HEATHROW GARDEN CENTRE

AIR QUALITY ASSESSMENT REPORT

NOVEMBER 2015

WSP | PARSONS BRINCKERHOFF

HEATHROW GARDEN CENTRE

AIR QUALITY ASSESSMENT REPORT

Lewdown Holdings Ltd

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EXECUTIVE SUMMARY

WSP | Parsons Brinckerhoff has been commissioned by Lewdown Holdings Limited to undertake an air quality assessment to support the planning applications for two proposed outline residential developments on land currently occupied by the Heathrow Garden Centre in Sipson, London. The two applications are for the same number of residential units, with Option A proposing to place them in the southwest of the Application Site, and Option B proposing to place them in the north.

This report presents the findings of the assessment, which addresses the potential air quality impacts during both the construction and operational phases of the Proposed Development. For both phases the type, source and significance of potential impacts were identified, and the measures that should be employed to minimise these proposed. The methodology followed in this study was discussed and agreed with the Environmental Health Officer of the London Borough of Hillingdon.

The assessment of construction phase impacts associated with fugitive dust and fine particulate matter (PM_{10}) emissions has been undertaken in line with the relevant Institute of Air Quality Management guidance. This identified that the Proposed Development is considered to be a **Medium to Low Risk Site** for dust deposition and PM_{10} concentrations. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM_{10} releases would be significantly reduced. The residual effects of the construction phase on air quality are considered to be **negligible**.

The assessment of the potential air quality impacts associated with traffic generated by the operational phase of the Proposed Development has been completed in line with published methodologies and technical guidance. The pollutants considered in this part of the assessment were nitrogen dioxide (NO_2) and PM_{10}.

An assessment of the potential for future residents of the Proposed Development to be exposed to poor air quality, given the site's location in an Air Quality Management Area and proximity to existing minerals extraction and landfill sites, has also been undertaken, the effects of which were found to be **negligible**.

An air quality neutral assessment of the buildings and transport related emissions associated with the operation of the Proposed Development was also undertaken, in accordance with the Mayor's policy.

The results show that the Proposed Development would have a negligible impact overall on NO_2 and PM_{10} concentrations at locations where the UK Air Quality Strategy objectives will apply. Annual mean concentrations of NO_2 are predicted to be above the relevant UK Air Quality Strategy objectives within the Proposed Development site. The assessment for Option A has predicted concentrations which fall under APEC Level B, and for Option B predicts concentrations in APEC Levels B and C. Consequently, appropriate mitigation aimed at reducing future resident exposure to elevated levels of NO_2 should be required. It is important to note, however, that the air quality assessment has assumed no improvement (reduction) in vehicle emissions factors and background concentrations over time between 2013 and the anticipated opening year of the Proposed Development (2019). This is therefore considered to represent a worst-case assessment of future NO_2 and PM_{10} concentrations within and in the vicinity of the Proposed Development.

Based on the assessment results, and following the implementation of the recommended mitigation measures, it is considered that the development proposals would comply with national, regional and local policy for air quality.

1 INTRODUCTION

1.1.1 WSP | Parsons Brinckerhoff has been commissioned by Lewdown Holdings Limited to carry out an assessment of the potential air quality impacts arising from the proposed residential development on land currently occupied by the Heathrow Garden Centre, Sipson Road, Sipson hereafter referred to as the 'Proposed Development' or 'Application Site'. This assessment applies to two different applications, both for 53 residential units: Option A proposes buildings be located in the southwest of the site; and Option B proposes they be placed in the north of the site.

1.1.2 The Application Site lies within the administrative boundary of London Borough of Hillingdon (LBH). The Application Site is situated on a 6.8ha site, to the east of the village of Sipson. It is bordered entirely on the east by the M4, and partially by Sipson Lane to the south, and Sipson Road to the west. To the north is a Holiday Inn hotel, and the south west corner of the Application Site borders a residential area comprising approximately 20 houses.

1.1.3 The Proposed Development envisages the demolition of the Heathrow Garden Centre and replacing it with a residential development. It will include 53 residential units (Class C3 – dwellings, houses, flats and apartments, including elderly living units), a community centre, associated private and public open space, and pedestrian and vehicular access and parking.

1.1.4 It is considered that the Proposed Development may have a temporary impact on local air quality during the construction phase, with demolition, earth-moving works and the storage of aggregates at the site posing the greatest risk with respect to the occurrence of 'nuisance dust'. Changes in local traffic volume and characteristics resulting from the operation of the Proposed Development may also have an impact on local air quality.

1.1.5 This report presents the findings of the assessment of the potential air quality impacts of the Proposed Development during both its construction and operational phases. For both phases, the type, source and significance of potential impacts are identified, and the measures that should be employed to minimise these described.

1.1.6 This report also considers the potential exposure of future residents of the Proposed Development to local pollution concentrations given the Application Site is located in an Air Quality Management Area.

1.1.7 A glossary of terms used in this report is provided in **Appendix A.**

2 LEGISLATION, POLICY & GUIDANCE

2.1 AIR QUALITY LEGISLATION & POLICY

2.1.1 A summary of the relevant air quality legislation and policy is provided below.

UK AIR QUALITY STRATEGY

2.1.2 The Government's policy on air quality within the UK is set out in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS) published in July 2007[1]. The AQS provides a framework for reducing air pollution in the UK with the aim of meeting the requirements of European Union legislation and international commitments.

2.1.3 The AQS also sets standards and objectives for nine key air pollutants to protect health, vegetation and ecosystems. These are benzene (C_6H_6), 1,3 butadiene (C_4H_6), carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), ozone (O_3), and polycyclic aromatic hydrocarbons (PAHs). The standards and objectives for the pollutants considered in this assessment are given in **Appendix B.**

2.1.4 The air quality standards are levels recommended by the Expert Panel on Air Quality Standards (EPAQS) and the World Health Organisation (WHO) with regards to current scientific knowledge about the effects of each pollutant on health and the environment.

2.1.5 The air quality objectives are medium-term policy based targets set by the Government which take into account economic efficiency, practicability, technical feasibility and timescale. Some objectives are equal to the EPAQS recommended standards or WHO guideline limits, whereas others involve a margin of tolerance, i.e. a limited number of permitted exceedences of the standard over a given period.

2.1.6 For some pollutants, (e.g. NO_2), there is both a long-term (annual mean) standard and a short-term standard. In the case of NO_2, the short-term standard is for a 1-hour averaging period, whereas for PM_{10} it is for a 24-hour averaging period. These periods reflect the varying impacts on health of differing exposures to pollutants, for example temporary exposure on the pavement adjacent to a busy road, compared with the exposure of residential properties adjacent to a road.

2.1.7 The AQS contains a framework for considering the effects of a finer group of particles known as '$PM_{2.5}$' as there is increasing evidence that this size of particles can be more closely associated with observed adverse health effects than PM_{10}.

AIR QUALITY REGULATIONS

2.1.8 Many of the objectives in the AQS have been made statutory in England with the Air Quality (England) Regulations 2000[2] and the Air Quality (England) (Amendment) Regulations 2002[3] for the purpose of Local Air Quality Management (LAQM).

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[1] Department for Environment, Food and Rural Affairs (DEFRA) and the Devolved Administrations (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volumes 1 and 2)
[2] The Air Quality (England) Regulations 2000 - Statutory Instrument 2000 No.928
[3] The Air Quality (England) (Amendment) Regulations 2002- Statutory Instrument 2002 No.3043

2.1.10 These Regulations require that likely exceedences of the AQS objectives are assessed in relation to:

- → *"…the quality of air at locations which are situated outside of buildings or other natural or man-made structures, above or below ground, and where members of the public are regularly present…"*

2.1.11 The Air Quality Standards Regulations 2010[4] transpose the European Union Ambient Air Quality Directive (2008/50/EC)[5] into law in England. This Directive sets legally binding limit values for concentrations in outdoor air of major air pollutants that impact public health such as PM_{10}, $PM_{2.5}$ and NO_2. The limit values for NO_2 are the same concentration levels as the AQS objectives, but applied from 2010. The limit values for PM_{10} and $PM_{2.5}$ are also the same concentration levels as the AQS objectives, but apply from 2005 for PM_{10} and will apply from 2015 for $PM_{2.5}$. It should be noted that currently there is no requirement for local authorities to assess $PM_{2.5}$ concentrations as part of their statutory obligations.

2.1.12 The 2010 Regulations also incorporate the European Union's 4th Air Quality Daughter Directive (2004/107/EC)[6], which sets targets for levels in outdoor air of certain toxic heavy metals and PAHs.

ENVIRONMENTAL PROTECTION ACT 1990

2.1.13 Section 79 of the Environmental Protection Act 1990 gives the following definitions of statutory nuisance relevant to dust and particles:

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

2.1.14 Following this, Section 80 says that where a statutory nuisance is shown to exist, the local authority must serve an abatement notice. Failure to comply with an abatement notice is an offence and if necessary, the local authority may abate the nuisance and recover expenses.

2.1.15 There are no statutory limit values for dust deposition above which 'nuisance' is deemed to exist. Nuisance is a subjective concept and its perception is highly dependent upon the existing conditions and the change which has occurred.

ENVIRONMENT ACT 1995

2.1.16 Under Part IV of the Environment Act 1995, local authorities must review and document local air quality within their area by way of staged appraisals and respond accordingly, with the aim of meeting the air quality objectives defined in the Regulations. Where the objectives are not likely to be achieved, an authority is required to designate an Air Quality Management Area (AQMA). For each AQMA the local authority is required to draw up an Air Quality Action Plan (AQAP) to secure improvements in air quality and show how it intends to work towards achieving air quality standards in the future.

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[4] The Air Quality Standards Regulations 2010 - Statutory Instrument 2010 No. 1001
[5] Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe
[6] Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

2.2 PLANNING POLICY

2.2.1 A summary of the relevant national, regional and local planning policy relevant to the Proposed Development and air quality is provided below.

NATIONAL PLANNING POLICY

NATIONAL PLANNING POLICY FRAMEWORK

2.2.2 The Government's overall planning policies for England are described in the National Planning Policy Framework[7]. This document also outlines the means by which Government intends to apply these policies at various levels to achieve its aim of contributing to sustainable development. The Framework acknowledges the importance of appropriate and robust planning at a local level and thus promotes opportunities for communities to engage in plan making at a neighbourhood level. The core underpinning principle of the framework is the presumption in favour of sustainable development, defined as:

- *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*

2.2.3 One of the 12 core planning principles in the NPPF is that planning should 'contribute to conserving and enhancing the natural environment and reducing pollution.'

2.2.4 In relation to air quality, the following paragraphs in the document are relevant:

- Paragraph 109, which states – *"The planning system should contribute to and enhance the natural and local environment by:…preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water, or noise pollution..";*
- Paragraph 110, which states – *"In preparing plans to meet development needs, the aim should be to minimise pollution and other adverse effects on the local and natural environment. Plans should allocate land with the least environmental or amenity value, where consistent with other policies in this Framework."*;
- Paragraph 122, which states – *"…local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities"*;
- Paragraph 124, which states – *"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan"*; and
- Paragraph 203, which states – *"Local Planning authorities should consider where otherwise unacceptable development could be made acceptable though the use of conditions or planning obligations. Planning obligations should only be used where it is not possible to address unacceptable impacts through a planning condition."*

[7] Department for Communities and Local Government (2012). National Planning Policy Framework.

REGIONAL PLANNING POLICY

THE MAYOR'S AIR QUALITY STRATEGY FOR LONDON

2.2.5 In 2010 the GLA/Mayor of London published a new Mayor's Air Quality Strategy for London[8]. This strategy is focused on improving London's air quality. It also explains the current air quality experienced across London and gives predictions of future levels of pollution. The sources are outlined and a comprehensive set of policies and proposals are set out that will improve air quality in the London Boroughs.

2.2.6 The strategy sets out a framework for delivering improvements to London's air quality and includes measures aimed at reducing emissions from transport, homes, offices and new developments, promoting smarter more sustainable travel, as well as raising awareness of air quality issues.

THE LONDON PLAN: SPATIAL DEVELOPMENT STRATEGY FOR GREATER LONDON

2.2.7 Policy 7.14 of the London Plan[9] is specific to the improvement of air quality and states that development proposals should:

- *"minimise increased exposure to existing poor air quality and make provision to address local problems of air quality;*
- *promote sustainable design and construction in order to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils' 'The control of dust and emissions from construction and demolition';*
- *be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality;*
- *ensure that where provision needs to be made to reduce emissions from a development, this is usually made on site; and*
- *where the development requires a detailed air quality assessment and biomass boilers are included, the assessment should forecast pollutant concentrations. Permission should only be granted if no adverse air quality impacts from the biomass boiler are identified."*

LOCAL PLANNING POLICY

HILLINGDON LOCAL PLAN: PART 1 – STRATEGIC POLICIES (NOVEMBER 2012) & PART 2 – DEVELOPMENT MANAGEMENT POLICIES (SEPTEMBER 2014)

2.2.8 Adopted in November 2012 to replace the Core Strategy, the Local Plan: Part 1 – Strategic Policies sets out long term objectives for the borough, including broad policies which are closely aligned with the Sustainable Community Strategy, focusing on three priority key components of the borough: People, Place and Prosperity. Under these it has six "priority themes": improving health and wellbeing; strong and active communities; protecting and enhancing the environment; making Hillingdon safer; a thriving economy; and improving aspiration through education and learning. Part 1 concentrates mainly on steering and shaping developments.

[8] Mayor of London: *Cleaning London's air, The Mayor's Air Quality Strategy (December 2010)*
[9] Mayor of London (July 2011) The London Plan: Spatial Development Strategy for Greater London (Updated March 2015).

2.2.10 Part 2's (Development Management Policies) purpose is to provide detailed policies that will form the basis of the Council's decisions on individual planning applications, looking at: The Econom; Town Centres; New Homes, Historic and the Built Environments; Environment Improvements; Community Infrastructure; and Transport and Aviation. It also recognises the need to mitigate air quality impacts around the strategic road network at Heathrow Airport.

2.2.11 With regards to Air Quality, both Plans make reference to its importance. The Strategic Objectives SO10 and SO11 (relating to policies EM1 – Climate Change Adaptation and Mitigation and EM8 – Land, Water, Air and Noise) address the issue of air quality resulting from traffic on major roads, around Heathrow, and air traffic.

2.2.12 Policy EM8: Land, Water and Noise aims to tackle air quality, stating that major developments should aim for air quality neutrality by, where appropriate:

- *"… actively contribute to the promotion of sustainable transport measures such as vehicle charging point and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum."*

2.2.13 The Council aims to implement this by: setting high standards for Air Quality; preparing a Local Development Document for the Heathrow Area; requiring development to limit water usage and use local sources where possible; using planning conditions and using Section 106 agreements; and implementing the borough Transport Strategy. This will then be monitored annually in the Annual Monitoring Report.

2.2.14 Part 2 goes into more detail specifically regarding the air quality of new developments. Its Policy DMEI18: Air Quality states that:

- *"Development proposals should as a minimum be at least "air quality neutral". Where air quality levels are above national and European regulated levels, proposals will be required to demonstrate appropriate reductions in emissions to ensure that local air quality levels for both proposed and existing receptors are met in accordance with the relevant European Union (EU) limit values."*

2.2.15 Furthermore for areas in close proximity to major roads (such as the M4) or Heathrow Airport where concentrations of atmospheric pollutants are consistently high, it says that:

- *"The inclusion of stringent mitigation measures will need to be introduced before consideration of new development in the area, especially where any development proposal either introduces new residents into areas of poor air quality or would lead to deterioration in air quality for existing residents."*

THE LONDON BOROUGH OF HILLINGDON AIR QUALITY ACTION PLAN

2.2.16 The London Borough of Hillingdon (LBH) Air Quality Action Plan has considered a variety of other plans during its development, such as The Mayor of London's Air Quality Strategy, The Local Implementation Plan, The London Plan and the Hillingdon Community Plan.

2.2.17 The 2014 Progress Report highlights the need to improve air quality in the region immediately with regards to public health. It also recognises that the worst hit areas of the region are in the South, resulting from heavy traffic along the M4 and around Heathrow airport. However, as current air pollution levels are below recommended thresholds, the actions recommended for/by themselves are to continue monitoring air pollution and implementing action plan measures. There are also plans to proceed with an Updating and Screening Assessment (USA) in 2015.

2.2.18 In relation to this, the Local Implementation Plan (LIP) has some points relevant to Air Quality and therefore the Proposed Development, of which Objective 2 is the most relevant: 'Reduce the Negative Impacts of Transport on Air Quality and Noise'. This Objective is to be met by methods such as improvements to roads frequented by HGV's, improved pavements, and other environmental enhancements. The LIP also identifies that large developments and economic growth brings new demands for the transport networks. It aims to tackle this with its 5th Objective: 'Ensure that the Transport System Enables Sustainable Access to Health, Education, Employment, Leisure and Social Opportunities'.

2.3 GUIDANCE

2.3.1 A summary of the publications referred to in the undertaking of this assessment is provided below.

LOCAL AIR QUALITY MANAGEMENT REVIEW AND ASSESSMENT TECHNICAL GUIDANCE

2.3.2 The Department for Environment, Food and Rural Affairs (DEFRA) has published technical guidance for use by local authorities in their review and assessment work[10]. This guidance, referred to in this document as LAQM.TG(09), has been used where appropriate in the assessment presented herein.

DEVELOPMENT CONTROL: PLANNING FOR AIR QUALITY

2.3.3 This air quality guidance produced by Environmental Protection UK (EPUK) & IAQM[11] offers comprehensive advice on: when an air quality assessment may be required; what should be included in an assessment; how to determine the significance of any air quality impacts associated with a development; and, the possible mitigation measures which may be implemented to minimise these impacts.

GUIDANCE ON THE ASSESSMENT OF DUST FROM DEMOLITION AND CONSTRUCTION

2.3.4 This document[12] published by the Institute of Air Quality Management (IAQM) was produced to provide guidance to developers, consultants and environmental health officers on how to assess the impacts arising from construction activities. The emphasis of the methodology is on classifying sites according to the risk of impacts (in terms of dust nuisance, PM_{10} impacts on public exposure and impact upon sensitive ecological receptors) and to identify mitigation measures appropriate to the level of risk identified.

NATIONAL PLANNING PRACTICE GUIDANCE – AIR QUALITY

2.3.5 This guidance[13] provides a number of guiding principles on how the planning process can take into account the impact of new development on air quality, and explains how much detail air quality assessments need to include for proposed developments, and how impacts on air quality can be mitigated. It also provides information on how air quality is taken into account by Local

[10] DEFRA (2009) Part IV The Environment Act 1995 and Environment (Northern Ireland) Order 2002 Part III, Local Air Quality Management Review and Assessment Technical Guidance LAQM.TG(09)
[11] EP UK and IAQM . Land-Use Planning &Development Control: Planning for Air Quality (May 2015)
[12] Institute of Air Quality Management (February 2014): Guidance on the Assessment of Dust from Demolition and Construction
[13] Department of Communities and Local Government (DCLG) (March 2014) National Planning Practice Guidance

Authorities in both the wider planning context of Local Plans and neighbourhood planning, and in individual cases where air quality is a consideration in a planning decision.

LONDON COUNCILS GUIDANCE FOR AIR QUALITY ASSESSMENTS

2.3.6 The London Councils have published guidance[14] for undertaking air quality assessments in the London Boroughs, the majority of which have declared AQMAs. The guidance sets out suggested methods for undertaking such an assessment within the London area and provides a methodology to assist in determining the impacts of a development proposal on air quality. The main message of the document is, as above, that the factor of greatest importance will generally be the difference in air quality as a result of the proposed development.

MAYOR OF LONDON'S SUPPLEMENTARY PLANNING GUIDANCE FOR THE CONTROL OF DUST AND EMISSIONS DURING CONSTRUCTION AND DEMOLITION

2.3.7 This Supplementary Planning Guidance[15] (SPG) builds on the voluntary guidance published in 2006 by the London Councils to establish best practice in mitigating impacts on air quality during construction and demolition work.

2.3.8 The SPG incorporates more detailed guidance and best practice, and seeks to address emissions from Non-Road Mobile Machinery through the use of a low emission zone, which is to be introduced in 2015.

2.3.9 The SPG provides a methodology for assessing the potential impact of construction and demolition activities on air quality following the same procedure as set out in the IAQM guidance. It then identifies the relevant controls and mitigation measures that should be put in place to minimise any adverse impacts, which need to be set out, in draft, in an air quality assessment report submitted with the planning application, and then formalised post submission as an Air Quality and Dust Management Plan. Details of site air quality monitoring protocols are also provided with varying requirements depending on the size of the site and the potential risk of adverse impacts.

GREATER LONDON AUTHORITY: SUSTAINABLE DESIGN AND CONSTRUCTION SPG (2014)

2.3.10 Section 4.3 of this Supplementary Planning Guidance (SPG)[16] provides guidance on the following key areas: assessment requirements; construction and demolition; design and occupation; air quality neutral policy for buildings and transport; and emissions standards for combustion plant.

2.3.11 The London Plan and the Mayor's Air Quality Strategy set out that developments are to be at least 'air quality neutral'. To enable the implementation of this policy, emission benchmarks have been produced for building and transport across London based on the latest technology. Developers will have to calculate the oxides of nitrogen (NO_x) and/or PM_{10} emissions from the buildings and transport elements of their developments and compare them to the benchmarks set out in Appendix 5 and 6. These are considered to be minimum benchmarks, which are kept under review.

[14] London Councils (January 2007): Air Quality and Planning Guidance – Revised version
[15] Mayor of London (July 2014): The control of dust and emissions during construction and demolition – Supplementary Planning Guidance.
[16] Greater London Authority (2014): Sustainable Design and Construction Supplementary Planning Guidance.

2.3.12 Developments that do not exceed these benchmarks will be considered to avoid any increase in NO_x and PM_{10} emissions across London as a whole and therefore be 'air quality neutral'.

2.3.13 Developers of schemes which do not meet the 'air quality neutral' benchmark for buildings or transport (considered separately) after appropriate on-site mitigation measures have been incorporated will be required to off-set any excess in emissions. This can be achieved by providing NO_x and PM abatement measures in the vicinity of the development, such as: green planting/walls and screens, with special consideration given to planting that absorbs or supresses pollutants; upgrade or abatement work to combustion plant; retro-fitting abatement technology for vehicles and flues; and exposure reduction. These measures can be secured by condition or Section 106 contribution. Air quality monitoring is not eligible for funding as it is not considered to contribute to actual air quality improvements.

2.3.14 In addition, the SPG contains emission standards for combustion plant that provide heat and power to developments. These are outlined in paragraphs 4.3.20 – 4.3.25 of the SPG and Appendix 7, and apply to all developments in London where solid biomass or CHP plant are proposed.

MINERALS POLICY STATEMENT 2: CONTROLLING AND MITIGATING THE ENVIRONMENTAL EFFECTS OF MINERALS EXTRACTION IN ENGLAND – ANNEX 1: DUST

2.3.15 This document[17] acknowledges the potentially significant adverse environmental impacts associated with uncontrolled dust emissions from surface mineral operations. It prescribes dust management and mitigation measures that are expected to be applied by Minerals Planning Authorities (and ultimately adopted by operators). The primary aim is the protection of the environment, however the economic and practical viabilities of mitigations are also considered.

[17] Office of the Deputy Prime Minister (2005) Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England – Annex 1: Dust.

3 METHODOLOGY

3.1 SCOPE

3.1.1 The scope of the assessment has been determined in the following way:

- consultation with the Environmental Health Officer (EHO) of LBH to discuss the availability and location of local monitoring data, to agree the scope of the assessment and the methodology to be applied;
- review of LBH's latest review and assessment reports[18] and air quality data for the area surrounding the site, including data from LBH, DEFRA[19], the Environment Agency (EA)[20], and the London Air websites[21];
- desk study to confirm the locations of nearby existing receptors that may be sensitive to changes in local air quality and a review of the masterplan for the Proposed Development to establish the locations of new sensitive receptors;
- review of the traffic data provided by WSP | Parsons Brinckerhoff, which have been used as an input to the air quality assessment; and,
- review of the emission data for the proposed energy centre as supplied by the equipment suppliers. The emission data have been used as an input into the air quality assessment.

3.1.2 The scope of the assessment includes consideration of the potential impacts on local air quality resulting from:

- dust and particulate matter generated by on-site activities during the construction phase;
- increases in pollutant concentrations (namely NO_2 and PM_{10}) as a result of exhaust emissions arising from construction traffic and plant; and
- increases in pollutant concentrations (namely NO_2 and PM_{10}) as a result of both exhaust emissions from road traffic generated by the operation of the Proposed Development and energy centre emissions resulting from the operation of the proposed energy centre associated with the Application Site on existing public exposure sensitive locations.

3.1.3 In addition to the above, the potential exposure of future users of the Proposed Development to air pollution will also be assessed.

3.2 METHODOLOGY

3.2.1 The methodology presented hereunder has been agreed with LBH[22].

[18] Wandworth Borough Council Progress Report 2014
[19] DEFRA Local Air Quality Management (LAQM) Support Pages. Available at: http://laqm.defra.gov.uk/ Accessed on 11/11/14
[20] Environment Agency Website. Available at http://www.environmentagency.gov.uk/homeandleisure/37793.aspx. Accessed on 11/11/14)
[21] London Air Website. Available at: http://www.londonair.org.uk/LondonAir/Default.aspx. Accessed on 10/11/14
[22] Email correspondence with Nayani Chandran (Contaminated Land and Air Quality, LBH), 11/09/15

CONSTRUCTION PHASE

3.2.2 An assessment of the likely significant impacts on local air quality due to the generation and dispersion of dust and PM_{10} during the construction phase has been undertaken using: the relevant assessment methodology published by the IAQM; the available information for this phase of the Proposed Development provided by the Client and Project Team; and, professional judgement.

3.2.3 The IAQM assessment is undertaken where there are: 'human receptors' within 350m of the site boundary, or within 50m of the routes used by construction vehicles on the public highway, up to 500m from the site entrance; and within 50m of the routes used by construction vehicles on the public highway, and up to 500m from the site entrance. It is within these distances that the impacts of dust soiling and increased PM_{10} in the ambient air will have the greatest impact on local air quality at sensitive receptors.

3.2.4 The IAQM methodology assesses the risk of potential dust and PM_{10} impacts from the following four sources: demolition; earthworks; general construction activities and track-out. It takes into account the nature and scale of the activities undertaken for each source and the sensitivity of the area to an increase in dust and PM_{10} levels to assign a level of risk. Risks are described in terms of there being a low, medium or high risk of dust impacts. Once the level of risk has been ascertained, then site specific mitigation proportionate to the level of risk is identified, and the significance of residual effects determined. A summary of the IAQM assessment methodology is provided in **Appendix C**.

3.2.5 In addition to impacts on local air quality due to on-site construction activities, exhaust emissions from construction vehicles and plant may have an impact on local air quality adjacent to the routes used by these vehicles to access the Application Site and in the vicinity of the Application Site itself. As information on the number of vehicles and plant associated with the each part of the construction phase is not available at the time of writing, a qualitative assessment of their impact on local air quality has been undertaken using professional judgement and by considering the following:

- the number and type of construction traffic and plant likely to be generated by this phase of the Proposed Development;
- the number and proximity of sensitive receptors to the Application Site and along the likely routes to be used by construction vehicles; and
- the likely duration of the construction phase and the nature of the construction activities undertaken.

OPERATIONAL PHASE

3.2.6 Of the pollutants included in the AQS, concentrations of NO_2 and PM_{10} have been considered in this assessment as road traffic is a major source of both pollutants and their concentrations tend to be in exceedence of the objectives in urban locations, such as the location of the Application Site.

3.2.7 For the prediction of impacts due to emissions arising from road traffic during the operation of the Proposed Development, the advanced dispersion model ADMS Roads (version 3.2) has been used. This model uses detailed information regarding traffic flows on the local road network, surface roughness, and local meteorological conditions to predict pollutant concentrations.

3.2.8 A summary of the traffic data and pollutant emission factors used in the assessment can be found in **Appendix D**. It includes details of Annual Average Daily Traffic flows (AADT), vehicle speeds (kph) and the percentage of Heavy Duty Vehicles (HDVs) for the local road network in all assessment years considered. Traffic data were provided for a baseline year of 2014.

Discussions with the project's transport planners confirmed that flows were representative of those in 2013, due to no material growth in the area. As both Option A and B comprise the same number of units, traffic data is considered to be the same for both layouts.

3.2.9 Meteorological data, including wind speed and direction, is used by the model to determine pollutant transportation and levels of dilution by the wind. Meteorological data used in the model was obtained from the Met Office observing station at Heathrow. This station is considered to provide data representative of the meteorological conditions at the site of the Proposed Development. The meteorological data used for this assessment was for 2013.

3.2.10 For the assessment, three scenarios were modelled. These scenarios are as follows:

- 2013 'model verification' and 'baseline';
- 2019 Option A 'without and with development'; and
- 2019 Option B 'without and with development'.

3.2.11 2013 is the most recent year for which monitoring data and meteorological data are available to enable verification of the model results, and so this year has been used as the baseline year for this assessment. 2019 is the anticipated opening year of the Proposed Development.

3.2.12 The traffic flows for the 'without development' scenarios account for flows associated with committed developments in the locality of the Application Site but do not include any contribution to road traffic from the Proposed Development itself. The traffic flows for the 'with development' scenario include contributions to road traffic from the Proposed Development itself and locally committed developments.

3.2.13 Vehicle emission factors for use in the assessment have been obtained using the Emission Factor Toolkit (EFT) version 6.0.2[23] (published in November 2014) available on the DEFRA website. The EFT allows for the calculation of emission factors arising from road traffic for all years between 2008 and 2030. For the predictions of future year emissions, the toolkit takes into account factors such as anticipated advances in vehicle technology and changes in vehicle fleet composition, such that vehicle emissions are assumed to reduce over time. However, there is currently some uncertainty over how representative the future predictions are. To address this uncertainty, it has been assumed that there will be no improvement in emission factors from the baseline verification year of 2013 in future years. This represents a worst-case approach to the assessment and was agreed with the EHO at LBH prior to commencement of the assessment.

SELECTION OF BACKGROUND CONCENTRATIONS

3.2.14 Background pollutant concentrations used in the assessment have been taken from the DEFRA website, where background concentrations of those pollutants included within the AQS have been mapped at a grid resolution of 1x1km for the whole of the UK. For NO_2, oxides of nitrogen (NO_x) (which is required in the calculation of NO_2 concentrations), and PM_{10}, estimated concentrations are available for all years between 2011 and 2030. Inherent within the background maps is the assumption that background concentrations will improve (i.e. reduce) over time. However, many local authorities are finding that the results of their local monitoring do not always support this assumption, with many areas showing that pollutant concentrations have remained fairly stable over recent years. For the purposes of the assessment, 2013 background concentrations have therefore been adopted for all assessment scenarios. This approach was agreed in consultation

[23] Emission Factor Toolkit. Available at http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

with the EHO of LBH. Further details on the background concentrations are provided in Section 4 of this report.

3.2.15 It should be noted that for NO_x and PM_{10}, the background maps present both the 'total' estimated background concentrations and the individual contributions from a range of emission sources (for example, motorways, aircraft, domestic heating etc.). When detailed modelling of an individual sector is required as part of an air quality assessment, the respective contribution can be subtracted from the overall background estimate to avoid the potential for 'double-counting'. For this assessment, traffic data for some, but not all, A Roads within grid square (524500, 174500) were included in the modelling; therefore, contributions from this sector have been retained in the background concentrations for this square, which is considered a worst-case approach.

MODEL VERIFICATION AND PROCESSING OF RESULTS

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

3.2.17 Model validation undertaken by the software developer will not have included validation in the vicinity of the Proposed Development. To determine the performance of the model at a local level, a comparison of modelled results with local monitoring data at relevant locations was undertaken. This process of verification aims to minimise modelling uncertainty and systematic error by correcting modelled results by an adjustment factor to gain greater confidence in the final results.

3.2.18 Suitable local NO_2 monitoring data for the purpose of model verification is available at the location described in **Table 3-1**.

Table 3-1 Local monitoring data sources suitable for model verification

Location & Site Classification	O.S. Grid Reference	Distance to Site	2013 Monitored NO_2 Concentrations ($\mu g/m^3$)
HD200 – Zealand Avenue	505920,177188	1.5km	41.3

3.2.19 Model verification has been undertaken following the methodology specified in Annex 3 of LAQM.TG(09) using the NO_x:NO_2 calculator (version 4.1, released in June 2014) available from the DEFRA website[24] to calculate the roadside NO_x component of the annual mean NO_2 concentrations measured at the monitoring sites listed in the table above. Details of the verification calculations are presented in **Appendix E**.

3.2.20 A factor of 2.2 was obtained during the verification process and this factor has been applied to the modelled NO_x roads component. Following model verification and adjustment, the modelled road contribution to NO_x concentrations were converted to annual mean NO_2 concentrations using the methodology given in LAQM.TG(09) and the NO_x:NO_2 calculator.

3.2.21 Local monitoring data are not available for concentrations of PM_{10}, and as such, final modelling results for this pollutant have been adjusted using the factor calculated for adjusting the modelled NO_x roads component. This approach is consistent with guidance given in LAQM.TG(09).

IMPACTS OF THE EMISSIONS FROM THE ROAD TRAFFIC

3.2.22 NO_x emitted to the atmosphere from vehicle emissions will consist largely of nitric oxide (NO), a relatively innocuous substance. Once released into the atmosphere, nitric oxide is oxidised to

[24] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html#NOXNO2calc

NO_2, which is of concern with respect to health and other impacts. The proportion of NO converted to NO_2 depends on a number of factors including wind speed, distance from the source, solar irradiation and the availability of oxidants, such as O_3.

3.2.23 The dispersion model used for the prediction of road traffic emissions predicts concentrations of NO_x which subsequently require conversion to NO_2. A NO_x to NO_2 calculator is available from the DEFRA website to calculate NO_2 from NO_x wherever NO_x emissions from road traffic are predicted using dispersion modelling

3.2.24 Following model verification, the modelled road contribution to NO_x concentrations were converted to annual mean NO_2 concentrations using the methodology given in LAQM.TG(09) and the NO_x:NO_2 calculator and local background concentrations to obtain the total annual mean NO_2 concentrations, in order to assess the long-term impact.

3.2.25 LAQM.TG(09) advises that exceedences of the 1 hour mean NO_2 objective is unlikely to occur where annual mean concentrations are below 60µg/m^3, and provides guidance on the approach that should be taken if either measured or predicted annual mean NO_2 concentrations are 60µg/m^3 or above. This applies to concentrations where road traffic emissions are the main contributor to concentrations.

3.2.26 The predicted annual mean PM_{10} concentration contributions arising from road traffic were added to the relevant background concentrations, which were then used to calculate the number of exceedences of the 24-hour mean objective for direct comparison with the relevant AQS objective, following the methodology given in LAQM.TG(09).

3.2.27 Predicted concentrations have been compared against the relevant current statutory standards and objectives set out in **Appendix B**.

ASSESSMENT OF IMPACTS OF DUST AND PM_{10} EMISSIONS GENERATED BY THE OPERATION OF MINERAL EXTRACTION AND LANDFILL SITES ON LOCAL AIR QUALITY

3.2.28 Activities undertaken at the nearby mineral extraction and landfill sites are a potential source of dust and PM_{10}. Due to the nature of these activities a qualitative assessment has been completed by applying the assessment methodology contained within the 2014 IAQM 'Guidance on the Assessment of Dust from Demolition and Construction', in conjunction with the Minerals Policy Statement 2: 'Controlling and Mitigating the Environmental Effect of Minerals Extraction in England – Annex 1: Dust'.

3.3 SIGNIFICANCE CRITERIA

CONSTRUCTION PHASE

3.3.1 The IAQM assessment methodology recommends that significance criteria is only assigned to the identified risk of dust impacts occurring from a construction activity with appropriate mitigation measures in place. For almost all construction activities, the application of effective mitigation should prevent any significant effects occurring to sensitive receptors and therefore the residual effect will normally be negligible. For the assessment of the impact of emissions from plant and construction vehicles accessing and leaving the Site on local air quality, the significance of residual effects have been determined using professional judgement and the significance criteria described below for operational phase impacts.

OPERATIONAL PHASE

3.3.2 The impacts of traffic associated with the Proposed Development on local air quality once operational have been evaluated against the significance criteria published by EPUK & IAQM. Whilst it is noted that the criteria presented within the EPUK & IAQM guidance were developed

specifically for the assessment of changes in road traffic emissions, they have been used to determine the significance of the impact of all of the pollutant emissions from the Proposed Development.

3.3.3 The approach outlined in the EPUK & IAQM guidance considers the change in pollution concentrations and the overall pollutant concentrations in the area, as compared to the relevant air quality standard. The magnitude of impact is determined quantitatively by establishing the change in pollutant concentrations at each of the selected receptors, as predicted by the dispersion modelling. Full details of the impact descriptors, which are applicable to concentrations of NO_2 and PM_{10}, are provided in **Appendix F**.

3.3.4 The EPUK & IAQM guidance does not provide criteria for determining the significance of the impacts of hourly mean NO_2 concentrations as a result of the Proposed Development. The significance of the impact on concentrations of these pollutants has therefore been determined qualitatively using professional judgement and the principles of the EPUK & IAQM significance criteria.

3.3.5 In addition to these quantitative criteria, the EPUK & IAQM guidance outlines a method that uses textual descriptors to identify the differing levels of relative priority that should be afforded to the air quality considerations of a development proposal in the planning process. A summary of the method is given in **Table 3-2**.

Table 3-2 Summary of method for Assessing the Significance of Air Quality in the Planning Process

Impacts of Development	Outcome
Development would lead to a breach or significant(1) worsening of a breach of an EU limit value; cause a new breach to occur, or introduce of new exposure into an exceedence area.	Air Quality an overriding consideration.
Lead to a breach or significant (1) worsening of a breach of an AQ Objective, or cause a new AQMA to be declared, or introduce new exposure into an area of exceedence (2).	Air Quality a high priority consideration.
Development would interfere significantly with or prevent the implementation of actions within an AQ action plan	Air Quality a high priority consideration.
Development would interfere significantly with the implementation of a local AQ strategy.	Air Quality a medium priority consideration.
Development would lead to a significant increase in emissions, degradation in air quality or increase in exposure, below the level of a breach of an objective.	Air Quality a medium priority consideration.
None of the above.	Air Quality a low priority consideration.

(1) Where the term significant is used, it will be based on the professional judgement of the Local Authority officer.

(2) This could include the expansion of an existing AQMA or introduction of new exposure to cause a new AQMA to be declared. Where new exposures is introduced this should be with reference to the exceedence area, and not the AQMA boundary.

3.3.6 In addition to these criteria, the flow chart method for determining the significance of the predicted air quality impacts of a proposed development and published in the London Councils guidance for air quality assessments has been used. A summary of the flow chart for determining significance is shown below in **Table 3-3**.

Table 3-3 Summary of the London Councils method for assessing the significance of air quality impacts

Effect of Development	Outcome
Will development interfere with or prevent implementation of measures in the AQAP	Air Quality is an overriding consideration.
Is development likely to cause a worsening of air quality or introduce new exposure into the AQMA?	Air Quality is a highly significant consideration.
Would the development contribute to air quality exceedences or lead to the designation of a new AQMA?	Air Quality is a highly significant consideration.
Is the development likely to increase emissions of or increase/introduce new exposure to PM_{10}	Air Quality is a significant consideration.
None of the above.	Air Quality is not a significant consideration but mitigation measures may still need to be considered.

3.3.7 In determining both the significance of new exposure to air pollution and the levels of mitigation required on the Proposed Development Site, consideration was given to the Air Pollution Exposure Criteria (APEC) published in the London Councils guidance for air quality assessments and shown in **Table 3-4**.

Table 3-4 London Councils Air Pollution Exposure Criteria

APEC Level	Applicable Range Annual average NO_2	Applicable Range PM_{10}	Recommendation
A	> 5% below national objective	Annual Mean > 5% below national objective 24 hour mean > 1 day less than the national objective	No air quality grounds for refusal; however mitigation of any emissions should be considered.
B	Between 5% below or above national objective	Annual Mean Between 5% below or above national objective 24 hour mean Between 1 day above or below the national objective	May not be sufficient air quality grounds for refusal, however appropriate mitigation must be considered e.g., maximise distance from pollution source, proven ventilation systems, parking considerations, winter gardens, internal layout considered and internal pollutant emissions minimised.
C	> 5% above national objective	Annual Mean > 5% above national objective 24 hour mean > 1 day more than the national objective	Refusal on air quality grounds should be anticipated, unless the Local Authority has a specific policy enabling such land use and ensure best endeavours to reduce exposure are incorporated. Worker exposure in commercial/industrial land uses should be considered further. Mitigation measures must be presented with air quality assessment, detailing anticipated outcomes of mitigation measures.

3.3.8 To address the Mayor's Air Quality Neutral policy, and in line with the 2014 Sustainable Design and Construction SPG, NO_x and PM_{10} emissions from the buildings and transport elements of the Proposed Development were calculated and compared to the benchmarks set out below.

3.3.9 Where the benchmark is exceeded mitigation is required, either locally or by way of off-setting emissions.

3.3.10 As the Proposed Development is not envisaged to have any on-site centralised heating/energy plant, the assessment of development performance against prescribed Building Emission Benchmarks (BEBs) has been scoped out.

3.3.11 Two Transport Emissions Benchmarks (TEBs) have been used as per current guidance, one for NO_x and one for PM_{10}, for the relevant land-use classes in the "Outer London" category. The benchmarks for residential dwellings are expressed in terms of grams of pollutant per dwelling per annum. The benchmarks used in the assessment are provided in **Table 3-5**.

Table 3-5 Selected Building and Transport Emission Benchmarks

Land Use Class	Benchmark Category	NO_x Benchmark	PM_{10} Benchmark
Residential (Class C3)	Building Emissions	N/A	N/A
	Transport Emissions	1553 g/dwelling/annum	267 g/dwelling/annum

3.4 SELECTION OF SENSITIVE RECEPTORS

3.4.1 Sensitive locations are places where the public or sensitive ecological habitats may be exposed to pollutants resulting from activities associated with the Proposed Development. These will include locations sensitive to an increase in dust deposition and PM_{10} exposure as a result of on-site construction activities, and locations sensitive to exposure to gaseous pollutants emitted from the proposed energy centre and from the exhausts of construction and operational traffic associated with the Proposed Development.

3.4.2 There are residential receptors in the immediate vicinity of the Proposed Development, on Sipson Road and Harmondsworth Lane. Heathrow Primary School is located approximately 200m from the Application Site. There are no designated ecological receptors in the immediate vicinity of the Proposed Development.

3.4.3 In terms of locations that are sensitive to gaseous pollutants emitted from engine exhausts (road vehicles and construction plant), these will include places where members of the public are likely to be regularly present over the period of time prescribed in the AQS.

3.4.4 For instance, on a footpath where exposure will be transient (for the duration of passage along that path) comparison with a short-term standard (i.e. 15 minute mean or 1 hour mean) may be relevant. In a school or adjacent to a private dwelling, where exposure may be for longer periods, comparison with a long-term standard (such as 24 hour mean or annual mean) may be more appropriate. Box 1.4 of LAQM.TG(09) provides examples of the locations where the air quality objectives should/should not apply, and is reproduced below as **Table 3-6.**

Table 3-6 Examples of where the air quality objectives should/should not apply

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
Annual mean	All locations where members of the public might be regularly exposed. Building facades of residential properties, schools, hospitals, care homes etc.	Building facades of offices or other places of work where members of the public do not have regular access. Hotels, unless people live there as their permanent residence. Gardens of residential properties. Kerbside sites (as opposed to locations at the building façade), or any other locations where public exposure is expected to be short term.
24-hour mean	All locations where the annual mean objective would apply, together with hotels. Gardens of residential properties.[1]	Kerbside sites (as opposed to locations at the building façade), or any other locations where public exposure is expected to be short term.

Averaging Period	Objectives should apply at:	Objectives should generally not apply at:
1-hour mean	All locations where the annual mean and 24 - hour mean objectives apply. Kerbside sites (e.g., pavements of busy shopping streets) Those parts of car parks, bus stations and railway stations etc. which are not fully enclosed, where members of the public might reasonably be expected to spend one hour or more. Any outdoor locations where members of the public might reasonably expected to spend one hour or longer.	Kerbside sites where the public would not be expected to have regular access.
15-min mean	All locations where members of the public might reasonably be exposed for a period of 15 minutes or longer.	

[1].Such locations should represent parts of the garden where relevant public exposure is likely, for example where there are seating or play areas. It is unlikely that relevant public exposure would occur at the extremities of the garden boundary, or in front gardens, although local judgement should always be applied.

3.4.5 Taking account of the above, a number of 'receptors', representative of locations of relevant public exposure, were identified at which pollution concentrations were predicted. Receptors have been located adjacent to the roads that are likely to experience the greatest change in traffic flows or composition, and therefore NO_2 and PM_{10} concentrations, as a result of the Proposed Development.

3.4.6 To complete the exposure assessment, concentrations were also predicted at a number of locations across the Proposed Development site.

3.4.7 The locations of the assessment receptors are shown on **Figures 1, 2 and 3** are listed in **Table 3-7** below. Concentrations were predicted at 1.5m, 4.5m and 7.5m representing exposure at the guideline level and at heights on different storeys of buildings for sensitive receptors.

Table 3-7 Receptor locations used in the assessment

Receptor Name	X Coordinate	Y Coordinate	Height above ground level (m)
Existing Exposure			
E1	507169	178002	1.5
E2	507193	178166	1.5
E3	507186	177920	1.5
E4	507248	177873	1.5
E5	507284	177780	1.5
E6	507295	177885	1.5
E7	507155	178023	1.5
E8	507181	178102	1.5
E9	507275	177827	1.5
Future Exposure – Option A			
N1	507252	178108	1.5 – 7.5
N2	507252	178108	1.5 – 7.5
N3	507252	178108	1.5 – 7.5
N4	507225	178030	1.5 – 7.5

NR5	507225	178030	1.5 – 7.5
NR6	507225	178030	1.5 – 7.5
NR7	507243	177959	1.5 – 7.5
NR8	507243	177959	1.5 – 7.5
NR9	507243	177959	1.5 – 7.5
NR10	507312	178049	1.5 – 7.5
NR11	507312	178049	1.5 – 7.5
NR12	507312	178049	1.5 – 7.5
NR13	507243	177968	1.5 – 7.5
NR14	507243	177968	1.5 – 7.5
NR15	507243	177968	1.5 – 7.5
NR16	507244	177978	1.5 – 7.5
NR17	507244	177978	1.5 – 7.5
NR18	507244	177978	1.5 – 7.5
NR19	507243	177987	1.5 – 7.5
NR20	507243	177987	1.5 – 7.5
Future Exposure – Option B			
NR21	507398	178228	1.5 – 7.5
NR22	507399	178253	1.5 – 7.5
NR23	507389	178264	1.5 – 7.5
NR24	507380	178264	1.5 – 7.5
NR25	507370	178264	1.5 – 7.5
NR26	507193	178246	1.5 – 7.5
NR27	507200	178232	1.5 – 7.5
NR28	507208	178207	1.5 – 7.5
NR29	507384	178223	1.5 – 7.5
NR30	507369	178223	1.5 – 7.5
NR31	507352	178226	1.5 – 7.5
NR32	507331	178217	1.5 – 7.5
NR33	507348	178261	1.5 – 7.5
NR34	507322	178262	1.5 – 7.5
NR35	507313	178258	1.5 – 7.5
NR36	507292	178255	1.5 – 7.5

4 BASELINE CONDITIONS

4.1 LBH'S REVIEW & ASSESSMENT OF AIR QUALITY

4.1.1 LBH designated an AQMA in 2001 for the whole administrative area as part of their Review and Assessment responsibilities, due to exceedences of the annual mean NO_2 and daily mean PM_{10} objectives.

4.2 LOCAL EMISSION SOURCES

4.2.1 The Application Site is located in an area where air quality is mainly influenced by emissions from road transport from the M4, which runs to the north and east (M4 Spur), and Sipson Road located adjacent to the site's western edge.

4.2.2 Immediately to the east of the M4 (approximately 80m from the boundary of the Application Site) is a mineral sand and gravel extraction site. There are also three active landfill sites nearby. These are located 100m north east of the site (miscellaneous waste), 100m south east of the site (non-biodegradable waste) and 240m south west of the site (household, commercial and industrial waste).

4.3 BACKGROUND AIR QUALITY DATA

4.3.1 **Table 3-1** presents the background concentrations that were used in the assessment. In 2013, estimated background concentrations are below the relevant objectives.

Table 4-1 Background Concentrations used in the Assessment (µg/m^3)

Coordinates (X,Y)	Pollutant	2013 Background Concentrations (µg/m^3)
507500, 178500	NO_2	37.2
	PM_{10}	22.6
507500, 177500	NO_2	38.3
	PM_{10}	21.4
506500, 177500	NO_2	35.5
	PM_{10}	20.7
505500,177500	NO_2	34.4
	PM_{10}	21.7

4.4 LOCAL AUTHORITY AIR QUALITY MONITORING DATA

4.4.1 Concentrations of NO_2 measured in the vicinity of the Proposed Development site by LBH are provided in **Table 4-2.**

Table 4-2 LBH Monitoring Data

Site ID	Site Type	X (m)	Y (m)	Within AQMA	Annual mean concentration (µg/m^3)		
					2011	2012	2013
HD57 – 25 Cranford Lane	Airport	508756	177717	Y	36.5	39.3	37.5
HD200 – 49 Zealand Avenue	Roadside	505920	177188	Y	-	37.6	41.3

4.4.2 Analysis of the monitoring results in **Table 4.2** indicates that the measured concentrations recorded in the past three years were mostly below the annual mean objective for NO_2 at these locations, with exception of HD200 in 2013, which exceeded it by 1.3µg/m^3. Trends are not clearly discernible from the data.

5 ASSESSMENT OF IMPACTS

5.1 CONSTRUCTION PHASE

DUST AND PM_{10} ARISING FROM ON-SITE ACTIVITIES

5.1.1 During the construction phase, there will be a number of activities which have the potential to generate and/or re-suspend dust and PM_{10}.

5.1.2 Dust comprises particles typically in the size range 1-75 micrometres (µm) in aerodynamic diameter and is created through the action of crushing and abrasive forces on materials. The larger dust particles fall out of the atmosphere quickly after initial release and therefore tend to be deposited in close proximity to the source of emission. Dust therefore, is unlikely to cause long-term or widespread changes to local air quality; however, its deposition on property and cars can cause 'soiling' and discolouration. This may result in complaints of nuisance through amenity loss or perceived damage caused, which is usually temporary.

5.1.3 The smaller particles of dust (typically less than 10µm in aerodynamic diameter) are known as particulate matter (PM_{10}) and represent only a small proportion of total dust released. As these particles are at the smaller end of the size range of dust particles they remain suspended in the atmosphere for a longer period of time than the larger dust particles, and can therefore be transported by wind over a wider area. PM_{10} is small enough to be drawn into the lungs during breathing, which in sensitive members of the public could have a potential impact on health. Therefore, standards and objectives for PM_{10} are defined in the AQS and Regulations, and the impact of this phase on PM_{10} concentrations is referred to below as the impact on 'human health'.

5.1.4 Significant increases in dust deposition levels and particulate matter concentrations can also affect sensitive vegetation by blocking stomata, reducing photosynthesis and plant growth.

5.1.5 Construction activities that have the potential to generate and/or re-suspend dust and PM_{10}. include:

- Site clearance and preparation including demolition activities;
- Preparation of temporary access/egress to the Application Site and haulage routes;
- Earthworks;
- Materials handling, storage, stockpiling, spillage and disposal;
- Movement of vehicles and construction traffic within the Application Site (including excavators and dumper trucks);
- Use of crushing and screening equipment/plant;
- Exhaust emissions from site plant, especially when used at the extremes of their capacity and during mechanical breakdown;
- Construction of buildings, roads and areas of hardstanding alongside fabrication processes;
- Internal and external finishing and refurbishment; and
- Site preparation and restoration after completion.

5.1.6 The majority of the releases are likely to occur during the 'working week'. However, for some potential release sources (e.g. exposed soil produced from significant earthwork activities) in the absence of dust control mitigation measures, dust generation has the potential to occur 24 hours per day over the period during which such activities are to take place.

ASSESSMENT OF POTENTIAL DUST EMISSION MAGNITUDE

5.1.7 The IAQM assessment methodology has been used to determine the potential dust emission magnitude for the following four different dust and PM_{10} sources: demolition; earthworks; construction; and, trackout. The findings of the assessment are presented below.

DEMOLITION

5.1.8 It is proposed that the existing structures at the Application Sites will be demolished in order to facilitate the Proposed Development. The scale and type of demolition activities is expected to be less than 20,000m^3 with activities occurring no higher than 10m above ground level. Therefore, the magnitude of dust and PM_{10} emissions is considered **small** for demolition activities.

EARTHWORKS

5.1.9 The total area of the Application Site is approximately 74,000m^2 (0.74ha) in size, the soil type is assumed to be potentially dusty, the total material moved is estimated to be below 20,000 tonnes. Therefore the magnitude of dust and PM_{10} emissions is conservatively considered **medium** for earthworks activities

CONSTRUCTION

5.1.10 The total volume of buildings to be constructed on the Application Site has conservatively been assumed to be between 25,000-100,000m^3. Therefore, the potential dust emission magnitude is considered to be **medium** for construction activities.

TRACKOUT

5.1.11 It is anticipated that at peak construction there will be less than 10 HDV (>3.5t) outward movements in any one day. However, due to the size of the site, it is assumed that the length of unpaved road within Application Site may be greater than 100m. Therefore, in the absence of more definitive information, it is considered that the magnitude of dust and PM_{10} emissions is **medium** for trackout.

5.1.12 **Table 10** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 5-1 Potential Dust Emission Magnitude

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Medium
Construction Activities	Medium
Trackout	Medium

ASSESSMENT OF SENSITIVITY OF THE STUDY AREA

5.1.13 A windrose generated using the meteorological data used for the dispersion modelling of operational phases impacts is provided in **Appendix G**. This shows that the prevailing wind direction is predominantly from the southwest, with a fairly significant component from the

northeast. Therefore, receptors located to northeast of the Application Site are most likely to be affected by dust and particulate matter emitted and re-suspended during the construction phase, with a risk of impacts at any properties to the southwest of the Application Site.

5.1.14 Depending on wind speed and turbulence, it is likely that the majority of dust would be deposited in the area immediately surrounding the source. The Application Site is located on the fringe of an urban area and it is estimated that there are between 100 and 200 dwellings within 350m of the site. There are between 10 and 100 existing dwellings located within 20m of the Application Site boundary.

5.1.15 Background PM_{10} concentrations in the vicinity of the Application Site are below 24µg/m^3.

5.1.16 Taking the above into account and following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in **Table 5-2.**

Table 5-2 Sensitivity of the Study Area

Potential Impact	Sensitivity of the Surrounding Area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Medium	High	High	High
Human Health	Low	Low	Low	Low

RISK OF IMPACTS

5.1.17 The predicted dust emission magnitude has been combined with the defined sensitivity of the area to determine the risk of impacts during the construction phase, prior to mitigation. **Table 5-3** below provides a summary of the risk of dust impacts for the Proposed Development. The risk category identified for each construction activity has been used to determine the level of mitigation required. Overall, the Proposed Development is judged to be of **medium** to **negligible** risk of construction impacts.

Table 5-3 Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust Soiling	Low Risk	Medium Risk	Medium Risk	Medium Risk
Human Health	Negligible	Low Risk	Low Risk	Low Risk

CONSTRUCTION VEHICLES & PLANT

5.1.18 The greatest impact on air quality due to emissions from vehicles and plant associated with the construction phase will be in the areas immediately adjacent to the site access. It is anticipated that construction traffic will access the site via the A408 (Sipson Road). Due to the size of the site, it is considered likely that the construction traffic flows will be low in comparison to the existing traffic flows on this road.

5.1.19 Final details of the exact plant and equipment likely to be used on site will be determined by the appointed contractor, however, it is considered likely to comprise Dump Trucks, Tracked Excavators, Diesel Generators, Rollers, Compressors and Trucks. The number of plant and their location within the site are likely to be variable over the construction period, however it is considered unlikely that there will be more than 5 heavy earth moving vehicles active on site at any one time.

5.1.20 Based on the current local air quality in the area, the proximity of sensitive receptors to the roads likely to be used by construction vehicles, and the likely numbers of construction vehicles and plant that will be used, the impacts are therefore considered to be of **negligible** significance according to the EPUK & IAQM significance criteria.

5.2 OPERATION PHASE

5.2.1 Full results of the dispersion modelling are presented in **Appendix H** and a summary is provided below.

ANNUAL MEAN NO_2 CONCENTRATIONS

5.2.2 The objective for annual mean NO_2 concentrations is 40µg/m^3 to be achieved by the end of 2005 and thereafter. The results of the assessment show that in the 2013 baseline case concentrations exceed the objective value of 40µg/m^3 at all of the 9 modelled receptors. The highest predicted concentration is 49.4µg/m^3 at Receptor E1.

5.2.3 These results agree with the conclusions of the review and assessment work undertaken by LBH, which concluded that exceedences of the annual mean NO_2 objective were likely across the borough.

5.2.4 By 2019, the opening year of the Proposed Development, concentrations at the receptors both with and without the development are slightly increased from the 2013 baseline case, due to the conservative assumption that emission factors and background concentrations do not decrease in future years and some traffic growth on the local road network. The absolute concentrations exceed the objective of 40µg/m^3 at all of the 9 assessment receptors, both without or with the Proposed Development in operation.

5.2.5 The highest concentrations are predicted at Receptor E1 where the predicted concentrations are 50.2µg/m^3 and 50.4µg/m^3 for the 'without development' and 'with development' scenario, respectively. The greatest increase in concentrations due to the redevelopment is 0.2µg/m^3 at Receptor E1, which given the high concentrations present, is classed as Moderate Significance, according to the EPUK & IAQM and IAQM significance criteria. Overall however, the impact of the development on NO_2 concentrations can be classed as **negligible**, as all other change is classed as negligible, based on the EPUK & IAQM guidance.

5.2.6 With regards to the new exposure, in Option A, the highest recorded concentration predicted is 41.8µg/m^3 at receptor NR3_1, and of the 60 receptors modelled, 55 are predicted to exceed the 40µg/m^3 annual mean objective. Based on the London Councils' APEC, in the 2019 opening year, all of the modelled future exposure receptors fall within APEC Level B for annual mean NO_2 concentrations.

5.2.7 Option B predicts slightly higher concentrations across the north of the site, with the highest recorded concentration predicted is 44.4µg/m^3, predicted at receptor NR21_1, and of the 48 receptors modelled, 42 are predicted to exceed the 40µg/m^3 annual mean objective. Based on the London Council's APEC, 16 of the modelled receptors fall under APEC Level C, and the remaining 32 fall under APEC Level B.

5.2.8

HOURLY MEAN NO_2 CONCENTRATIONS

5.2.9 Annual mean concentrations predicted at all future exposure receptors are below 60µg/m^3 and therefore it is unlikely that future residents will be exposed to concentrations which exceed the hourly mean NO_2 objective.

5.2.10 In addition to this, the impacts of the proposed development on NO_2 concentrations are considered to be negligible, and therefore the impact of the Proposed Development on hourly mean NO_2 concentrations at existing sensitive receptors is also judged to be **negligible**.

ANNUAL MEAN PM_{10} CONCENTRATIONS

5.2.11 The objective for annual mean PM_{10} concentrations is a concentration of 40µg/m^3 to be achieved by the end of 2004 and thereafter. The results of the assessment show that in the 2013 baseline case concentrations at all of the receptors considered are predicted to meet the objective. The highest predicted concentration is 24.7µg/m^3 at Receptor E1.

5.2.12 By 2019, the highest predicted concentrations are again predicted at Receptor E1, and are 24.9µg/m^3 and 25.0µg/m^3 in the 'without development' and 'with development' scenarios respectively. The greatest increase in concentrations due to the redevelopment is 0.05µg/m^3 at Receptors E1.

5.2.13 The increases in concentrations with the Proposed Development operational are all imperceptible and the impact is judged to be **negligible**.

5.2.14 Based on the London Councils' APEC, in the 2019 opening year scenario, annual mean PM_{10} concentrations at all of the modelled receptors for both Option A and B fall within APEC Level A, i.e. no air quality grounds for refusal.

DAILY MEAN PM_{10} CONCENTRATIONS

5.2.15 The objective for 24 hourly mean PM_{10} concentrations is 50µg/m^3 to be exceeded no more than 35 times a year by the end of 2004 and thereafter. The results of the dispersion modelling indicate that the maximum days of exceedence per year would be 12 (at Receptor E1) in the 2013 baseline case, 2019 'without development' scenario and 2019 'with development' scenario.

5.2.16 Based on the EPUK & IAQM significance criteria, the impact of the Proposed Development on daily mean PM_{10} concentrations is **negligible**.

5.2.17 According to the London Councils' APEC, in the opening year the proposed development is APEC Level A for daily mean PM_{10} concentrations.

AIR QUALITY NEUTRAL ASSESSMENT

5.2.18 The air quality neutral assessment took into account figures pertaining to GFA, number of dwellings and anticipated vehicle trip generation rates in respect of the Proposed Development. These figures were provided by the project architects and using a combination of project-specific data and default factors from air quality neutral assessment guidance, and are presented in **Table 5-4** (the figures are applicable to both Options A and B).

Table 5-4 Parameters Used in Air Quality Neutral Assessment Calculations

Parameter	Proposed Development Values
Gross Floor Area	Class C3 – 5,075 sqm
Number of New Residential Units	53
Annual Vehicle Trip Generation	Class C3 – 116,699 Est. Annual Trips

5.2.19 Performance against the TEB policy standards was found to be deficient in respect of both NO_x and PM_{10}. Where a benchmark is exceeded, on- or off-site mitigation or offsetting (likely to be financial, but subject to confirmation) is required. A summary of the findings of this assessment are presented in **Table 5-5**.

Table 5-5 Summary of Air Quality Neutral Assessment Results

Category	Parameter	NO_x (kg/annum)	PM_{10} (kg/annum)
Transport Emissions	Benchmark	82.3	14.2
	Proposed Development	469.6	80.6
	Category Deficit	387.3	66.5

ASSESSMENT OF IMPACTS OF DUST AND PM_{10} EMISSIONS GENERATED BY THE OPERATION OF MINERAL EXTRACTION AND LANDFILL SITES ON LOCAL AIR QUALITY

5.2.20 The IAQM assessment methodology has been deemed an appropriate method to determine the potential dust emission magnitude for earthworks activities and trackout at the nearby sites. The findings of the assessment are presented below. Where specific information was not available, professional judgement has been used.

EARTHWORKS

5.2.21 The total area of the surrounding active mineral extraction and landfill sites is approximately 7,200m^2 (0.72ha) in size, the soil type is assumed to be potentially dusty and the total material moved is estimated to range between 20,000 and 100,000 tonnes. Therefore the magnitude of dust and PM_{10} emissions is considered **medium** for earthworks activities.

TRACKOUT

5.2.22 It is anticipated that, at peak, there will be between 10 and 50 HDV (>3.5t) outward vehicle movements at these sites in any one day. Due to the size of the sites, it is assumed that the length of internal unpaved roads will be greater than 100m. Therefore, in the absence of more definitive information, it is conservatively considered that the magnitude of dust and PM_{10} emissions is **large** for trackout.

5.2.23 **Table 5-6** provides a summary of the potential dust emission magnitude determined for each construction activity considered.

Table 5-6 Potential Dust Emission Magnitude From Nearby Landfill Sites

Activity	Dust Emission Magnitude
Earthworks	Medium
Trackout	Large

ASSESSMENT OF SENSITIVITY OF THE APPLICATION SITE

5.2.24 As described above, the prevailing wind direction is predominantly from the southwest, with a portion coming from the northeast. The Application Site is located such that it will be upwind of the nearest active works for the majority of the time.

5.2.25 The background PM_{10} concentrations and the respective distances and locations of the sites to the Application Site have been considered in the determination of the Application Site's sensitivity. Following the IAQM assessment methodology, the sensitivity of the area to changes in dust and PM_{10} has been derived for each of the construction activities considered. The results are shown in **Table 5-7.**

Table 5-7 Sensitivity of the Application Site With Regards To Nearby Minerals Extraction and Landfill Sites

Potential Impact	Sensitivity of the Surrounding Area	
	Earthworks	Trackout
Dust Soiling	Low	Dust Soiling
Human Health	Low	Human Health

RISK OF IMPACTS

5.2.26 The predicted dust emission magnitude has been combined with the defined sensitivity of the Application Site to determine the risk of impacts. **Table 5-8** below provides a summary of the risk of dust impacts on the Proposed Development. Overall, the Proposed Development is expected to be subject to **low** risk of dust and PM_{10} impacts as a result of operations at the surrounding sites.

Table 5-8 Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk	
	Earthworks	Trackout
Dust Soiling	Low Risk	Dust Soiling
Human Health	Low Risk	Human Health

6 MITIGATION & RESIDUAL EFFECTS

6.1 CONSTRUCTION PHASE

MITIGATION

6.1.1 Based on the assessment results, the mitigation measures to be implemented to eliminate the identified risk of dust impacts associated with the various activities of the construction phase of the Proposed Development are listed below.

GENERAL COMMUNICATION

- A stakeholder communications plan that includes community engagement before work commences on site should be developed and implemented; and
- The name and contact details of person(s) accountable for air quality and dust issues needs to be displayed on the site boundary. This may be the environment manager/engineer or the site manager. The head or regional office contact information should also be displayed.

GENERAL DUST MANAGEMENT

- A Dust Management Plan (DMP), which may include measures to control other emissions, in addition to the dust and PM_{10} mitigation measures given in this report, should be developed and implemented, and approved by the Local Authority. In London, additional measures may be required to ensure compliance with the Mayor of London's guidance. The DMP may include a requirement for monitoring of dust deposition, dust flux, realtime PM_{10} continuous monitoring and/or visual inspections.

SITE MANAGEMENT

- Record all dust and air quality complaints and identify the 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;
- Any exceptional incidents that cause dust and/or air emissions, either on- or offsite need to be recorded, and the action taken to resolve the situation recorded in the log book; and
- Regular liaison meetings with any high risk construction sites within 500m of the site boundary need to be held, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes.

MONITORING

- Daily on-site and off-site inspections must be undertaken, where receptors (including roads) are nearby to monitor dust. The inspection results should be recorded and made available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary;
- Regular site inspections to monitor compliance with the DMP must carried out, inspection results recorded, and an inspection log made 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;

- Any dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations are to be discussed and agreed with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a large site, before work on a phase commences.

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 active for an extensive period;
- Avoid site runoff of water or mud;
- Keep site fencing, barriers and scaffolding clean using wet methods; and
- 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 appropriately.

OPERATING VEHICLE/MACHINERY AND SUSTAINABLE TRAVEL

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRMM standards, where applicable;
- 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;
- All non road mobile machinery (NRMM) to use ultra-low sulphur tax-exempt diesel (ULSD) where available;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

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; and
- 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.

MEASURES SPECIFIC TO DEMOLITION

- Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust;
- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground;
- Avoid explosive blasting, using appropriate manual or mechanical alternatives;
- Bag and remove any biological debris or damp down such material before demolition; and
- Securely cover skips and minimise drop heights.

MEASURES SPECIFIC TO 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;
- Stockpile surface areas to be minimised (subject to health and safety and visual constraints regarding slope gradients and visual intrusion) to reduce area of surfaces exposed to wind pick-up;
- Where appropriate, windbreak netting/screening can be positioned around material stockpiles and vehicle loading/unloading areas, as well as exposed excavation and material handling operations, to provide a physical barrier between the Application Site and the surroundings;
- Where practicable, stockpiles of soils and materials should be located as far as possible from sensitive properties, taking account of the prevailing wind direction; and
- During dry or windy weather, material stockpiles and exposed surfaces could be dampened down using a water spray to minimise the potential for wind pick-up.

MEASURES SPECIFIC TO 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 particular process, in which case ensure that appropriate additional control measures are in place;
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust; and
- All construction plant and equipment should be maintained in good working order and not left running when not in use.

MEASURES SPECIFIC TO TRACKOUT

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use;
- Avoid dry sweeping of large areas;

- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport;
- 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;
- Consider implementing a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site) where reasonably practicable; and
- Access gates to be located at least 10m from receptors where possible.

RESIDUAL EFFECTS

6.1.2 The residual effects of dust and PM_{10} generated by construction activities following the application of the mitigation measures described above and good site practice is considered to be **negligible**.

6.1.3 The residual effects of emissions to air from construction vehicles and plant on local air quality is considered to be **negligible.**

6.2 OPERATION PHASE

MITIGATION

6.2.1 The change in NO_2 and PM_{10} concentrations attributable to emissions associated with the operation phase of the Proposed Development (i.e. impacts on local air quality) are **negligible** (themselves not warranting the need for mitigation), for both Options A and B.

6.2.2 The existing ambient NO_2 concentrations however, are such that it is proposed that a means of mechanical ventilation be considered for the Proposed Development. The results of the assessment indicate that new residential exposure receptors fall within the London Council's APEC Level B in Option A, and both B and C in Option B, therefore, it is recommended that appropriate mitigation be considered in respect of the development's ventilation strategy.

6.2.3 Additionally it is recommended that the Proposed Development provides electric vehicle charging points or a charging bay in a parking area (to be agreed with LBH), to support improvement in local air quality.

6.2.4 The risk of dust impacts at the Proposed Development on account of the activities at nearby minerals extraction and landfill sites will be mitigated by means of the proposed landscaped vegetation barrier on the eastern boundary of the Application Site.

RESIDUAL EFFECTS

6.2.5 The Proposed Development is predicted to result in an imperceptible increase in NO_2 and PM_{10} concentrations at modelled existing receptors. The residual effects of the Proposed Development on air quality at existing properties are **negligible** based on the EPUK & IAQM significance criteria.

6.2.6 With the implementation of suitable mitigation measures (e.g. mechanical ventilation system with filters) in place, future users of the Proposed Development would not be exposed to annual mean NO_2 concentrations that exceed the AQS objectives. The residual effect on future residents would thus be **negligible**.

6.2.7 The significance of potential dust and PM_{10} impacts from the nearby minerals extraction and landfill sites is expected to be **negligible**.

7 CONCLUSIONS

7.1.1 A qualitative assessment of the potential impacts on local air quality from construction activities has been carried out for this phase of the Proposed Development using the IAQM methodology (this is the same for Options A and B). This assessment identified that the Proposed Development is considered to be a **low** to **medium risk** site for dust deposition and PM_{10} concentrations. However, through good site practice and the implementation of suitable mitigation measures, the effect of dust and PM_{10} releases would be significantly reduced, with residual effects considered to be **negligible**. The residual effects of emissions to air from construction vehicles and plant on local air quality is also considered to be **negligible**.

7.1.2 In addition, a quantitative assessment of the potential impacts during the operational phase was undertaken using ADMS Roads to predict the changes in NO_2 and PM_{10} concentrations that would occur due to traffic generated by the Proposed Development. The results show that the Proposed Development would bring about an imperceptible increase in pollutant concentrations; consequently the Proposed Development is judged to have a **negligible** impact on air quality at existing properties.

7.1.3 The nearby minerals extraction and landfill sites are expected to present a risk of **negligible** significance in respect of the levels of dust and PM_{10} experienced by future residents of the Proposed Development.

7.1.4 A number of the receptors introduced as part of the Proposed Development are predicted to experience concentrations of NO_2 which exceed the annual mean objective, and fall within APEC Level B in Option A, and both B and C in Option B. It is recommended that appropriate mitigation be considered in respect of the development's ventilation strategy. Notwithstanding this recommendation, it is important to note that the air quality assessment has assumed no improvement (reduction) in vehicle emissions factors and background concentrations over time between 2013 and 2019. This is therefore considered to represent a worst-case assessment of future NO_2 and PM_{10} concentrations within and in the vicinity of the Proposed Development.

7.1.5 Based on the assessment significance criteria, the residual effects of the Proposed Development are considered to be **negligible**.

7.1.6 Furthermore, it is considered that the development proposals comply with national and local policy for air quality, and air quality is considered to be a low priority within the planning process.

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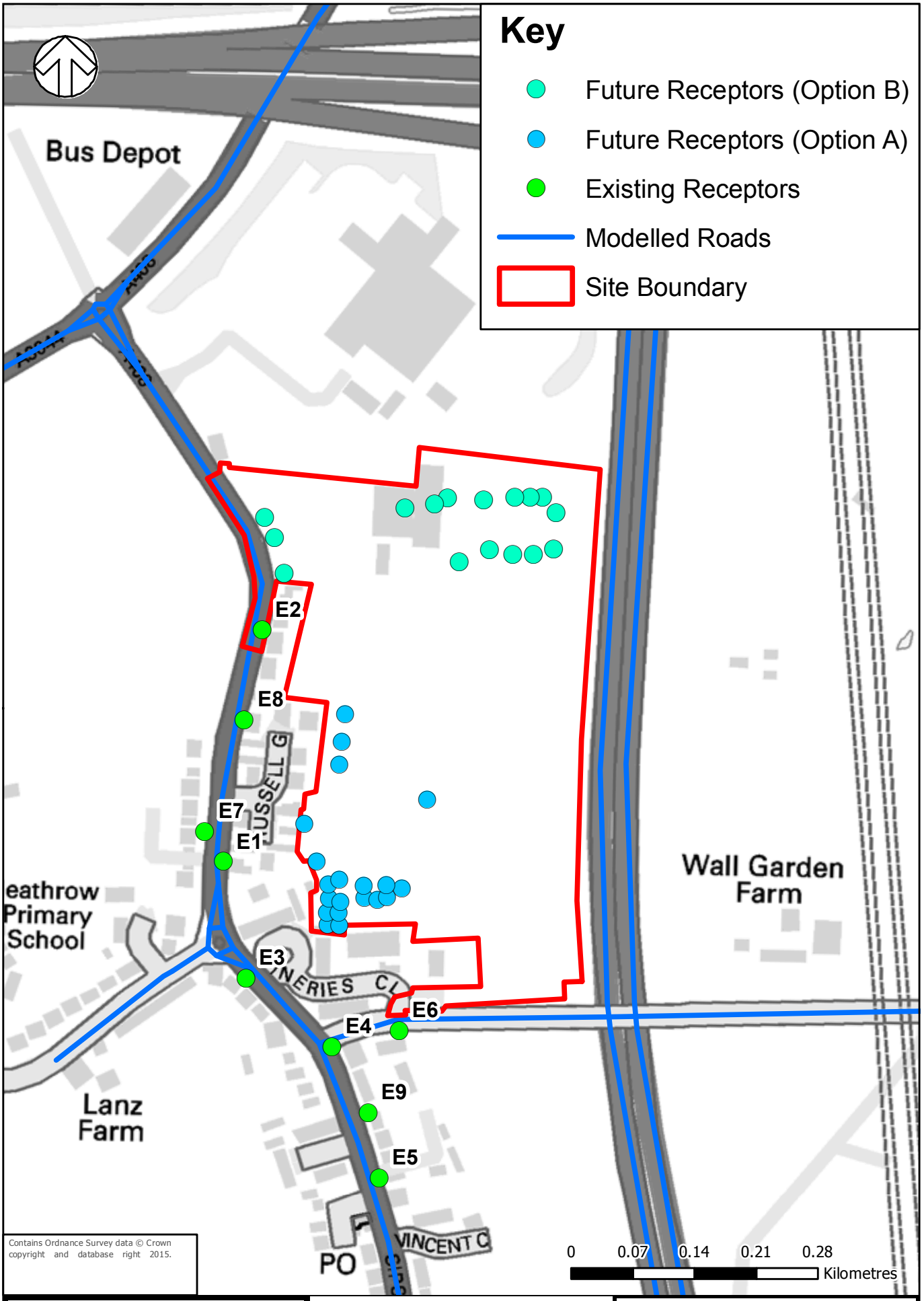

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HEATHROW GARDEN CENTRE

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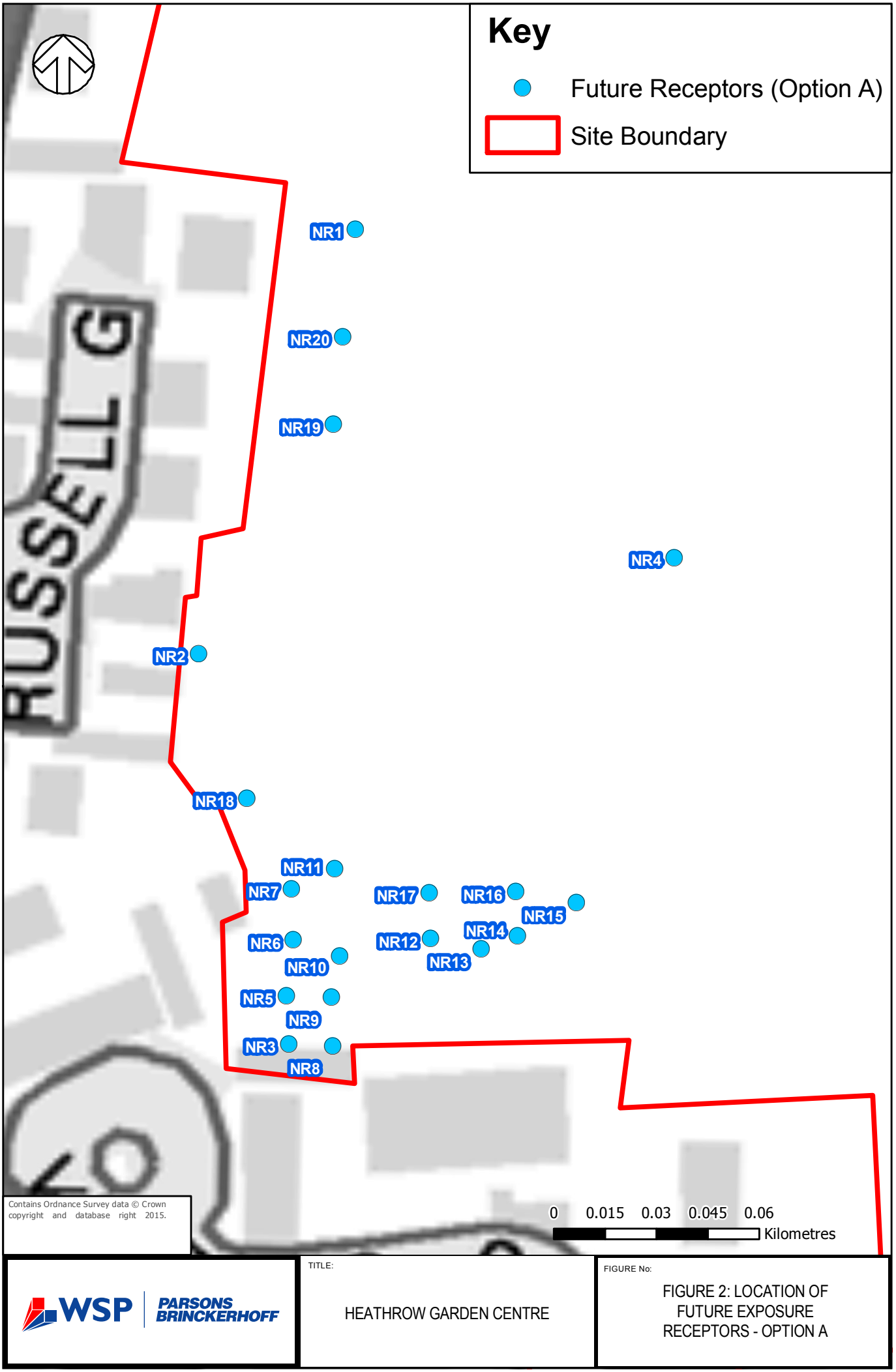
FIGURE 1
LOCATION OF
EXISTING RECEPTORS



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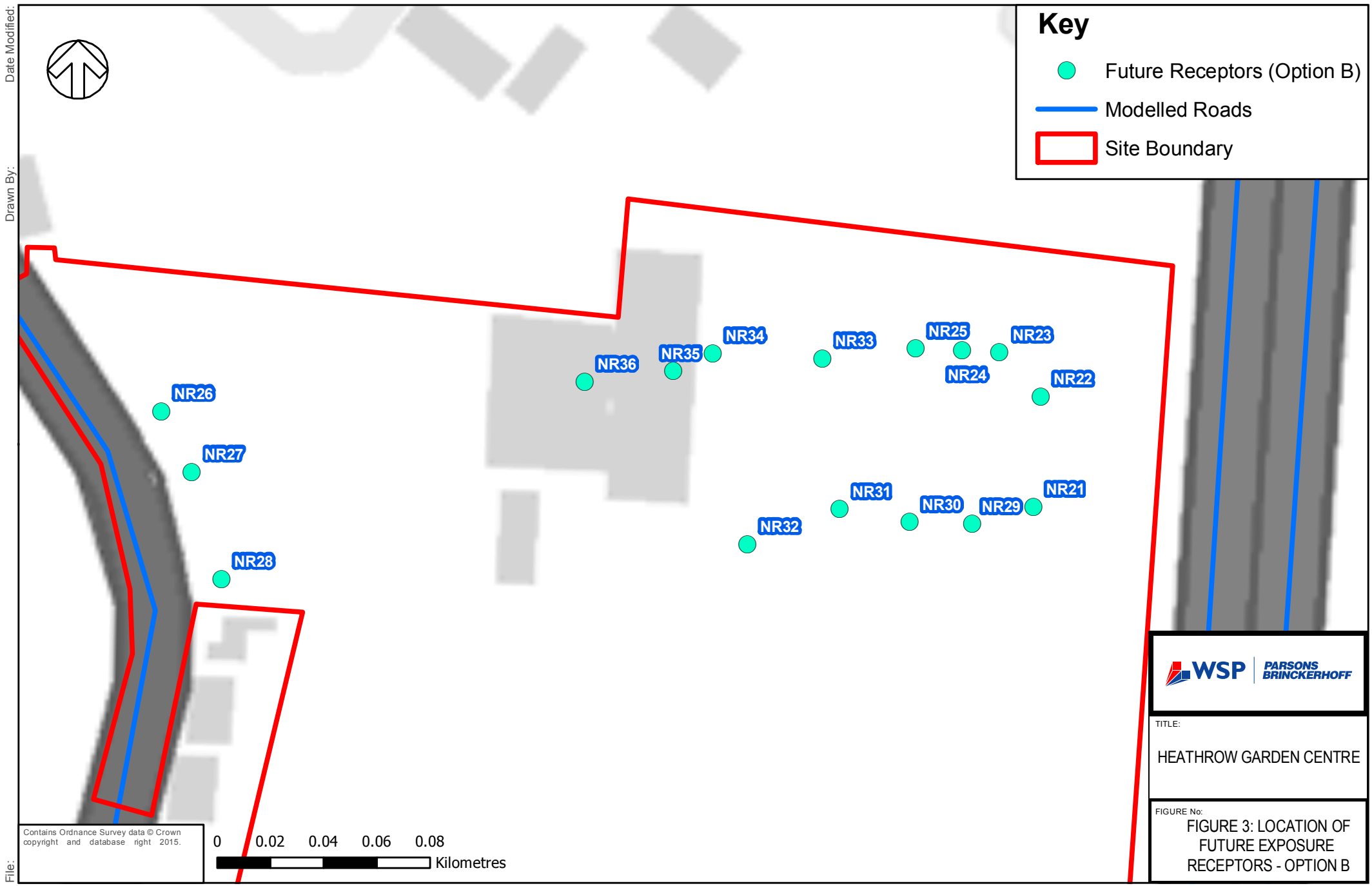
HEATHROW GARDEN CENTRE

FIGURE No:

FIGURE 2: LOCATION OF FUTURE EXPOSURE RECEPTORS - OPTION A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Future Receptors (Option B)
Modelled Roads
Site Boundary
NR21
NR22
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NR28
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NR30
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NR32
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FIGURE 3: LOCATION OF FUTURE EXPOSURE RECEPTORS - OPTION B

Appendix A

GLOSSARY

Term	Definition
AADT Annual Average Daily Traffic	A daily total traffic flow (24 hrs), expressed as a mean daily flow across all 365 days of the year.
Adjustment	Application of a correction factor to modeled results to account for uncertainties in the model
Accuracy	A measure of how well a set of data fits the true value.
Air quality objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedences within a specific timescale (see also air quality standard).
Air quality standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups (see also air quality objective).
Ambient air	Outdoor air in the troposphere, excluding workplace air.
Annual mean	The average (mean) of the concentrations measured for each pollutant for one year.
AQMA	Air Quality Management Area.
Conservative	Tending to over-predict the impact rather than under-predict.
DEFRA	Department for Environment, Food and Rural Affairs.
Emission rate	The quantity of a pollutant released from a source over a given period of time.
Exceedence	A period of time where the concentrations of a pollutant is greater than the appropriate air quality standard.
HDV/HGV	Heavy Duty Vehicle/Heavy Goods Vehicle.
LAQM	Local Air Quality Management.
Minor roads	Non A roads of Motorways.
Model adjustment	Following model verification, the process by which modelled results are amended. This corrects for systematic error.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Road link	A length of road which is considered to have the same flow of traffic along it. Usually, a link is the road from one junction to the next.
$\mu g/m^3$ microgrammes per cubic metre	A measure of concentration in terms of mass per unit volume. A concentration of $1ug/m^3$ means that one cubic metre of air contains one microgram (millionth of a gram) of pollutant.
Uncertainty	A measure, associated with the result of a measurement, which characterizes the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the

Term	Definition
	range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it on recent European legislation.
Validation (modelling)	Refers to the general comparison of modelled results against monitoring data carried out by model developers.
Verification (modelling)	Comparison of modelled results versus any local monitoring data at relevant locations.

Appendix B

RELEVANT UK AIR QUALITY STRATEGY OBJECTIVES

Air Quality Objectives currently included in the Air Quality Regulations 2000 and (Amendment) Regulations 2002 for the purpose of Local Air Quality Management (LAQM)						
Pollutant	**Applies to**	***Standard***		***Objective***		**EU Limit Values**
		Concentration	***Measured as***	***Annual exceedences allowed***	***Target date***	
Nitrogen dioxide (NO_2)	All UK	200µg/m^3	1 hour mean	18	31.12.2005	01.01.2010
	All UK	40µg/m^3	annual mean	-	31.12.2005	
Particulate Matter (PM_{10}) (gravimetric)[1]	All UK	40µg/m^3	annual mean	-	31.12.2004	01.01.2005
	All UK	50µg/m^3	24 hour mean	35	31.12.2004	01.01.2005

Explanation
µg/m^3 = microgram per cubic metre; [1] Measured using the European gravimetric transfer sampler or equivalent.

Appendix C

SUMMARY OF IAQM CONSTRUCTION PHASE IMPACT ASSESSMENT PROCEDURE

Step 1 – Screen the need for a Detailed Assessment

Step 2A – Define the Potential Dust Emission Magnitude

The following are examples of how the potential dust emission magnitude for different activities can be defined. (Note that not all the criteria need to be met for a particular class).

1) Demolition

- Large: Total building volume >50 000 m^3 potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- Medium: Total building volume 20 000 m^3 – 50 000m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- Small: Total building volume <20 000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

2) Earthworks

- Large: Total site area >10 000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100 000 tonnes;
- Medium: Total site area 2 500 m^2 – 10 000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20 000 tonnes – 100 000 tonnes; and,
- Small: Total site area <2 500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10 000 tonnes, earthworks during wetter months.

3) Construction Activities

- Large: Total building volume >100 000 m^3, on site concrete batching, sandblasting
- Medium: Total building volume 25 000 m^3 – 100 000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching; and
- Small: Total building volume <25 000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber).

4) Trackout

- Large: >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100m;
- Medium: 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50m – 100m; and
- Small / Medium: <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50m.

Step 2B – Define the Sensitivity of the Area

The tables below presents the IAQM assessment methodology determines the sensitivity of the area can be determined for dust soiling, human health and ecological impacts respectively. The IAQM guidance also provides examples of the sensitivity of different types of receptors to dust soiling, health effects and PM_{10} effects to help with determining the area sensitivity to construction phase impacts.

Table 2B: Sensitivity of the Area to Dust Soiling Effects

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table 2B: Sensitivity of the Area to Human Health Impacts

Receptor Sensitivity	Annual Mean PM_{10} Concentration ($\mu g/m^3$)	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low

Medium	-	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 2B: Sensitivity of the Area to Ecological Impacts

Receptor Sensitivity	Distance from the Sources (m)	
	<20	<50
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C – Define the Risk of Impacts

The dust emissions magnitude determined at Step 2A should be combined with the sensitivity of the area determined at Step 2B to determine the risk of impacts with no mitigation applied. For those cases where the risk category is 'negligible' no mitigation measures beyond those required by legislation will be required.

Table 2C: Risk of Dust Impacts – Demolition

Sensitivity of surrounding 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 2C: Risk of Dust Impacts – Earthworks

Sensitivity of surrounding 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 2C: Risk of Dust Impacts – Construction

Sensitivity of surrounding 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 2C: Risk of Dust Impacts – Trackout

Sensitivity of surrounding area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Step 3 –Site Specific Mitigation

Having determined the risk categories for each of the four activities it is possible to determine the site-specific measures to be adopted. These measures will be related to whether the site is considered to be a low, medium or high risk site. The IAQM guidance details the mitigation measures required for high, medium and low risk sites as determined in Step 2C.

Step 4 – Determine Significant Effects

Once the risk of dust impacts has been determined in Step 2C and the appropriate dust mitigation measures identified in Step 3, the final step is to determine whether there are significant effects arising from the construction phase.

Step 5 – Prepare the dust assessment report

Appendix D

TRAFFIC DATA

Baseline (2013)

Road ID	Road Link	Annual Average Daily Traffic Flow	%HDVs	Speed (kph)	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Holloway Lane (A408)	1 Split App	8212	6.1	26	0.076	0.004
Holloway Lane (A408)	1 Split	8212	6.1	96	0.049	0.004
Holloway Lane (A408)	1 Split App	8212	6.1	26	0.076	0.004
Holloway Lane (A408)	1 Split	8212	6.1	96	0.049	0.004
Holloway Lane (A408)	1	16423	6.1	96	0.097	0.008
Holloway Lane (A408)	1 App	16423	6.1	26	0.151	0.009
Holloway Lane (A408)	1 Split App	8212	6.1	26	0.076	0.004
Holloway Lane (A408)	1 Split App	8212	6.1	26	0.076	0.004
A408/A3044/Sip Rd (N) Roundabout	R/About_123	20830	5.6	26	0.162	0.010
Holloway Lane (A3044)	2 Split App	7339	3.0	26	0.054	0.004
Holloway Lane (A3044)	2 Split App	7339	3.0	26	0.054	0.004
Sipson Road (N)	3 Split App	5279	2.1	26	0.036	0.002
Sipson Road (N)	3 Split App	5279	2.1	26	0.036	0.002
Sipson Road (N)	3	10558	2.1	40	0.057	0.005
Sipson Road (N)	3 Split App	5279	2.1	26	0.036	0.002
Sipson Road (N)	3 Split App	5279	2.1	26	0.036	0.002
Sip Rd (N)/Sip Rd (S)/ Harm Ln Roundabout	R/About_345	9746	1.9	26	0.061	0.005
Sipson Road (S)	4 Split App	3429	1.6	26	0.022	0.002
Sipson Road (S)	4 Split App	3429	1.6	26	0.022	0.002
Sipson Road (S)	4 App	6858	1.6	26	0.044	0.003
Sipson Road (S)	4	6858	1.6	32	0.040	0.003
Sipson Lane	6 App	5605	0.6	26	0.033	0.003
Sipson Lane	6	5605	0.6	48	0.024	0.002
Holloway Lane (A3044)	2 App	14678	3.0	26	0.108	0.007
Holloway Lane (A3044)	2	14678	3.0	96	0.077	0.007
Sipson Road (N)	3 App	10558	2.1	26	0.071	0.005
Harmondsworth Lane	5	2075	0.1	40	0.009	0.001
M4 Spur	7 Split Split App	14870	1.1	26	0.107	0.005
M4 Spur	7 Split Split App	14870	1.1	26	0.107	0.005
M4 Spur	7 Split	29739	1.1	80	0.144	0.009
M4 Spur	7 Split Split App	14870	1.1	26	0.107	0.005
M4 Spur	7 Split Split App	14870	1.1	26	0.107	0.005
M4 Spur	7 Split	29739	1.1	80	0.144	0.009
Sipson Road (S)	4 App	6858	1.6	26	0.044	0.003
Sipson Road (S)	4 App	6858	1.6	26	0.044	0.003
Sipson Road (S)	4	6858	1.6	32	0.040	0.003
Harmondsworth Lane	5 App	2075	0.1	26	0.011	0.001
Hatch Lane (Zealand Avenue)	8 App	14678	3.0	26	0.108	0.007
Hatch Lane (Zealand Avenue)	8	14678	3.0	48	0.077	0.007

Opening Year Without Development (2019)

Road ID	Road Link	Annual Average Daily Traffic Flow	%HDVs	Speed (kph)	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Holloway Lane (A408)	1 Split App	8832	6.1	26	0.081	0.005
Holloway Lane (A408)	1 Split	8832	6.1	96	0.052	0.005
Holloway Lane (A408)	1 Split App	8832	6.1	26	0.081	0.005
Holloway Lane (A408)	1 Split	8832	6.1	96	0.052	0.005
Holloway Lane (A408)	1	17665	6.1	96	0.105	0.009
Holloway Lane (A408)	1 App	17665	6.1	26	0.163	0.009
Holloway Lane (A408)	1 Split App	8832	6.1	26	0.081	0.005
Holloway Lane (A408)	1 Split App	8832	6.1	26	0.081	0.005
A408/A3044/Sip Rd (N) Roundabout	R/About_123	22404	5.6	26	0.174	0.011
Holloway Lane (A3044)	2 Split App	7894	3.0	26	0.058	0.004
Holloway Lane (A3044)	2 Split App	7894	3.0	26	0.058	0.004
Sipson Road (N)	3 Split App	5678	2.1	26	0.038	0.003
Sipson Road (N)	3 Split App	5678	2.1	26	0.038	0.003
Sipson Road (N)	3	11356	2.1	40	0.061	0.005
Sipson Road (N)	3 Split App	5678	2.1	26	0.038	0.003
Sipson Road (N)	3 Split App	5678	2.1	26	0.038	0.003
Sip Rd (N)/Sip Rd (S)/ Harm Ln Roundabout	R/About_345	10482	1.9	26	0.066	0.005
Sipson Road (S)	4 Split App	3688	1.6	26	0.024	0.002
Sipson Road (S)	4 Split App	3688	1.6	26	0.024	0.002
Sipson Road (S)	4 App	7377	1.6	26	0.048	0.003
Sipson Road (S)	4	7377	1.6	32	0.043	0.003
Sipson Lane	6 App	6028	0.6	26	0.035	0.003
Sipson Lane	6	6028	0.6	48	0.026	0.003
Holloway Lane (A3044)	2 App	15788	3.0	26	0.116	0.008
Holloway Lane (A3044)	2	15788	3.0	96	0.083	0.008
Sipson Road (N)	3 App	11356	2.1	26	0.077	0.005
Harmondsworth Lane	5	2232	0.1	40	0.010	0.001
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split	31987	1.1	80	0.155	0.009
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split	31987	1.1	80	0.155	0.009
Sipson Road (S)	4 App	7377	1.6	26	0.048	0.003
Sipson Road (S)	4 App	7377	1.6	26	0.048	0.003
Sipson Road (S)	4	7377	1.6	32	0.043	0.003
Harmondsworth Lane	5 App	2232	0.1	26	0.012	0.001
Hatch Lane (Zealand Avenue)	8 App	15788	3.0	26	0.116	0.008
Hatch Lane (Zealand Avenue)	8	15788	3.0	48	0.083	0.007

Opening Year With Development (2019)

Road ID	Road Link	Annual Average Daily Traffic Flow	%HDVs	Speed (kph)	NO_x Emission Factors (g/s/km)	PM_{10} Emission Factors (g/s/km)
Holloway Lane (A408)	1 Split App	8924	6.0	26	0.082	0.005
Holloway Lane (A408)	1 Split	8924	6.0	96	0.053	0.005
Holloway Lane (A408)	1 Split App	8924	6.0	26	0.082	0.005
Holloway Lane (A408)	1 Split	8924	6.0	96	0.053	0.005
Holloway Lane (A408)	1	17848	6.0	96	0.105	0.009
Holloway Lane (A408)	1 App	17848	6.0	26	0.164	0.009
Holloway Lane (A408)	1 Split App	8924	6.0	26	0.082	0.005
Holloway Lane (A408)	1 Split App	8924	6.0	26	0.082	0.005
A408/A3044/Sip Rd (N) Roundabout	R/About_123	22669	5.6	26	0.176	0.011
Holloway Lane (A3044)	2 Split App	7935	3.0	26	0.058	0.004
Holloway Lane (A3044)	2 Split App	7935	3.0	26	0.058	0.004
Sipson Road (N)	3 Split App	5811	2.1	26	0.039	0.003
Sipson Road (N)	3 Split App	5811	2.1	26	0.039	0.003
Sipson Road (N)	3	11621	2.1	40	0.062	0.005
Sipson Road (N)	3 Split App	5811	2.1	26	0.039	0.003
Sipson Road (N)	3 Split App	5811	2.1	26	0.039	0.003
Sip Rd (N)/Sip Rd (S)/ Harm Ln Roundabout	R/About_345	10690	1.9	26	0.067	0.005
Sipson Road (S)	4 Split App	3749	1.6	26	0.024	0.002
Sipson Road (S)	4 Split App	3749	1.6	26	0.024	0.002
Sipson Road (S)	4 App	7499	1.6	26	0.048	0.003
Sipson Road (S)	4	7499	1.6	32	0.043	0.003
Sipson Lane	6 App	6130	0.6	26	0.036	0.003
Sipson Lane	6	6130	0.6	48	0.027	0.003
Holloway Lane (A3044)	2 App	15869	3.0	26	0.116	0.008
Holloway Lane (A3044)	2	15869	3.0	96	0.083	0.008
Sipson Road (N)	3 App	11621	2.1	26	0.078	0.005
Harmondsworth Lane	5	2259	0.1	40	0.010	0.001
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split	31987	1.1	80	0.155	0.009
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split Split App	15994	1.1	26	0.115	0.005
M4 Spur	7 Split	31987	1.1	80	0.155	0.009
Sipson Road (S)	4 App	7499	1.6	26	0.048	0.003
Sipson Road (S)	4 App	7499	1.6	26	0.048	0.003
Sipson Road (S)	4	7499	1.6	32	0.043	0.003
Harmondsworth Lane	5 App	2259	0.1	26	0.013	0.001
Hatch Lane (Zealand Avenue)	8 App	15869	3.0	26	0.116	0.008
Hatch Lane (Zealand Avenue)	8	15869	3.0	48	0.083	0.007

Appendix E

MODEL VERIFICATION CALCULATIONS

The comparison of modelled concentrations with local monitored concentrations is a process termed 'verification'. Model verification investigates the discrepancies between modelled and measured concentrations, which can arise due to the presence of inaccuracies and/or uncertainties in model input data, modelling and monitoring data assumptions. The following are examples of potential causes of such discrepancy:

a) estimates of background pollutant concentrations;

b) meteorological data uncertainties;

c) traffic data uncertainties;

d) model input parameters, such as 'roughness length'; and

e) overall limitations of the dispersion model.

Verification Methodology

The data used in the verification process are presented in Table E1. An adjustment factor (of **2.2**) was derived as the slope of the best fit line applied to the data, which indicates that model is under-estimating current conditions when compared to the measured concentrations.

Table E1 – Verification Process Data

Site ID	Monitored Total NO_2	Background NO_2	Monitored Road NO_x Contribution	Modelled Road Contribution NO_x	Ratio of monitored NO_x road contribution /modelled road contribution NO_x
HD200	41.3	34.4	15.9	7.2	2.2

Table E2 – Application of Adjustment Factor

Site ID	Ratio of monitored NO_x road contribution /modelled road contribution NO_x	Adjustment factor for modelled road contribution	Adjusted modelled road contribution NO_x	Modelled Total NO_2	Monitored Total NO_2	% Difference
HD200	2.2	2.2	15.9	41.3	41.3	0

Appendix F

SUMMARY OF EPUK & IAQM IMPACT DESCRIPTORS FOR INDIVIDUAL RECEPTORS

The following criteria relate to changes in annual mean NO_2/PM_{10} concentrations and 24-hour mean PM_{10} concentrations resulting from the development (extracted from EPUK & IAQM & IAQM Land-Use Planning & Development Control: Planning for Air Quality).

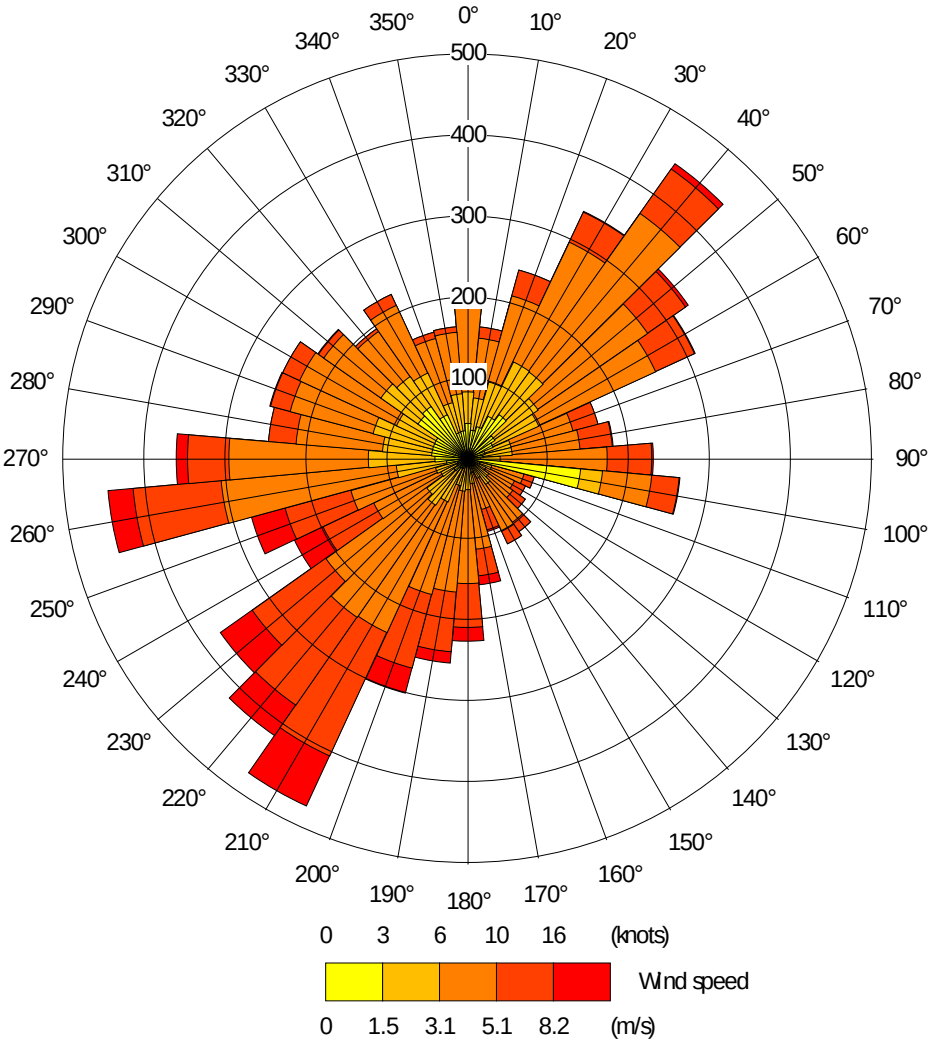
Long term average Concentration at receptor in assessment year	% Change in concentration relative to Air Quality Assessment Level (AQAL)			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76-94% of AQAL	Negligible	Slight	Moderate	Moderate
95-102% of AQAL	Slight	Moderate	Moderate	Substantial
103-109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Explanation

1. AQAL = Air Quality Assessment Level, which may be an air quality objective, EU limit or target value, or an Environment Agency 'Environmental Assessment Level (EAL)'.
2. The Table is intended to be used by rounding the change in percentage pollutant concentration to whole numbers, which then makes it clearer which cell the impact falls within. The user is encouraged to treat the numbers with recognition of their likely accuracy and not assume a false level of precision. Changes of 0%, i.e. .less than 0.5% will be described as Negligible..
3. The Table is only designed to be used with annual mean concentrations.
4. Descriptors for individual receptors only; the overall significance is determined using professional judgement (see Chapter 7). For example, a 'moderate' adverse impact at one receptor may not mean that the overall impact has a significant effect. Other factors need to be considered.
5. When defining the concentration as a percentage of the AQAL, use the 'without scheme' concentration where there is a decrease in pollutant concentration and the 'with scheme;' concentration for an increase.
6. The total concentration categories reflect the degree of potential harm by reference to the AQAL value. At exposure less than 75% of this value, i.e. well below, the degree of harm is likely to be small. As the exposure approaches and exceeds the AQAL, the degree of harm increases. This change naturally becomes more important when the result is an exposure that is approximately equal to, or greater than the AQAL.
7. It is unwise to ascribe too much accuracy to incremental changes or background concentrations, and this is especially important when total concentrations are close to the AQAL. For a given year in the future, it is impossible to define the new total concentration without recognising the inherent uncertainty, which is why there is a category that has a range around the AQAL, rather than being exactly equal to it.

Appendix G

WIND ROSE FOR HEATHROW AIRPORT 2013


0°
10°
20°
30°
40°
50°
60°
70°
80°
90°
100°
110°
120°
130°
140°
150°
160°
170°
180°
190°
200°
210°
220°
230°
240°
250°
260°
270°
280°
290°
300°
310°
320°
330°
340°
350°
500
400
300
200
100
0 3 6 10 16 (knots)
Wind speed
0 1.5 3.1 5.1 8.2 (m/s)

Appendix H

ASSESSMENT RESULTS

OPERATION PHASE – NO_2 Annual Mean Results ($\mu g/m^3$)

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual NO_2 Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
Existing Exposure							
E1	507169	178002	1.5	49.4	50.2	50.4	0.2
E2	507193	178166	1.5	46.9	47.6	47.7	0.2
E3	507186	177920	1.5	46.6	47.1	47.2	0.1
E4	507248	177873	1.5	49.1	49.8	50.0	0.1
E5	507284	177780	1.5	45.4	45.9	46.0	0.1
E6	507295	177885	1.5	45.0	45.5	45.6	0.1
E7	507155	178023	1.5	43.5	44.0	44.1	0.1
E8	507181	178102	1.5	47.5	48.2	48.4	0.2
E9	507275	177827	1.5	43.8	44.1	44.2	0.1
Future Exposure – Option A							
NR1_1	507252	178108	1.5	-	-	40.3	-
NR1_2	507252	178108	4.5	-	-	40.1	-
NR1_3	507252	178108	7.5	-	-	39.8	-
NR2_1	507225	178030	1.5	-	-	40.6	-
NR2_2	507225	178030	4.5	-	-	40.3	-
NR2_3	507225	178030	7.5	-	-	39.9	-
NR3_1	507243	177959	1.5	-	-	41.8	-
NR3_2	507243	177959	4.5	-	-	41.5	-
NR3_3	507243	177959	7.5	-	-	41.1	-
NR4_1	507312	178049	1.5	-	-	40.7	-
NR4_2	507312	178049	4.5	-	-	40.5	-
NR4_3	507312	178049	7.5	-	-	40.2	-
NR5_1	507243	177968	1.5	-	-	41.7	-
NR5_2	507243	177968	4.5	-	-	41.5	-
NR5_3	507243	177968	7.5	-	-	41.1	-
NR6_1	507244	177978	1.5	-	-	41.6	-
NR6_2	507244	177978	4.5	-	-	41.4	-
NR6_3	507244	177978	7.5	-	-	41.0	-
NR7_1	507243	177987	1.5	-	-	41.6	-
NR7_2	507243	177987	4.5	-	-	41.4	-
NR7_3	507243	177987	7.5	-	-	41.0	-
NR8_1	507251	177959	1.5	-	-	41.7	-
NR8_2	507251	177959	4.5	-	-	41.5	-
NR8_3	507251	177959	7.5	-	-	41.1	-
NR9_1	507251	177968	1.5	-	-	41.6	-
NR9_2	507251	177968	4.5	-	-	41.4	-
NR9_3	507251	177968	7.5	-	-	41.1	-
NR10_1	507252	177975	1.5	-	-	41.6	-
NR10_2	507252	177975	4.5	-	-	41.4	-
NR10_3	507252	177975	7.5	-	-	41.1	-
NR11_1	507251	177991	1.5	-	-	41.5	-
NR11_2	507251	177991	4.5	-	-	41.3	-
NR11_3	507251	177991	7.5	-	-	41.0	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual NO_2 Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR12_1	507269	177979	1.5	-	-	41.5	-
NR12_2	507269	177979	4.5	-	-	41.4	-
NR12_3	507269	177979	7.5	-	-	41.1	-
NR13_1	507278	177977	1.5	-	-	41.6	-
NR13_2	507278	177977	4.5	-	-	41.4	-
NR13_3	507278	177977	7.5	-	-	41.1	-
NR14_1	507285	177980	1.5	-	-	41.6	-
NR14_2	507285	177980	4.5	-	-	41.4	-
NR14_3	507285	177980	7.5	-	-	41.2	-
NR15_1	507295	177986	1.5	-	-	41.6	-
NR15_2	507295	177986	4.5	-	-	41.5	-
NR15_3	507295	177986	7.5	-	-	41.2	-
NR16_1	507284	177988	1.5	-	-	41.5	-
NR16_2	507284	177988	4.5	-	-	41.4	-
NR16_3	507284	177988	7.5	-	-	41.1	-
NR17_1	507268	177987	1.5	-	-	41.5	-
NR17_2	507268	177987	4.5	-	-	41.3	-
NR17_3	507268	177987	7.5	-	-	41.1	-
NR18_1	507235	178004	1.5	-	-	40.5	-
NR18_2	507235	178004	4.5	-	-	40.3	-
NR18_3	507235	178004	7.5	-	-	39.9	-
NR19_1	507249	178072	1.5	-	-	40.3	-
NR19_2	507249	178072	4.5	-	-	40.1	-
NR19_3	507249	178072	7.5	-	-	39.8	-
NR20_1	507250	178088	1.5	-	-	40.3	-
NR20_2	507250	178088	4.5	-	-	40.1	-
NR20_3	507250	178088	7.5	-	-	39.8	-
Future Exposure – Option B							
NR21_1	507398	178228	1.5	-	-	44.4	-
NR21_2	507398	178228	4.5	-	-	43.4	-
NR21_3	507398	178228	7.5	-	-	42.1	-
NR22_1	507399	178253	1.5	-	-	44.3	-
NR22_2	507399	178253	4.5	-	-	43.4	-
NR22_3	507399	178253	7.5	-	-	42.0	-
NR23_1	507389	178264	1.5	-	-	43.2	-
NR23_2	507389	178264	4.5	-	-	42.6	-
NR23_3	507389	178264	7.5	-	-	41.6	-
NR24_1	507380	178264	1.5	-	-	42.5	-
NR24_2	507380	178264	4.5	-	-	42.0	-
NR24_3	507380	178264	7.5	-	-	41.3	-
NR25_1	507370	178264	1.5	-	-	41.9	-
NR25_2	507370	178264	4.5	-	-	41.5	-
NR25_3	507370	178264	7.5	-	-	40.9	-
NR26_1	507193	178246	1.5	-	-	43.0	-
NR26_2	507193	178246	4.5	-	-	41.2	-
NR26_3	507193	178246	7.5	-	-	39.8	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual NO_2 Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR27_1	507200	178232	1.5	-	-	42.9	-
NR27_2	507200	178232	4.5	-	-	41.2	-
NR27_3	507200	178232	7.5	-	-	39.9	-
NR28_1	507208	178207	1.5	-	-	42.9	-
NR28_2	507208	178207	4.5	-	-	41.3	-
NR28_3	507208	178207	7.5	-	-	39.9	-
NR29_1	507384	178223	1.5	-	-	43.0	-
NR29_2	507384	178223	4.5	-	-	42.4	-
NR29_3	507384	178223	7.5	-	-	41.5	-
NR30_1	507369	178223	1.5	-	-	42.0	-
NR30_2	507369	178223	4.5	-	-	41.7	-
NR30_3	507369	178223	7.5	-	-	41.0	-
NR31_1	507352	178226	1.5	-	-	41.3	-
NR31_2	507352	178226	4.5	-	-	41.1	-
NR31_3	507352	178226	7.5	-	-	40.6	-
NR32_1	507331	178217	1.5	-	-	40.7	-
NR32_2	507331	178217	4.5	-	-	40.6	-
NR32_3	507331	178217	7.5	-	-	40.3	-
NR33_1	507348	178261	1.5	-	-	41.0	-
NR33_2	507348	178261	4.5	-	-	40.8	-
NR33_3	507348	178261	7.5	-	-	40.4	-
NR34_1	507322	178262	1.5	-	-	40.4	-
NR34_2	507322	178262	4.5	-	-	40.3	-
NR34_3	507322	178262	7.5	-	-	40.0	-
NR35_1	507313	178258	1.5	-	-	40.3	-
NR35_2	507313	178258	4.5	-	-	40.2	-
NR35_3	507313	178258	7.5	-	-	39.9	-
NR36_1	507292	178255	1.5	-	-	40.1	-
NR36_2	507292	178255	4.5	-	-	40.0	-
NR36_3	507292	178255	7.5	-	-	39.8	-

OPERATION PHASE – PM_{10} Annual Mean Results ($\mu g/m^3$)

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual PM_{10} Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
Existing Exposure							
E1	507169	178002	1.5	24.7	24.9	25.0	0.05
E2	507193	178166	1.5	24.5	24.6	24.7	0.04
E3	507186	177920	1.5	22.9	23.0	23.0	0.02
E4	507248	177873	1.5	23.4	23.5	23.6	0.03
E5	507284	177780	1.5	22.7	22.8	22.8	0.02
E6	507295	177885	1.5	22.7	22.8	22.8	0.02
E7	507155	178023	1.5	23.7	23.8	23.8	0.02
E8	507181	178102	1.5	24.6	24.8	24.8	0.04
E9	507275	177827	1.5	22.4	22.4	22.5	0.01
Future Exposure – Option A							
NR1_1	507252	178108	1.5	-	-	24.4	-
NR1_2	507252	178108	4.5	-	-	24.4	-
NR1_3	507252	178108	7.5	-	-	24.3	-
NR2_1	507225	178030	1.5	-	-	24.4	-
NR2_2	507225	178030	4.5	-	-	24.4	-
NR2_3	507225	178030	7.5	-	-	24.3	-
NR3_1	507243	177959	1.5	-	-	22.9	-
NR3_2	507243	177959	4.5	-	-	22.9	-
NR3_3	507243	177959	7.5	-	-	22.8	-
NR4_1	507312	178049	1.5	-	-	24.4	-
NR4_2	507312	178049	4.5	-	-	24.4	-
NR4_3	507312	178049	7.5	-	-	24.3	-
NR5_1	507243	177968	1.5	-	-	22.9	-
NR5_2	507243	177968	4.5	-	-	22.8	-
NR5_3	507243	177968	7.5	-	-	22.8	-
NR6_1	507244	177978	1.5	-	-	22.9	-
NR6_2	507244	177978	4.5	-	-	22.8	-
NR6_3	507244	177978	7.5	-	-	22.8	-
NR7_1	507243	177987	1.5	-	-	22.9	-
NR7_2	507243	177987	4.5	-	-	22.8	-
NR7_3	507243	177987	7.5	-	-	22.8	-
NR8_1	507251	177959	1.5	-	-	22.9	-
NR8_2	507251	177959	4.5	-	-	22.8	-
NR8_3	507251	177959	7.5	-	-	22.8	-
NR9_1	507251	177968	1.5	-	-	22.9	-
NR9_2	507251	177968	4.5	-	-	22.8	-
NR9_3	507251	177968	7.5	-	-	22.8	-
NR10_1	507252	177975	1.5	-	-	22.9	-
NR10_2	507252	177975	4.5	-	-	22.8	-
NR10_3	507252	177975	7.5	-	-	22.8	-
NR11_1	507251	177991	1.5	-	-	22.8	-
NR11_2	507251	177991	4.5	-	-	22.8	-
NR11_3	507251	177991	7.5	-	-	22.8	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual PM_{10} Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR12_1	507269	177979	1.5	-	-	22.8	-
NR12_2	507269	177979	4.5	-	-	22.8	-
NR12_3	507269	177979	7.5	-	-	22.8	-
NR13_1	507278	177977	1.5	-	-	22.8	-
NR13_2	507278	177977	4.5	-	-	22.8	-
NR13_3	507278	177977	7.5	-	-	22.8	-
NR14_1	507285	177980	1.5	-	-	22.8	-
NR14_2	507285	177980	4.5	-	-	22.8	-
NR14_3	507285	177980	7.5	-	-	22.8	-
NR15_1	507295	177986	1.5	-	-	22.8	-
NR15_2	507295	177986	4.5	-	-	22.8	-
NR15_3	507295	177986	7.5	-	-	22.8	-
NR16_1	507284	177988	1.5	-	-	22.8	-
NR16_2	507284	177988	4.5	-	-	22.8	-
NR16_3	507284	177988	7.5	-	-	22.8	-
NR17_1	507268	177987	1.5	-	-	22.8	-
NR17_2	507268	177987	4.5	-	-	22.8	-
NR17_3	507268	177987	7.5	-	-	22.8	-
NR18_1	507235	178004	1.5	-	-	24.4	-
NR18_2	507235	178004	4.5	-	-	24.4	-
NR18_3	507235	178004	7.5	-	-	24.3	-
NR19_1	507249	178072	1.5	-	-	24.4	-
NR19_2	507249	178072	4.5	-	-	24.3	-
NR19_3	507249	178072	7.5	-	-	24.3	-
NR20_1	507250	178088	1.5	-	-	24.4	-
NR20_2	507250	178088	4.5	-	-	24.3	-
NR20_3	507250	178088	7.5	-	-	24.3	-
Future Exposure – Option B							
NR21_1	507398	178228	1.5	-	-	23.6	-
NR21_2	507398	178228	4.5	-	-	23.5	-
NR21_3	507398	178228	7.5	-	-	23.3	-
NR22_1	507399	178253	1.5	-	-	23.6	-
NR22_2	507399	178253	4.5	-	-	23.5	-
NR22_3	507399	178253	7.5	-	-	23.3	-
NR23_1	507389	178264	1.5	-	-	23.4	-
NR23_2	507389	178264	4.5	-	-	23.4	-
NR23_3	507389	178264	7.5	-	-	23.2	-
NR24_1	507380	178264	1.5	-	-	23.3	-
NR24_2	507380	178264	4.5	-	-	23.3	-
NR24_3	507380	178264	7.5	-	-	23.2	-
NR25_1	507370	178264	1.5	-	-	23.3	-
NR25_2	507370	178264	4.5	-	-	23.2	-
NR25_3	507370	178264	7.5	-	-	23.1	-
NR26_1	507193	178246	1.5	-	-	23.7	-
NR26_2	507193	178246	4.5	-	-	23.3	-
NR26_3	507193	178246	7.5	-	-	23.0	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Annual PM_{10} Concentration ($\mu g/m^3$)			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR27_1	507200	178232	1.5	-	-	23.6	-
NR27_2	507200	178232	4.5	-	-	23.3	-
NR27_3	507200	178232	7.5	-	-	23.0	-
NR28_1	507208	178207	1.5	-	-	23.6	-
NR28_2	507208	178207	4.5	-	-	23.3	-
NR28_3	507208	178207	7.5	-	-	23.0	-
NR29_1	507384	178223	1.5	-	-	23.4	-
NR29_2	507384	178223	4.5	-	-	23.3	-
NR29_3	507384	178223	7.5	-	-	23.2	-
NR30_1	507369	178223	1.5	-	-	23.3	-
NR30_2	507369	178223	4.5	-	-	23.2	-
NR30_3	507369	178223	7.5	-	-	23.1	-
NR31_1	507352	178226	1.5	-	-	23.2	-
NR31_2	507352	178226	4.5	-	-	23.1	-
NR31_3	507352	178226	7.5	-	-	23.1	-
NR32_1	507331	178217	1.5	-	-	23.1	-
NR32_2	507331	178217	4.5	-	-	23.1	-
NR32_3	507331	178217	7.5	-	-	23.0	-
NR33_1	507348	178261	1.5	-	-	23.1	-
NR33_2	507348	178261	4.5	-	-	23.1	-
NR33_3	507348	178261	7.5	-	-	23.1	-
NR34_1	507322	178262	1.5	-	-	23.1	-
NR34_2	507322	178262	4.5	-	-	23.0	-
NR34_3	507322	178262	7.5	-	-	23.0	-
NR35_1	507313	178258	1.5	-	-	23.0	-
NR35_2	507313	178258	4.5	-	-	23.0	-
NR35_3	507313	178258	7.5	-	-	23.0	-
NR36_1	507292	178255	1.5	-	-	23.0	-
NR36_2	507292	178255	4.5	-	-	23.0	-
NR36_3	507292	178255	7.5	-	-	23.0	-

OPERATION PHASE – PM_{10} – Number Of Mean 24 Hour Exceedences Per Year (Maximum of 35) ($\mu g/m^3$)

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Number Of Days Of Exceedence			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
Existing Exposure							
E1	507169	178002	1.5	12	12	12	0
E2	507193	178166	1.5	11	12	12	0
E3	507186	177920	1.5	8	8	8	0
E4	507248	177873	1.5	9	9	9	0
E5	507284	177780	1.5	8	8	8	0
E6	507295	177885	1.5	8	8	8	0
E7	507155	178023	1.5	10	10	10	0
E8	507181	178102	1.5	11	12	12	0
E9	507275	177827	1.5	7	7	7	0
Future Exposure – Option A							
NR1_1	507252	178108	1.5	-	-	11	-
NR1_2	507252	178108	4.5	-	-	11	-
NR1_3	507252	178108	7.5	-	-	11	-
NR2_1	507225	178030	1.5	-	-	11	-
NR2_2	507225	178030	4.5	-	-	11	-
NR2_3	507225	178030	7.5	-	-	11	-
NR3_1	507243	177959	1.5	-	-	8	-
NR3_2	507243	177959	4.5	-	-	8	-
NR3_3	507243	177959	7.5	-	-	8	-
NR4_1	507312	178049	1.5	-	-	11	-
NR4_2	507312	178049	4.5	-	-	11	-
NR4_3	507312	178049	7.5	-	-	11	-
NR5_1	507243	177968	1.5	-	-	8	-
NR5_2	507243	177968	4.5	-	-	8	-
NR5_3	507243	177968	7.5	-	-	8	-
NR6_1	507244	177978	1.5	-	-	8	-
NR6_2	507244	177978	4.5	-	-	8	-
NR6_3	507244	177978	7.5	-	-	8	-
NR7_1	507243	177987	1.5	-	-	8	-
NR7_2	507243	177987	4.5	-	-	8	-
NR7_3	507243	177987	7.5	-	-	8	-
NR8_1	507251	177959	1.5	-	-	8	-
NR8_2	507251	177959	4.5	-	-	8	-
NR8_3	507251	177959	7.5	-	-	8	-
NR9_1	507251	177968	1.5	-	-	8	-
NR9_2	507251	177968	4.5	-	-	8	-
NR9_3	507251	177968	7.5	-	-	8	-
NR10_1	507252	177975	1.5	-	-	8	-
NR10_2	507252	177975	4.5	-	-	8	-
NR10_3	507252	177975	7.5	-	-	8	-
NR11_1	507251	177991	1.5	-	-	8	-
NR11_2	507251	177991	4.5	-	-	8	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Number Of Days Of Exceedence			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR11_3	507251	177991	7.5	-	-	8	-
NR12_1	507269	177979	1.5	-	-	8	-
NR12_2	507269	177979	4.5	-	-	8	-
NR12_3	507269	177979	7.5	-	-	8	-
NR13_1	507278	177977	1.5	-	-	8	-
NR13_2	507278	177977	4.5	-	-	8	-
NR13_3	507278	177977	7.5	-	-	8	-
NR14_1	507285	177980	1.5	-	-	8	-
NR14_2	507285	177980	4.5	-	-	8	-
NR14_3	507285	177980	7.5	-	-	8	-
NR15_1	507295	177986	1.5	-	-	8	-
NR15_2	507295	177986	4.5	-	-	8	-
NR15_3	507295	177986	7.5	-	-	8	-
NR16_1	507284	177988	1.5	-	-	8	-
NR16_2	507284	177988	4.5	-	-	8	-
NR16_3	507284	177988	7.5	-	-	8	-
NR17_1	507268	177987	1.5	-	-	8	-
NR17_2	507268	177987	4.5	-	-	8	-
NR17_3	507268	177987	7.5	-	-	8	-
NR18_1	507235	178004	1.5	-	-	11	-
NR18_2	507235	178004	4.5	-	-	11	-
NR18_3	507235	178004	7.5	-	-	11	-
NR19_1	507249	178072	1.5	-	-	11	-
NR19_2	507249	178072	4.5	-	-	11	-
NR19_3	507249	178072	7.5	-	-	11	-
NR20_1	507250	178088	1.5	-	-	11	-
NR20_2	507250	178088	4.5	-	-	11	-
NR20_3	507250	178088	7.5	-	-	11	-
Future Exposure – Option B							
NR21_1	507398	178228	1.5	-	-	9	-
NR21_2	507398	178228	4.5	-	-	9	-
NR21_3	507398	178228	7.5	-	-	9	-
NR22_1	507399	178253	1.5	-	-	9	-
NR22_2	507399	178253	4.5	-	-	9	-
NR22_3	507399	178253	7.5	-	-	9	-
NR23_1	507389	178264	1.5	-	-	9	-
NR23_2	507389	178264	4.5	-	-	9	-
NR23_3	507389	178264	7.5	-	-	9	-
NR24_1	507380	178264	1.5	-	-	9	-
NR24_2	507380	178264	4.5	-	-	9	-
NR24_3	507380	178264	7.5	-	-	8	-
NR25_1	507370	178264	1.5	-	-	9	-
NR25_2	507370	178264	4.5	-	-	8	-
NR25_3	507370	178264	7.5	-	-	8	-
NR26_1	507193	178246	1.5	-	-	9	-
NR26_2	507193	178246	4.5	-	-	9	-

Receptor Name	X Coordinate	Y Coordinate	Height Above Ground Level (m)	Number Of Days Of Exceedence			
				2013 Baseline	2019 Without Development	2019 With Development	Change (With-Without)
NR26_3	507193	178246	7.5	-	-	8	-
NR27_1	507200	178232	1.5	-	-	9	-
NR27_2	507200	178232	4.5	-	-	9	-
NR27_3	507200	178232	7.5	-	-	8	-
NR28_1	507208	178207	1.5	-	-	9	-
NR28_2	507208	178207	4.5	-	-	9	-
NR28_3	507208	178207	7.5	-	-	8	-
NR29_1	507384	178223	1.5	-	-	9	-
NR29_2	507384	178223	4.5	-	-	9	-
NR29_3	507384	178223	7.5	-	-	8	-
NR30_1	507369	178223	1.5	-	-	9	-
NR30_2	507369	178223	4.5	-	-	9	-
NR30_3	507369	178223	7.5	-	-	8	-
NR31_1	507352	178226	1.5	-	-	8	-
NR31_2	507352	178226	4.5	-	-	8	-
NR31_3	507352	178226	7.5	-	-	8	-
NR32_1	507331	178217	1.5	-	-	8	-
NR32_2	507331	178217	4.5	-	-	8	-
NR32_3	507331	178217	7.5	-	-	8	-
NR33_1	507348	178261	1.5	-	-	8	-
NR33_2	507348	178261	4.5	-	-	8	-
NR33_3	507348	178261	7.5	-	-	8	-
NR34_1	507322	178262	1.5	-	-	8	-
NR34_2	507322	178262	4.5	-	-	8	-
NR34_3	507322	178262	7.5	-	-	8	-
NR35_1	507313	178258	1.5	-	-	8	-
NR35_2	507313	178258	4.5	-	-	8	-
NR35_3	507313	178258	7.5	-	-	8	-
NR36_1	507292	178255	1.5	-	-	8	-
NR36_2	507292	178255	4.5	-	-	8	-
NR36_3	507292	178255	7.5	-	-	8	-