1 This appendix presents the technical information and data upon which the air quality assessment is based.

Completed Development Assessment

Model

1.2 In urban areas, pollutant concentrations are primarily determined by the balance between pollutant emissions that increase concentrations, and the ability of the atmosphere to reduce and remove pollutants by dispersion, advection, reaction and deposition. An atmospheric dispersion model is used as a practical way to simulate these complex processes; which requires a range of input data, which can include pollutant emissions rates, meteorological data and local topographical information.

1.3 The effect of the Development on local air quality was assessed using the advanced atmospheric dispersion model ADMS-Roads, considering the contribution of emissions from forecast road-traffic on the local road network by the completion year.

1.4 The Development does not include a centralised energy plant such as a centralised gas-fired boiler or Combined Heat and Power Plant and instead would utilise the existing power network and/or use zero emission technology on the Development (such as air source heat pumps). Therefore, there are no emissions to air. Given this the air quality assessment does not consider any emissions to air from any centralised heating or power plant.

ADMS-Roads

1.5 The ADMS-Roads model is a comprehensive tool for investigating air pollution in relation to road networks. On review of the Site, and its surroundings, ADMS-Roads was considered appropriate for the assessment of the long and short-term effects of the proposals on air quality. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions of air pollutant concentrations. It can predict long-term and short-term concentrations, including percentile concentrations.

1.6 ADMS-Roads model is a formally validated model, developed in the United Kingdom (UK) by CERC (Cambridge Environmental Research Consultants). This includes comparisons with data from the UK's air quality Automatic Urban and Rural Network (AURN) and specific verification exercises using standard field, laboratory and numerical data sets. CERC is also involved in European programmes on model harmonisation, and their models were compared favourably against other EU and U.S. EPA systems. Further information in relation to this is available from the CERC web site at www.cerc.co.uk.

Model Scenarios

1.7 To assess the effect of the Development on local air quality, future ‘without Development’ and ‘with Development’ scenarios were assessed. The Development is anticipated to be complete in 2030 and therefore this is the year in which these future scenarios were modelled.

1.8 The year 2018 was modelled to establish the existing baseline situation, as it is the latest full year Sevenoaks District Council air quality monitoring data is available. Base year traffic data for 2013 and meteorological data for 2013 were also used to be consistent with the verification year (discussed further below).

1.9 Considering recent analyses by Defra[1] showing that historical nitrogen oxide (NO_x) and nitrogen dioxide (NO_2) concentrations are not declining in line with emission forecasts, as outlined in main chapter, a sensitivity analysis has been undertaken based on no future reductions in NO_x/NO_2 concentrations (i.e. considering the potential effects of the Development against the current baseline 2018 conditions by applying the 2030 road traffic data to 2018 background concentrations and road traffic emission rates). The results for this sensitivity analysis are presented in the main report.

Traffic Data

1.10 Traffic flow data comprising Annual Average Daily Traffic (AADT) flows, traffic composition (% Heavy-Duty Vehicles (HDVs)) used in the model was provided by the Applicants transport consultant, in **Table A1** below, which presents the traffic data used within the Air Quality Assessment.

Table A1: 24-hour AADT Data Used within the Assessment

Link Name	Direction	Speed (kph)	Base 2018		Without 2030		With 2030	
			AADT	%HDV	AADT	%HDV	AADT	%HDV
A224 London Road	NB	40	5964	6.1	8081	5.4	8828	5.1
	SB		6615	7.0	8562	6.2	9418	5.9
Crow Drive	NB	37	859	9.5	2763	3.5	3264	3.3
	SB		845	9.3	2467	3.3	3253	3.1
Star Hill	NB	48	1406	6.3	1759	6.0	1878	5.8
	SB		1344	6.2	1658	6.0	1812	5.7
Polhill	NB	60	5616	5.4	7008	5.1	6937	5.2
	NB		6378	6.4	7997	6.0	7752	6.1
Rushmore Hill	SB	40	2082	7.6	2388	7.5	2349	7.6
	SB		1887	7.6	2158	7.5	2138	7.5
Old London Road	NB	40	2318	3.4	2684	3.3	2797	3.3
	SB		2404	2.7	2718	2.7	2841	2.7
Main Road/ Halstead Lane	EB	38	1163	6.4	1414	6.3	1475	6.1
	WB		1282	6.5	1563	6.4	1614	6.3
Shoreham Lane/ Knockholt Road	WB	60	579	6.2	648	6.2	648	6.2
	EB		498	1.4	557	1.4	557	1.4
Otford Lane	WB	60	433	0	486	0.1	503	0.2
	EB		260	0	374	0.1	626	1.1
M25 (South of A21)	NB	96	50809	8.6	58020	8.5	57797	8.5
	SB		51392	8.6	58720	8.5	58469	8.5
	NB	38	4912	9.5	6780	8.1	7370	7.6

[1] http://laqm.defra.gov.uk/faqs/faqs.html: Measured nitrogen oxides (NOx) and/or nitrogen dioxide (NO_2) concentrations in my local authority area do not appear to be declining in line with national forecasts.

A224 Orpington By-pass	SB		5543	9.9	7296	8.5	7978	8.0
A21 Sevenoaks Road	WB	60	12086	12	13663	11.9	13776	11.8
	EB		11837	10.6	13314	10.5	13437	10.4
Otford High Street	EB	33	4630	4.5	5380	4.4	5550	4.4
	WB		4478	4.4	5201	4.3	5419	4.3
A224 London Road (Bullfinch Lane)	NB	30	9077	4.5	10953	4.5	11152	4.4
	SB		8761	4.8	10776	4.8	10934	4.7
A224 London Road (Station Road)	NB	30	6212	4.2	7434	4.2	7633	4.1
	SB		6143	5.5	7395	5.4	7553	5.4

Vehicle Speeds

1.11 To consider the presence of slow moving traffic near junctions and at roundabouts with the model, the speed at each junction was reduced to 20 kph. This follows the criteria recommended within LAQM.TG(16)[2], which considers that in most instances the two-way average speed for all vehicles at a junction would be in the range of 20-40 kph based on the estimate that:

- Traffic pulling away from the lights, 40-50 kph;
- Traffic approach the lights when green, 20-50 kph; and
- Traffic on the carriageway approaching the lights when red, 5-20 kph, depending on the time of day and how congested the junction is.

Diurnal Profile

1.12 The ADMS-Roads model uses an hourly traffic flow based on the daily (AADT) flows. Traffic flows follow a diurnal variation throughout the day and week. Therefore, a diurnal profile was used in the model to replicate how the average hourly traffic flow would vary throughout the day and the week. **Figure A1** presents the diurnal variation in traffic flows.

2 Defra, 2016, Local Air Quality Management Technical Guidance LAQM.TG(16)

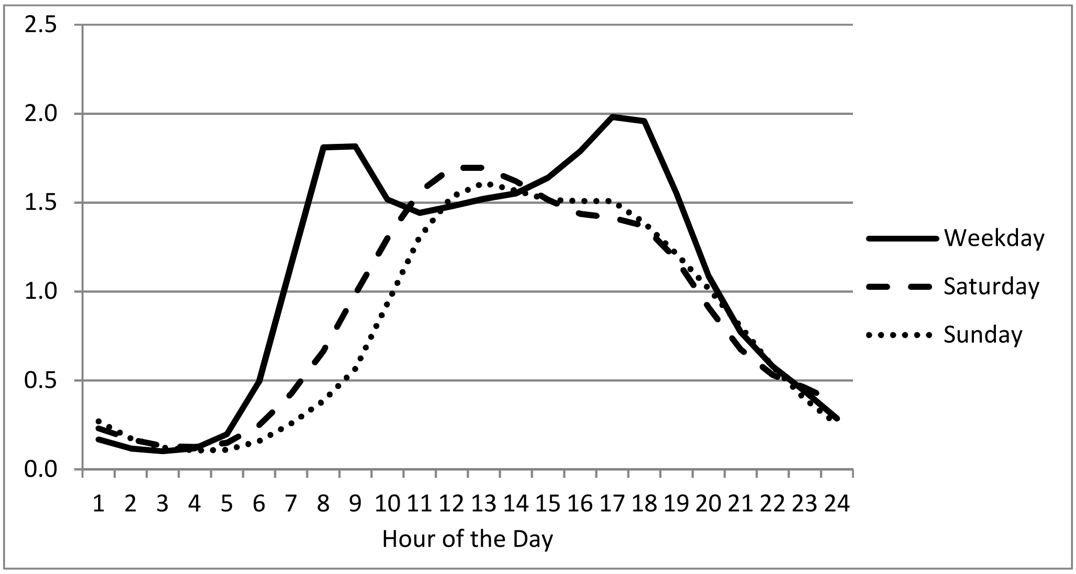


Figure A1: Diurnal Traffic Variation

Street Canyon Effect

1.13 Narrow streets with tall buildings on either side have the potential to create a confined space, which can interfere with the dispersion of traffic pollutants and may result in pollutant emissions accumulating in these streets. In an air quality model these narrow streets are described as street canyons.

1.14 ADMS-Roads includes a street canyon model to take account of the additional turbulent flow patterns occurring inside such a narrow street with relatively tall buildings on both sides. LAQM.TG(16) identifies a street canyon *"as narrow streets where the height of buildings on both sides of the road is greater than the road width."*

1.15 Following a review of the road network to be included within the model, it was considered that modelled roads are relatively wide and the existing buildings along these roads are not considered to be tall.

1.16 The proposed buildings within the Site would not cause any street canyons to be created where there is sensitive public exposure. Therefore, no street canyons were included within the model for any of the scenarios considered.

Road Traffic Emission Factors

1.17 The latest version of the ADMS-Roads model (version 4.1.1) was used for the assessment. The model includes the vehicle emission factors published by Defra in the Emission Factors Toolkit (EFT). Version seven of the EFT, published July 2016, has been used in the modelling assessment to enable emission factors from 2013 to be included in the modelling assessment.

1.18 The EFT uses several parameters (traffic flow, percentage of HDV, speed and road type) to calculate road traffic emissions for the selected pollutants.

Background Pollutant Concentrations

1.19 Background pollutant concentration data (i.e. concentrations due to the contribution of pollution sources not directly considered in the dispersion modelling) have been added to contributions from the modelled pollution sources, for each year of assessment.

1.20 NO_2 and PM_{10} concentrations were measured at the Greatness Park automatic monitor located approximately 4.5km southeast of the Site. **Table A2** shows the concentrations of NO_2 and PM_{10}

Table A2: Annual Mean Concentrations at the Greatness Park Urban Background Automatic Monitor

Pollutant	2013	2018
NO_2	20	15
PM_{10}	20	19

1.21 Given the distance of the monitor to the Site, background monitoring of NO_2 was undertaken by Waterman at 3 diffusion tube locations. **Table A3** shows the 2013 concentrations measured at the three locations.

Table A3: Measured concentrations at the closest urban background diffusion tube locations to the site (µg/m^3)

ID	Location	Estimated 2013 Annual Mean
2	Middle of Site	17.6
3	Crow Drive/Crow Road near site entrance	18.0
4	Lennard Jones Road	18.1

1.22 SDC does not undertake any background monitoring of $PM_{2.5}$ within their administrative boundary. In addition to the monitoring data, background concentrations of NO_2, PM_{10} and $PM_{2.5}$ are available from the Defra LAQM Support website[3] for 1x1km grid squares for assessment years between 2013 and 2030. **Table A4** presents the Defra background concentrations for the year 2013 and 2018, for the grid square the Site is located within (549500; 159500).

Table A4: Defra Background Maps for the Grid Square at the Site

Pollutant	Annual Mean Concentration (µg/m^3)	
	2013	2018
NO_x	19.0	15.5
NO_2	14.0	10.2
PM_{10}	17.1	13.0
$PM_{2.5}$	11.9	8.8

1.23 The 2013 urban background concentrations for NO_2 at the Greatness Park automatic monitor are slightly higher than the 3 diffusion tube locations. However given the distance of the monitor to the Site, the concentrations measured at DT2, DT3 and DT4 have been used. The 2018 PM_{10} concentration at the Greatness Park automatic monitor is higher than the Defra background map therefore data from the automatic monitor has been used in the assessment. As no data was

[3] http://laqm.defra.gov.uk/

available for $PM_{2.5}$, Defra background maps were used. The background concentrations data used within the assessment are presented in **Table A5**.

Table A5: Background Concentrations used in the Assessment (µg/m³)

Pollutant	Annual Mean Concentration (µg/m³)	
	2018	2030
All Receptors		
NO_2	14.1^	8.5*
PM_{10}	19.0	18.3
Grid Square 550500,160500; Receptor 5		
$PM_{2.5}$	10.0	9.5
Grid Square 548500,159500; Receptors 3, 6, 7		
$PM_{2.5}$	8.6	8.2
Grid Square 548500,160500; Receptor 8		
$PM_{2.5}$	8.8	8.3
Grid Square 548500,161500; Receptors 9 and 10		
$PM_{2.5}$	8.8	8.4
Grid Square 549500,161500 Receptor 11		
$PM_{2.5}$	8.8	8.4
Grid Square 549500,160500; Receptor 12		
$PM_{2.5}$	8.8	8.3
Grid Square 550500,157500; Receptor 13		
$PM_{2.5}$	10.5	10.0
Grid Square 551500,159500; Receptor 14		
$PM_{2.5}$	9.4	8.9
Grid Square 550500,159500; Receptors 4, 15 and 18		
$PM_{2.5}$	8.7	9.7
Grid Square 549500,159500; Receptors 12, 16 and 17		
$PM_{2.5}$	8.8	8.3
Grid Square 549500,158500; Receptors 1 and 2		
$PM_{2.5}$	8.4	8.7

Note: ^ The projection factor of 0.789 has been used, derived from the ratio between the 2013 and 2018 NO_2 data.
*The projection factor of 0.606 has been used, derived from the ratio between the 2018 and 2030 NO_2 data.
The projection factor of 0.9658 has been used, derived from the ratio between the 2018 and 2030 PM_{10} data

Meteorological Data

1.24 Local meteorological conditions strongly influence the dispersal of pollutants. Key meteorological data for dispersion modelling include hourly sequential data including wind direction, wind speed, temperature, precipitation and the extent of cloud cover for each hour of a given year. As a minimum ADMS-Roads requires wind speed, wind direction, and cloud cover.

1.25 Meteorological data to input into the model were obtained from the Biggin Hill Meteorological Station, which is the closest to the Site and considered to be the most representative. The 2013 data were used to be consistent with the model verification year. It was also used for the 2018 and 2030 scenario for the air quality assessment. **Figure A2** presents the wind-rose for the meteorological data.

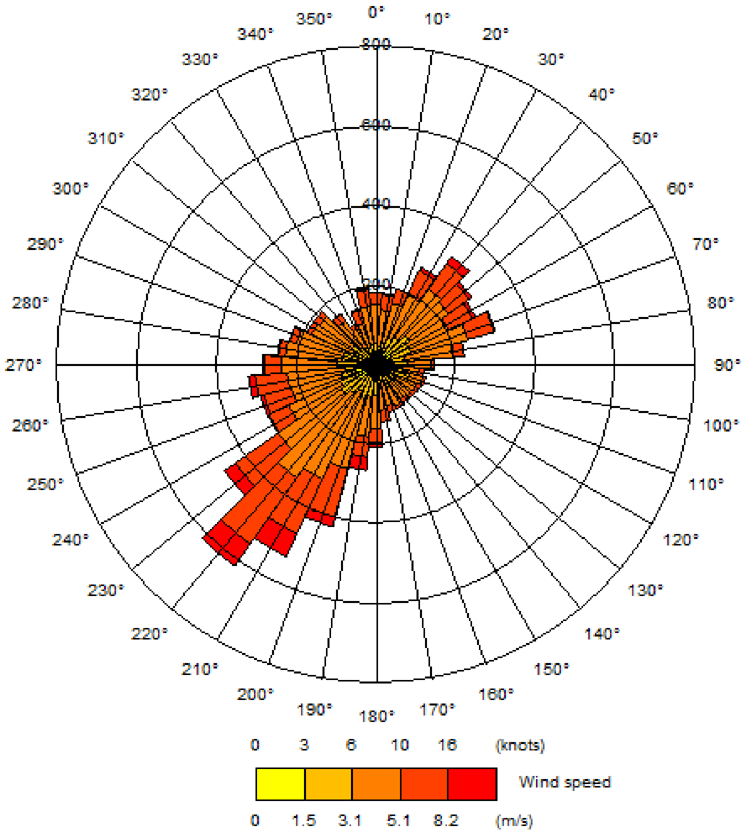


Figure A1: 2013 Wind Rose for the Biggin Hill Meteorological Station

1.26 Most dispersion models do not use meteorological data if they relate to calm winds conditions, as dispersion of air pollutants is more difficult to calculate in these circumstances. ADMS-Roads and ADMS 5 treats calm wind conditions by setting the minimum wind speed to 0.75 m/s. It is recommended in LAQM.TG(16) that the meteorological data file be tested within a dispersion model and the relevant output log file checked, to confirm the number of missing hours and calm hours that cannot be used by the dispersion model. This is important when considering predictions of high percentiles and the number of exceedances. LAQM.TG(16) recommends that meteorological data should only be used if the percentage of usable hours is greater than 85%. 2013 meteorological data from Biggin Hill includes 8,655 lines of usable hourly data out of the total 8,760 for the year (i.e. 98.8%). This is above the 85% threshold and is therefore adequate for the dispersion modelling.

1.27 A value of 0.2 was used for the Biggin Hill Meteorological Station, which is representative of agricultural areas and is considered appropriate following a review of the local area surrounding the Meteorological Station.

Model Data Processing

1.28 The modelling results were processed to calculate the averaging periods required for comparison with the Air Quality Strategy Objectives.

1.29 NO_X emissions from combustion sources (including vehicle exhausts) comprise principally nitric oxide (NO) and NO_2. The emitted NO reacts with oxidants in the air (mainly ozone) to form more NO_2. Since only NO_2 is associated with impacts on human health, the air quality standards for the protection of human health are based on NO_2 and not total NO_X or NO.

1.30 The ADMS-Roads model was run without the Chemistry Reaction option to allow verification (see below). Therefore, a suitable NO_X:NO_2 conversion was applied to the modelled NO_X concentrations. There are a variety of different approaches to dealing with NO_X:NO_2 relationships, a number of which are widely recognised as being acceptable. However, the current approach was developed for roadside sites, and is detailed within the Technical Guidance LAQM.TG(16).

1.31 The LAQM Support website provides a spreadsheet calculator[4] to allow the calculation of NO_2 from NO_X concentrations, accounting for the difference between primary emissions of NO_X and background NO_X, the concentration of O_3, and the different proportions of primary NO_2 emissions, in different years. This approach is only applicable to annual mean concentrations.

1.32 Research[5] undertaken on behalf of Defra has indicated that the hourly mean limit value and objective for NO_2 is unlikely to be exceeded at a roadside location where the annual-mean NO_2 concentration is less than 60µg/m^3, LAQM.TG(16) confirms that this assumption is still valid. The hourly objective is, therefore, not considered further within this assessment where the annual-mean NO_2 concentration is predicted to be less than 60µg/m^3.

1.33 To calculate the number of daily exceedances of 50µg/m^3 PM_{10}, the relationship between the number of 24-hour exceedances of 50µg/m^3 and the annual mean PM_{10} concentration from LAQM.TG (16) was applied as follows:

Number of Exceedances = $-18.5+0.00145 \times \text{annual mean}^3 + (206/\text{annual mean})$

Other Model Parameters

1.34 There are a number of other parameters that are used within the ADMS-Roads model which are described for completeness and transparency:

- The model requires a surface roughness value to be inputted.
  - A value of 0.5 was used for the Site, which is representative of parkland and open suburbia; and
  - A value of 0.2 was used for the Biggin Hill Airport Meteorological Station, which is representative of agricultural areas;
- The model requires the Monin-Obukhov length (a measure of the stability of the atmosphere) to be inputted. A value of 30m was used for the modelling; and
- The model requires the Road Type to be inputted. *'England [Urban]'* was selected and used for the modelling of the road links

Model Verification

1.35 Model verification is the process of comparing monitored and modelled pollutant concentrations for the same year, at the same locations, and adjusting modelled concentrations if necessary to be consistent with monitoring data. This increases the robustness of modelling results.

4 AEA, NOX to NO2 Calculator, http://laqm1.defra.gov.uk/review/tools/monitoring/calculator.php Version 4.1, 19 June 2014

5 Defra (2016), 'Local Air Quality Management Policy guidance PG(16)', DEFRA, London

1.36 Discrepancies between modelled and measured concentrations can arise for several reasons, for example:

- Traffic data uncertainties;
- Background concentration estimates;
- Meteorological data uncertainties;
- Sources not explicitly included within the model (e.g. car parks and bus stops);
- Overall model limitations (e.g. treatment of roughness and meteorological data, treatment of speeds); and
- Uncertainty in monitoring data, particularly diffusion tubes.

1.37 Verification is the process by which uncertainties such as those described above are investigated and minimised. Disparities between modelling and monitoring results are likely to arise as result of a combination of these aspects.

Nitrogen Dioxide

1.38 The dispersion model was run to predict 2013 annual mean NO_x concentrations at 3 diffusion tubes set up by Waterman (DT5, DT7, DT8). The monitoring locations are roadside and considered appropriate for the model verification.

1.39 Box 7.15 in LAQM.TG(16) indicates a method based on comparison of the road NO_X contributions and calculating an adjustment factor. This requires the roadside NO_X contribution to be calculated. In addition, monitored NO_X concentrations are required, which were calculated from the annual mean NO_2 concentration at the monitoring site using the NO_X to NO_2 spreadsheet calculator as described above. The steps involved in the adjustment process are presented in **Table A7**. The background data for 2013, as presented in **Table A6** were used.

Table A7: Model Verification Result for Un-adjustment NO_x Emissions (µg/m^3)

Site ID	Monitored NO_2	Monitored Road NO_2	Monitored Road NO_x	Modelled Road NO_x	Ratio of Monitored Road Contribution NO_x/Modelled Road Contribution NO_x
DT5	20.2	2.3	4.5	5.7	0.8
DT7	24.1	6.2	12.5	5.6	2.2
DT8	37.6	19.7	42.9	18.2	2.4

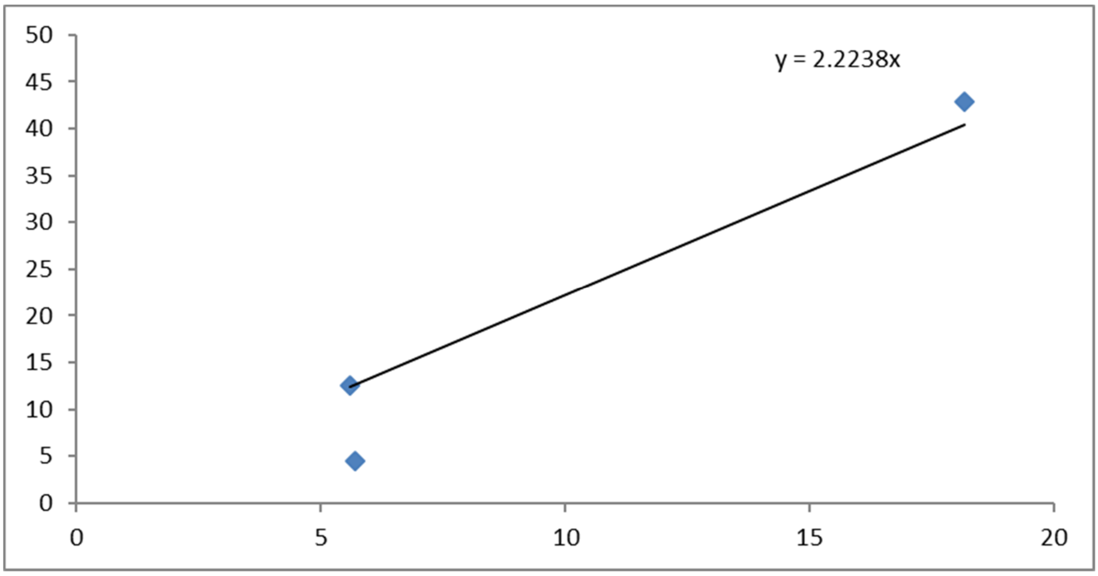


Figure A3: Unadjusted Modelled versus Monitored Annual Mean Roadside NO_x at the Monitoring Sites (µg/m^3)

1.40 Consequently, in **Table A8** the adjustment factor (2.2238) obtained from **Figure A3** is applied to the modelled NOx Roadside concentrations to obtain improved agreement between monitored and modelled annual mean NOx. This has been converted to annual mean NO_2 using the NOx:NO_2 spreadsheet calculator.

Table A8: Model Verification Result for Adjustment NO_x Emissions (µg/m^3)

Site ID	Adjusted Modelled Road NOx	Adjusted Modelled Total NO_x	Modelled Total NO_2	Monitored Total NO_2	% Difference
DT5	12.7	31.7	24.2	20.2	19.8
DT7	12.4	31.4	24.1	24.1	-0.1
DT8	40.4	59.4	36.6	37.6	-2.8

1.41 The results of **Table A8** indicates a better agreement between monitored and modelled annual mean NO_2 results compared to the unadjusted/unverified model shown in **Table A7**.

1.42 The NO_x adjustment process was subsequently applied to all roadside NO_x modelling for 2018 and 2030 'without' and 'with' the Development in place, at the specific receptor locations assessed, before the predicted concentrations were converted to NO_2.

Particulate Matter (PM_{10} and $PM_{2.5}$)

1.43 PM_{10} and $PM_{2.5}$ monitoring data is not available for the Site area. Therefore, the roadside modelled NOx adjustment factor of 2.2238 was subsequently applied to all the roadside PM_{10} and $PM_{2.5}$ modelling results, before adding on the background concentrations for the study area for 2018 and each of the 2030 scenarios, at the specific receptors locations assessed, and before the number of daily exceedances was calculated.

Verification Summary

1.44 Any atmospheric dispersion model study will always have a degree of inaccuracy due to a variety of factors. These include uncertainties in traffic emissions data, the differences between available meteorological data and the specific microclimate at each receptor location, and simplifications made in the model algorithms that describe the atmospheric dispersion and chemical processes. There will also be uncertainty in the comparison of predicted concentrations with monitored data, given the potential for errors and uncertainty in sampling methodology (technique, location, handling, and analysis) as well as processing of any monitoring data.

1.45 Whilst systematic under or over prediction can be taken in to account through the model verification / adjustment process, random errors will inevitably occur and a level of uncertainty will still exist in corrected / adjusted data.

1.46 Model uncertainties arise because of limited scientific knowledge, limited ability to assess the uncertainty of model inputs, for example, emissions from vehicles, poor understanding of the interaction between model and / or emissions inventory parameters, sampling and measurement error associated with monitoring sites and whether the model itself completely describes all the necessary atmospheric processes.

1.47 Overall, it was concluded that with the adjustment factors applied to the ADMS-Roads model, it is performing well and modelled results are suitable to determine the potential effects of the Development on local air quality.

Assessor Experience

Name: Alessandra Boccuzzi

Years of Experience: 1

Qualifications:

- BSc (Hons)

Alessandra has one year of experience specialising in the assessment of air quality and odour for a variety of projects. Alessandra has knowledge and experience of designing and undertaking ambient air quality monitoring programmes using passive diffusion tubes.

Name: Chris Brownlie

Years of Experience: 11

Qualifications:

- BSc (Hons)
- MSc
- AIEMA (Associate Member of the Institute of Environmental Management and Assessment)
- MIAQM (Member of the Institute of Air Quality Management)

Chris has over eleven years of experience in the assessment of air quality and odour for a variety of environmental impact assessment projects. Chris has knowledge and extensive experience of designing and undertaking ambient air quality monitoring programmes using real time equipment and passive diffusion tubes. This includes devising monitoring programs for dust deposition, typically to monitor levels of dust generated during construction activities in populated areas where there is the potential for nuisance to be caused.

Chris has been responsible for the technical delivery of a wide range of air quality projects for a variety of clients in both the public and private sector. These projects include consideration of emissions from both transportation and industrial sources, through both monitoring and modelling, and therefore he has an in depth understanding of the regulatory requirements for these sources and the published technical guidance for their assessment.

Annex B: Air Quality Monitoring Report

Fort Halstead, Kent

February 2015

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Annex B: Air Quality Monitoring Report

Fort Halstead, Kent

Client Name: Armstrong (Kent) LLP
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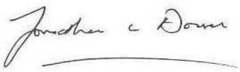
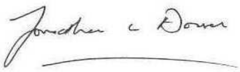
Quality Assurance – Approval Status

This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2008, BS EN ISO 14001: 2004 and BS OHSAS 18001:2007)

Issue	Date	Prepared by	Checked by	Approved by
Draft	January 2015	Guido Pellizzaro Associate Director	Alice Humphries Associate Director	Jonathan Dosser Technical Director 
Final	February 2015	Guido Pellizzaro Associate Director	Alice Humphries Associate Director	Jonathan Dosser Technical Director 

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1. Introduction

1.1. A short term monitoring study for nitrogen dioxide (NO_2) was undertaken at Fort Halstead centred on National Grid Reference 549741, 159317 (hereafter referred to as the 'Site'), in Sevenoaks District Council (SDC), by Waterman Energy, Environment and Design Ltd ('Waterman'). The monitoring study for the purposes of the Environmental Impact Assessment (EIA) was undertaken from July 2014 to January 2015 to establish current air quality conditions, attributed to vehicle emissions, at and surrounding the Site.

1.2. The Site is located approximately 4 kilometres (km) north-east of Sevenoaks and 8km south-east of Orpington on the edge of the North Downs. The Site is currently occupied by QinetiQ and the Defence Science and Technology Laboratory (DSTL), which carry out scientific and technical research to the Ministry of Defence. The Site is largely confined to the existing built form and highways on the land at Fort Halstead, and covers an area of 62.7 hectares (ha). The Applicant's land ownership boundary extends beyond the Site to include the immediate surrounding land, but excludes the residential properties along Crow Drive, which are located immediately north-east of the main part of the Site. The surrounding land within the Applicant's ownership, but outside the Site, covers an additional area of 69.3ha.

1.3. The results obtained from this monitoring study will inform the baseline air quality assessment to be undertaken as part of the Air Quality Assessment for an outline planning application for the redevelopment of the Site. This includes employment uses, a village centre, residential and open space, together with landscape and ecological enhancements on the Site and adjacent offsite on land within the Applicant's ownership (hereafter referred to the 'Development'). The results will also be used to verify the air quality model (comparison of monitored and modelled concentrations, and the use of an adjustment factor, should this be required) to predict future air pollutant concentrations at the Site, and the likely significant impacts of the Development on air pollutant concentrations in the surrounding area.

1.4. NO_2 diffusion tubes were placed at eight locations at 1.8 metres (m) above ground on and around the Site, as shown on Figure 1. These locations were chosen to obtain a good distribution on and immediately adjacent to the Site. In addition, tubes were co-located at the Bat and Ball automatic monitor operated by the SDC, approximately 8km to the south-east of the Site, to allow bias-adjustment of the monitoring results (see below for further details).

2. Methodology

2.1. The NO_2 monitoring study was undertaken for a six-month period from 9 July 2014 to 6 January 2015 and consisted of deploying two NO_2 diffusion tubes at each of the eight locations, as shown in Figure 1, and three tubes at the Bat and Ball automatic monitor (National Grid Reference 553043, 156690), which were changed monthly throughout the monitoring period.

2.2. The six-month NO_2 diffusion tube monitoring accords with best practice guidance (Defra, 2009, Local Air Quality Management Technical Guidance LAQM.TG (09)[1]), which states that *"For assessment against the annual mean objective for NO_2, it may in many circumstances prove possible to use data from a shorter period of monitoring, for example, six months consecutive sampling (including three months winter and three months summer), preferably with monitoring commencing in January or July"*. This time period is sufficient to provide a reasonable assessment of existing NO_2 concentrations in an area, but it does not provide data equivalent to the annual mean, which was estimated from the monitoring results. This approach was agreed with SDC during a consultation meeting of the 16th December 2014.

2.3. The diffusion tubes were mounted on lampposts approximately 1.8m above ground level on and around the Site.

Diffusion Tubes

2.4. NO_2 diffusion tube monitoring is a method for screening the air quality in an area in order to give an indication of average NO_2 concentrations. The device consists of a tube with an appropriate absorbent material at one end, mounted on to street furniture. The chemical trap (i.e. the substance within the tube into which ambient NO_2 is absorbed) comprises 20% TEA (triethanolamine) in water and the tubes are activated by removing the bottom cap to allow sampling.

2.5. Following the relevant exposure period, the cap is replaced and the tube sent to a laboratory for analysis. For this study, the tubes were obtained from Gradko International Ltd (a UKAS Accredited laboratory) and, following exposure, were returned to Gradko for analysis.

Diffusion Tube Co-location

2.6. Diffusion tubes may systematically under or over-read NO_2 concentrations when compared to an automatic analyser. To improve accuracy, it is best practice to deploy duplicate / triplicate tubes specifically co-located with an automatic monitor to enable inter-comparison of monitored results and determine the 'bias' in diffusion tube results. This bias can then be corrected to improve the accuracy of the diffusion tube results, using a suitable bias-adjustment factor.

2.7. As part of the monitoring study, triplicate diffusion tubes were located at the SDC Bat and Ball automatic monitor in order to derive a local bias adjustment factor. A locally derived bias adjustment factor is more appropriate than using a national factor available from Defra[2] for the following reasons:

- The survey was not carried out over a calendar year (the national factors have been determined on a calendar year basis); and

1 Defra, 2009, Local Air Quality Management Technical Guidance LAQM.TG(09)
2 http://laqm.Defra.gov.uk/bias-adjustment-factors/national-bias.html

- NO_2 concentrations at all of the diffusion sites are significantly influenced by emissions from nearby roads. In accordance with existing diffusion tube guidance[3], the bias adjustment factors should be determined from co-location studies at similar monitoring locations.

2.8. The spreadsheet tool for Local Authorities to use for calculating precision, accuracy and bias adjustment factors[4] were used to check the accuracy of the triplicate diffusion tubes with the SDC Bat and Ball automatic monitor.

2.9. The spreadsheet provides a Coefficient of Variation (CV) of the diffusion tube results, which represents their precision and is an indicator of the overall performance of the diffusion tubes. Tube precision is separated into two categories, ‘good’ or ‘poor’. The tube results considered to have ‘good’ precision are where the CV of duplicate or triplicate diffusion tubes for eight or more periods during the year is less than 20%, and the average CV of all monitoring periods is less than 10%. Tubes are considered to have ‘poor’ precision where the CV of four or more periods is greater than 20% and / or the average CV is greater than 10%.

2.10. A summary of the data from the co-location study is presented in Table 1, and a copy of the precision and accuracy spreadsheet is presented in Appendix A. Only 5 months of monitoring data from the diffusion tube data is available, as the tubes were missing on the last monitoring month.

Table 1: Co-location Data at the Bat and Ball Automatic Monitor

Site	Diffusion Tubes		Automatic Monitor	Bias Adjustment
	Period Mean	Tube Mean CV (% Precision)	Period Mean	
SDC Bat and Ball	37	7	28	**0.77**

2.11. As shown in Appendix A, the monitoring at the Bat and Ball Automatic Monitor has been discounted for the period 7 November to 5 December 2014 due to the poor data capture rate.

2.12. The average CV for the co-location is less than 10%, and as such shows ‘good’ precision. Therefore, the adjustment factor of 0.77 was applied to the monitoring results.

3 Laxen and Marner for Defra, 2006. The relationship between diffusion tube bias and distance from the road.

4 www.airquality.co.uk/archive/laqm/tools.php

3. Results

3.1. Following guidance in Defra's Local Air Quality Management Technical Guidance (LAQM.TG(09)) (Box 3.2) estimating annual mean concentrations from short-term monitoring data entails deriving a scaling factor, from other long-term monitoring locations, to adjust the monitoring period mean.

3.2. Scaling factor estimation is based on the fact that patterns in pollutant concentrations usually affect a wide region and are subject to seasonal changes. To minimise the impact of local traffic, the monitoring locations used in the scaling exercise were distanced from sources of pollution and broadly representative of urban background conditions.

3.3. According to LAQM.TG(09), in order to derive a scaling factor without any considerable error; data from two to four nearby long-term monitoring sites, located at urban background locations and ideally forming part of the national network are required. It is estimated that the distance between sites should not be larger than 50 miles (80km).

3.4. There are a number of urban background automatic monitoring sites within 80km of the Site, from which the following four urban background monitoring locations were selected:

- London Bexley – London Borough of Bexley, approximately 17km from the Site;
- Thurrock – Thurrock Council, approximately 22km from the Site;
- Mole Valley – Mole Valley District Council, approximately 34km from the Site; and
- Canterbury – Canterbury City Council, approximately 66km from the Site.

3.5. The above automatic monitors form part of the London Air Quality Network (LAQN) and monitoring data are available for all monitors for the latest full ratified year of data (as 2013).

3.6. The ratio of the short-term monitoring period mean for NO_2 (3 July 2014 to 6 January 2015) at the four sites listed above to the latest NO_2 annual mean concentration (available for 2013) at the same site was obtained, as shown in Table 2.

Table 2: Adjustment Process to Estimate Annual Mean NO_2 Concentrations at the Sites

	Annual Mean 2013 [AM]	Period Mean [PM]	Ratio (AM/PM) [R]
London Bexley[(a)]	27.9	28.5	0.98
Thurrock[(a)]	27.2	27.7	0.69
Mole Valley[(b)]	21.8	19.7	1.11
Canterbury[(a)]	14.3	20.7	0.98
Average			**0.94**

Note: (a) Data obtained from Kent Air
(b) Data obtained from London Air

3.7. The average of the four ratios between the sampling period and annual mean NO_2 concentrations was calculated as 0.94, as shown in Table 2, which was therefore applied to the short-term NO_2 diffusion tube results set out in Table 3. Following guidance in LAQM.TG(09), given that the calculation is carried out using the ratio of the short-term monitoring period to the 2013 annual mean, the equivalent / estimated annual mean is for 2013.

3.8. The results of the monitoring for NO_2 are presented in Table 3, with the overall six-month average for each location calculated and the equivalent / estimated bias adjusted annual mean using the factor calculated above.

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Table 3: NO_2 Monitoring Results at the Site

Location	9th July 2014 – 8th August 2014	8th August 2014 – 9th September 2014	9th September 2014 – 9th October 2014	9th October 2014 – 7th November 2014	7th November 2014 – 5th December 2014	5th December 2014 – 6th January 2015	Overall Average	Adjusted / Co-location Annual Mean(a)	Adjusted Estimated 2013 Annual Mean(b)
	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³
1. On Site (Star Hill Site Entrance)	12.2	12.4	15.7	13.5	24.6	16.3	16.1	12.4	15.1
	11.7	12.6	15.3	14.7	28.1	16.2			
2. On Site – (Middle of Site)	12.6	14.9	19.3	18.9	28.9	20.7	18.8	14.5	17.6
	13.0	14.6	19.9	17.1	29.8	15.7			
3. On Site – (Crow Drive/Crow Road near Site Entrance)	14.1	15.2	18.0	18.0	31.7	20.5	19.1	14.7	18.0
	13.9	14.4	18.3	14.7	31.8	19.0			
4. On Site (Lennard-Jones Road)	14.3	14.2	17.5	21.0	27.4	19.6	19.3	14.8	18.1
	14.1	14.2	17.6	18.9	30.4	22.0			
5. Crow Drive (adjacent to Helipad)	16.4	16.4	22.5	19.3	33.8	21.6	21.5	16.6	20.2
	14.8	17.5	23.1	19.4	33.7	19.5			
6. Harrow Road	14.4	14.7	19.0	16.9	31.3	21.5	18.8	14.5	17.7
	14.1	16.0	18.7	15.3	27.2	16.8			
7. Harrow Inn	24.8	25.5	29.5	18.8	36.6	22.0	25.6	19.7	24.1
	25.6	23.7	29.2	13.3	30.6	28.3			
8. A224 Polhill Road	40.8	32.3	45.8	38.9	50.6	33.7	40.0	30.8	37.6
	39.9	34.4	45.5	34.7	51.0	32.4			
								Air Quality Objective	**40**

(a) Multiply previous column by 0.77
(b) Multiply previous column by 0.94

4. Conclusion

4.1. As indicated by Table 3, the monitored estimated annual mean NO_2 concentrations on and immediately around the Site are below the annual mean NO_2 objective at all monitoring locations. It is therefore concluded that traffic on the A224 is the greatest source of pollution in the local area (Location 8), with monitored concentrations slightly below the annual mean NO_2 objective.

UK and Ireland Office Locations