7. AIR QUALITY

Introduction

7.1 This chapter has been prepared by Ensafe Consultants on behalf of the Applicant and assesses the likely significant effects of the Development on the environment in respect to Air Quality. This chapter also describes the methods used to assess the effects; the baseline conditions currently existing at the Site and surrounding areas; the mitigation measures required to prevent, reduce or offset any significant adverse effects; and the likely residual effects after these measures have been adopted.

Policy Context

National Planning Policy

National Planning Policy Framework[i]

7.2 The revised National Planning Policy Framework (NPPF) published in February 2019 recognises air quality within Section 15: Conserving and enhancing the natural environment. The revised NPPF highlights that Developments should help improve the local environment, in terms of air quality wherever possible taking into account the relevant information.

7.3 To prevent unacceptable risks from air pollution, the revised NPPF states that:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air quality'.*

and

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development".*

7.4 More specifically on air quality, the revised NPPF states within paragraph 181 that:

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

Planning Practice Guidance[ii]

7.5 National Planning Practice Guidance (NPPG) has been developed in order to support the NPPF. The guidance provides a concise outline as to how air quality should be considered in order to comply with the NPPF and states when air quality is considered relevant to a planning application, which includes when the proposals:

- *'Significantly affect traffic in the immediate vicinity of the proposed development site or further afield. This could be by generating or increasing traffic congestion; significantly changing traffic volumes, vehicle speed or both; or significantly altering the traffic composition on local roads'*;
- *'Introduce new point sources of air pollution. This could include furnaces which require prior notification to local authorities; or extraction systems (including chimneys) which require approval under pollution control legislation or biomass boilers or biomass-fuelled CHP plant; centralised boilers or CHP plant burning other fuels within or close to an air quality management area or introduce relevant combustion within a Smoke Control Area'*;
- *'Expose people to existing sources of air pollutants. This could be by building new homes, workplaces or other development in places with poor air quality'*; and
- *'Give rise to potentially unacceptable impact (such as dust) during construction for nearby sensitive locations'*.

Regional Planning Policy

The London Plan: Spatial Development Strategy for Greater London[iii]

7.6 The Minor Alterations to The London Plan[iv] was published in March 2016 and sets out a fully integrated economic, environmental, transport and social framework for the development of the capital until 2031. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the

Mayor.

7.7 The London Plan policies relating to air quality are outlined below:

"*Policy 3.2 Improving health and addressing health inequalities*

Strategic

- *The Mayor will take account of the potential impact of development proposals on health and health inequalities within London. The Mayor will work in partnership with the NHS in London, boroughs and the voluntary and community sector as appropriate to reduce health inequalities and improve the health of all Londoners, supporting the spatial implications of the Mayor's Health Inequalities Strategy.*
- *The Mayor will promote London as a healthy place for all – from homes to neighbourhoods and across the city as a whole – by:*
- *Coordinating planning and action on the environment, climate change and public health to maximise benefits and engage a wider range of partners in action*

[…]

- *The impacts of major development proposals on the health and wellbeing of communities should be considered, for example through the use of Health Impact Assessments (HIA).*

Planning decisions

- *New developments should be designed, constructed and managed in ways that improve health and promote healthy lifestyles to help to reduce health inequalities.*

Policy 5.3 - Sustainable design and construction

Strategic

- *The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.*

Planning decisions

- *Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.*
- *Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:*

  […]

- *Minimising pollution (including noise, air and urban run-off)*

  […]

Policy 7.14 - Improving air quality

Strategic

- *The Mayor recognises the importance of tackling air pollution and improving air quality to London's development and the health and well-being of its people. He will work with strategic partners to ensure that the spatial, climate change, transport and design policies of this plan support implementation of his Air Quality and Transport strategies to achieve reductions in pollutant emissions and minimise public exposure to pollution.*

Planning decisions

Development proposals should:

- *Minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs) and where development is likely to be used by large numbers of those particularly vulnerable to poor air quality, such as children or older people) such as by design solutions, buffer zones or steps to promote greater use of sustainable transport modes through travel plans (see Policy 6.3).*
- *Promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London*

Council's '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 (such as areas designated as Air Quality Management Areas (AQMAs).*
- *Ensure that where provision needs to be made to reduce emissions from a development, this is usually made on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, and that it is possible to put in place measures having clearly demonstrated equivalent air quality benefits, planning obligations or planning conditions should be used as appropriate to ensure this, whether on a scheme by scheme basis or through joint area-based approaches."*

7.8 These policies have been considered throughout the completion of this Air Quality Assessment.

The Draft New London Plan (Intend to Publish)

7.9 The Draft New London Plan[v] sets out the proposed development strategy for London from 2019 to 2041. It was consulted on from 29th November 2017 until 2nd March 2018, with the Draft New London Plan showing Consolidated Suggested Changes, which includes clarifications, corrections and factual updates to the Consultation Draft Plan for 'Examination in Public[vi]', was published in July 2019. A review of the Draft New London Plan indicated the following policy in relation to air quality:

Draft Policy SI1: Improving air quality

A) Development Plans, through relevant strategic, site-specific and area based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B) To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed: 1 Development proposals should not: a) lead to further deterioration of existing poor air quality b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits c) create unacceptable risk of high levels of exposure to poor air quality.

2 In order to meet the requirements in Part 1, as a minimum:
a) development proposals must be at least Air Quality Neutral;
b) development proposals should use design solutions to prevent or minimise increased

exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures;

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1; and

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

Local Planning Policy

Kingston Upon Thames Core Strategy Development Plan

7.10 The Kingston upon Thames Core Strategy Development Plan[vii] was adopted in April 2012 and guides future development in the borough up to the year 2027. It sets out our network of roads, schools and community centres and maps the conservation and enhancement of our environment. A review of The Kingston Upon Thames Core Strategy indicated the following policies that are relevant to this assessment:

Policy CS1: Climate Change Mitigation

The Council will:

b. ensure that all development (including extensions, refurbishments and conversions) is designed and built to make the most efficient use of resources, reduce its lifecycle impact on the environment and contribute to climate change mitigation and adaptation by:

- *reducing levels of pollution; air, water, noise and light.*

European legislation

7.11 The European Union directive on ambient air quality and cleaner air for Europe (2008/50/EC)[viii] sets legally binding limits for pollutant concentrations. This directive was made law in England through the Air Quality Standards Regulations 2010.

National Legislation

7.12 Part IV of the Environment Act 1995[ix] places a duty on the Secretary of State for the

Environment to develop, implement and maintain an Air Quality Strategy with the aim of reducing atmospheric emissions and improving air quality. The latest Air Quality Strategy for England, Scotland, Wales and Northern Ireland was published in 2007[x], and provides the framework for ensuring the air quality limit values are complied with based on a combination of international, national and local measures to reduce emissions and improve air quality. The Air Quality Strategy includes a statutory duty, also under Part IV of the Environment Act 1995, for local authorities to undergo a process of Local Air Quality Management (LAQM). This requires local authorities to regularly and systematically review and assess air quality within their boundaries against a series of objectives and appraise development and transport plans against these assessments.

Air Quality Strategy[xi]

7.13 The Air Quality Strategy published by the Department for Environment, Food and Rural Affairs (Defra) and Devolved Administrations, provides the policy framework for air quality management and assessment in the UK. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. It also sets out how the different sectors: industry, transport and local government, can contribute to achieving the air quality objectives. Local authorities are seen to play a particularly important role. The strategy describes the LAQM regime that has been established, whereby every authority has to carry out regular reviews and assessments of air quality in its area to identify whether the objectives have been, or will be, achieved at relevant locations, by the applicable date. If this is not the case, the authority must declare an Air Quality Management Area (AQMA), and prepare an action plan which identifies appropriate measures that will be introduced in pursuit of the objectives.

Assessment Methodology

Consultation

7.14 An EIA Scoping Report (Appendix 2.1) was submitted to RBKuT in April 2020 with a formal request for an EIA Scoping Opinion in accordance with Regulation 15 of the EIA Regulations. As part of this process, the key statutory and non-statutory consultees were consulted to review the proposed methodology and criteria for assessment. RBKuT subsequently issued its Scoping Opinion in June 2020 commenting on the proposed scope and methodology of the topics for assessment within the EIA. The Scoping Opinion is provided as Appendix 2.2.

7.15 The EIA Scoping Report outlined the general methodology used for undertaking the Air Quality Assessment. The Scoping Opinion acknowledged that the Site is located within an Air Quality

Management Area (AQMA) and that the topic of "Air Quality" is to be included within the ES. This chapter presents that topic along with associated appendices in its entirety.

7.16 No further consultation has been undertaken specifically with regard to Air Quality.

Construction Phase Assessment

7.17 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have been assessed in accordance with the methodology outlined within the Greater London Authority (GLA) document 'The Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance'[xii]. Please refer to Appendix 7.2 for details associated with the construction phase Dust Risk methodology. The assessment has been informed by Chapter 5 Construction Methodology and Phasing of this ES.

Operational Phase Assessment

7.18 The Development has the potential to have an effect on existing air quality as a result of road traffic exhaust emissions and energy emissions, such as Nitrogen Dioxide (NO_2), particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) and particulate matter with an aerodynamic diameter of less than 2.5µm ($PM_{2.5}$), associated with vehicles travelling to and from the Site, as well as the potential to expose future Site-users to elevated pollutant levels.

7.19 The maximum number of vehicles generated by the operational phase will occur once the Development is completed. Potential impacts have been defined by predicting pollutant concentrations at sensitive locations using dispersion modelling for the following scenarios:

- **Current Baseline** and model verification scenario;
- **Future year do-minimum (DM)** (predicted traffic flows should the Development not proceed) inclusive of committed developments; and
- **Future year do-something (DS)** (predicted traffic flows should the Development be completed, with the addition of traffic flows generated by the development and emissions associated with on-site energy generating activities) inclusive of committed developments.

7.20 As detailed within this chapter the assessment has considered a worst-case approach using 2039 traffic forecasts. This was carried out in order to account for a potential future year scenario which is highly conservative.

7.21 In addition to traffic emissions, the Development will introduce a local emission source associated with the on-site provision of heating and hot water from the gas boilers (see Chapter 3 Site and Development Description and Appendix 3.3 for information on the energy strategy. These emissions sources will emit the combustion products of natural gas and discharge from the on-site stack located on building 'E', as such they are included within the modelling scenarios. It should be noted that combustion emissions of NO_2 have been assessed as the boilers do not emit particulates.

7.22 Reference should be made to Appendix 7.1 for assessment input data and details of the verification process.

7.23 Receptors potentially sensitive to changes in NO_2 and PM_{10} concentrations were identified within 200m of the affected highway network in accordance with the guidance provided within LAQM (TG16). The guidance provides the following examples of where annual mean Air Quality Objectives (AQOs) should apply:

- Residential properties;
- Schools;
- Hospitals; and
- Care homes.

7.24 The absolute concentration of pollutants in the modelled scenarios is used to identify the risk of the air quality objective values being exceeded for each scenario. For consideration of a change in annual mean concentrations, the Environmental Protection UK (EPUK) and Institute of Air Quality Management (IAQM) guidance 'Land-Use Planning and Development Control: Planning for Air Quality'[xiii] have published recommendations for describing the effects at individual receptors as presented in Table 7.1.

Table 7.1: Effect Descriptors at Individual Receptors (Annual Mean NO_2 and PM_{10})

Annual Mean Pollutant Concentration at Receptor in Assessment Year	Magnitude of Change (% Change in Concentration Relative to AQO)			
	1 (Negligible)	2-5 (Minor)	6-10 (Moderate)	>10 (Major)
75% or less of AQO (Negligible)	Negligible	Negligible	Minor	Moderate
76 - 94% of AQO (Minor)	Negligible	Minor	Moderate	Moderate
95 - 102% of AQO (Moderate)	Minor	Moderate	Moderate	Major
103 - 109% of AQO (Major)	Moderate	Moderate	Major	Major
110% or more of AQO (Major)	Moderate	Major	Major	Major

7.25 The terminology used in Table 7.1 has been adapted from the EPUK/IAQM guidance in order to maintain consistency with the assessments presented in other technical chapters of this ES. 'Major' is used instead of 'Substantial', and 'Minor' in place of 'Slight'. The description of each significance level, as well as the terms 'Moderate' and 'Negligible', remain the same.

7.26 A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% is considered to be so small as to be negligible. A change (effect) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

Energy Emission Impacts

7.27 As noted above, the Development includes the provision of on-site energy generating combustion facilities, which may have the potential to impact on existing air quality.

7.28 An impact assessment is likely to be considered necessary for stationary combustion sources where they meet the following criteria:

- Typically, any combustion plant where the single or combined NOx emission rate is less than 5 mg/sec[(a)] is unlikely to give rise to impacts, provided that the emissions are released from a vent or stack in a location and at a height that provides adequate dispersion;
- In situations where the emissions are released close to buildings with relevant receptors, or where the dispersion of the plume may be adversely affected by the size and/or height of adjacent buildings (including situations where the stack height is lower than the receptor) then consideration will need to be given to potential impacts at much lower emission rates; and
- Conversely, where existing nitrogen dioxide concentrations are low, and where the dispersion conditions are favourable, a much higher emission rate may be acceptable.

a) As a guide, the 5 mg/s criterion equates to a 450 kW ultra-low NOx gas boiler

7.29 Should these criteria not be met, then the guidance document considers air quality impacts associated with the energy generating facilities to be not significant and no further assessment is required.

Sensitive Receptors

Construction phase - Ecological Receptors

7.30 There are no nationally or European designated ecological receptors within 50m of the Site boundary, or within 50m from a route used by construction vehicles on the public highway (up to 500m from the Site entrance). Therefore, the risk of dust effects at a nationally or European designated ecological receptor site from construction impacts is not considered further in this assessment.

Construction Phase - Human Receptors

7.31 Receptors sensitive to potential dust impacts during earthworks and construction were identified from a desk-top study of the area up to 350m from the Site boundary in accordance with the GLA Guidance[xii]. These are summarised in Table 7.2.

7.32 Due to the phased nature of the Development, early phase occupants of the Development may also experience potential dust impacts from construction of later phases of the Development.

Table 7.2: Earthworks and Construction Dust Sensitive Receptors

Distance from Site Boundary (m)	Approximate Number of Human Receptors
Less than 20	10 – 100
20 – 50	10 – 100
50 – 100	More than 100
100 – 350	More than 100

7.33 Reference should be made to Figure 7.3 for a graphical representation of earthworks and construction dust buffer zones.

7.34 Trackout is the transport of dust and dirt from the construction site onto the public road network where it may be deposited and re-suspended by vehicles using the network as a result of Heavy Duty Vehicles (HDVs) leaving the Site. Receptors sensitive to potential dust impacts from trackout[1] were identified from a desk-top study of the area up to 50m from the road network within 500m of the Site access route. These are summarised in Table 7.3.

7.35 Construction vehicles will access Cambridge Road, utilising the main arterial roads where possible. Assuming this access route ensured that the maximum trackout distance was

[1] The transportation of dust and materials on the wheels of vehicles

considered.

Table 7.3: Trackout Dust Sensitive Receptors

Distance from Site Access Route (m)	Approximate Number of Human Receptors
Less than 20	More than 100
20 - 50	More than 100

7.36 Reference should be made to Figure 7.4 for a graphical representation of trackout dust buffer zones.

Additional Area Sensitivity Factors

7.37 A number of additional factors have been considered when determining the sensitivity of the surrounding area. These are summarised in Table 7.4.

Table 7.4: Additional Area Sensitivity Factors

Guidance	Comment
Whether there is any history of dust generating activities in the area	The Site is located in a predominantly residential area. There is likely to have been a history of dust generating activities due to development in the locality of the Site.
The likelihood of concurrent dust generating activity on nearby sites	A review of the RBKuT planning portal determined that there are several future proposed planning applications with following details within 500m of the Site. A list of cumulative schemes is outlined in Chapter 2. Should all the schemes receive planning consent there is potential for concurrent dust generating activity should the construction phases of each scheme overlap.
Pre-existing screening between the source and the receptors	The Site location is typical of an urbanised environment and the is limited vegetation surrounding the Site boundary.
Conclusions drawn from analysing local meteorological data which accurately represent the area: and if relevant the season during which works will take place	The wind direction is predominantly from the south west and north east of the Site, as shown in Figure 7.5. As such, properties to the north east and south west would be most affected by dust emissions.
Conclusions drawn from local topography	The topography of the area appears to be predominantly flat. As such, there are no constraints to dust dispersion.
Duration of the potential impact, as a receptor may become more sensitive over time	Given the opening year of 2033, the duration of the construction phase is likely to extend over several years. As such receptor sensitivity may increase over time.
Any known specific receptor sensitivities which go beyond the classifications given in the document.	No specific receptor sensitivities identified during the baseline.

Operational Phase Sensitive Receptors

7.38 A desk-top study was undertaken in order to identify any off-site sensitive receptor locations within 200m of the affected highway network that require specific consideration during the

assessment. These were modelled at varying heights in order to represent sensitive uses on ground and top floor level (closest to the energy generation) and are summarised in Table 7.5.

Table 7.5: Existing Sensitive Human Receptors

Receptor		NGR (m)		Height (m)
		X	Y	
R1	Residential - Springfield Place	520281.4	168483.1	1.5
R2	Residential - Kingston Road	520241.3	168525.0	1.5
R3	Residential - Kingston Road	520146.4	168544.8	4.5
R4	Educational - King Oak Primary School	519999.8	168700.9	1.5
R5	Residential - Kingston Road	520006.4	168641.4	1.5
R6	Residential - Kingston Road	519929.5	168665.6	1.5
R7	Residential - Kingston Road	519869.3	168733.1	1.5
R8	Residential - Cambridge Road	519642.5	168889.3	1.5
R9	Residential - Cambridge Road	519564.0	168913.8	1.5
R10	Residential - Cambridge Road	519015.6	169252.7	1.5
R10a	Residential - Cambridge Road	519015.6	169252.7	4.5
R11	Residential - Cambridge Road	518950.4	169289.7	1.5
R11a	Residential - Cambridge Road	518950.4	169289.7	4.5
R12	Medical - Kingston Hospital	519564.3	170025.3	1.5
R13	Medical - Kingston Hospital	519410.2	169903.0	1.5
R14	Residential - Kingston Hill	519254.7	169808.6	1.5
R15	Residential - Kingston Hill	519259.5	169765.7	1.5
R16	Residential - Kingston Hill	519528.5	170080.2	1.5
R17	Residential - Hawks Road	518974.0	169205.8	1.5
R17a	Residential - Hawks Road	518974.0	169205.8	4.5
R18	Residential - London Road	518945.9	169430.2	1.5
R19	Residential - London Road	518862.3	169345.1	4.5
R20	Residential - Hawks Road	518845.5	169104.4	1.5
R21	Educational - St Joseph's Catholic Nursery School	518680.3	169075.8	1.5
R22	Residential - Orchard Road	518266.1	169009.9	1.5
R23	Leisure - Tiffin Sports Centre	518770.3	169392.7	1.5
R24	Educational - Kingston Grammar School	518575.2	169317.0	1.5
R25	Educational - Tiffin School	518615.6	169399.0	1.5
R26	Educational - Kingston Grammar School	518629.9	169322.4	1.5
R27	Residential - Cambridge Road	519190.3	169185.9	4.5
R27a	Residential - Cambridge Road	519190.3	169185.9	14.0
R28	Residential - Cambridge Road	519371.5	169075.8	4.5
R28a	Residential - Cambridge Road	519371.5	169075.8	8.0
R29	Residential - Portman Road	518966.3	169136.0	1.5
R29a	Residential - Portman Road	518966.3	169136.0	4.5
R30	Residential - Somerset Road	518988.0	169051.6	1.5
R30a	Residential - Somerset Road	518988.0	169051.6	4.5
R31	Residential - Somerset Road	518956.0	169007.7	1.5
R31a	Residential - Somerset Road	518956.0	169007.7	4.5
R32	Residential - Rowlls Road	519022.2	168934.8	1.5
R32a	Residential - Rowlls Road	519022.2	168934.8	4.5
R33	Residential - Piper Road	519080.7	168928.1	1.5
R33a	Residential - Piper Road	519080.7	168928.1	4.5
R34	Residential - Cambridge Grove Road	519237.4	168932.7	1.5
R34a	Residential - Cambridge Grove Road	519237.4	168932.7	4.5

7.39 The sensitive receptors identified in Table 7.5 represent worst-case locations.

7.40 Reference should be made to Figure 7.6 for a graphical representation of the location of

sensitive human receptor locations from operational phase emissions.

Significance Criteria

7.41 Whilst impacts might be determined as 'minor', 'moderate' or 'major' at individual receptors, overall effect might not necessarily be deemed as significant in some circumstances. The following factors may provide some assistance in determining the overall significance of the Development:

- Number of properties affected by significant air quality impacts and a judgement on the overall balance;
- Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective will be relevant;
- The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors;
- Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a major increase or decrease; and
- The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.

7.42 These factors were considered and an overall significance determined for the effect of operational phase road traffic emissions. It should be noted that the determination of significance relies on professional judgement and reasoning should be provided as far as practicable. This has been considered throughout the assessment when defining predicted impacts.

7.43 An overall assessment of significance will be made based on the above assessment and by giving consideration to further criteria outlined in the EPUK, and IAQM guidance documents.

7.44 To align with the overall assessment of the EIA, the assessment of likely significant effects uses the Effect Significance Matrix as presented in Table 7.6.

Table 7.6: Effect Significance Matrix

Magnitude	Sensitivity		
	Major	Medium	Minor or Low
Major	Major Adverse/ Beneficial	Major-Moderate Adverse-Beneficial	Moderate –Minor Adverse-Beneficial
Moderate	Major –Moderate Adverse/ Beneficial	Moderate –Minor Adverse-Beneficial	Minor Adverse/ Beneficial
Minor	Moderate – Minor Adverse/ Beneficial	Minor Adverse/ Beneficial	Minor Adverse/Beneficial - Negligible

Magnitude	Sensitivity		
	Major	Medium	Minor or Low
Negligible	Negligible	Negligible	Negligible

7.45 The terminology used in Table 7.6 has been adapted from the EPUK/IAQM guidance in order to maintain consistency with the assessments presented in other technical chapters of this ES. 'Major' is used instead of 'Substantial', and 'Minor' in place of 'Slight'. The description of each significance level, as well as the terms 'Moderate' and 'Negligible', remain the same.

7.46 A change in predicted annual mean concentrations of NO_2 or PM_{10} of less than 0.5% is considered to be so small as to be negligible. A change (effect) that is negligible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

Limitations and Assumptions

Construction Phase Assessment

- Additionally, as outlined in Chapter 5, it is anticipated that the Development will generate less than 25 HDV trips per day during the construction phase of the Development; and
- The surface material and unpaved road length was not known at this stage of the assessment. As such, worse case assumptions have been made.

Operational Phase Assessment

7.47 Uncertainty in dispersion modelling predictions can be associated with a variety of factors, including:

- Data uncertainty - due to errors in input data, including emission estimates, operational procedures, land use characteristics and meteorology; and
- Variability - random or systematic error of measurements used.

7.48 These potential uncertainties in model results were minimised as far as practicable and worst-case inputs used in order to provide a robust assessment. This included the following:

- Choice of model - ADMS 5 (v5.2) and ADMS-Roads (v5.0) are commonly used atmospheric dispersion model and results have been verified through a number of studies to ensure predictions are as accurate as possible;

- Meteorological data - Modelling was undertaken using 1 year of annual meteorological data from the most representative meteorological station observation to the Site to take account of local conditions;
- Emission rates for traffic used Emission Factor Toolkit v.10 and for energy plant technical data sheets for proposed plant in line with current best practice approaches as discussed were appropriate within this chapter; and
- Variability - All model inputs are as accurate as possible and worst-case conditions were considered as necessary in order to ensure a robust assessment of potential pollutant concentrations.

7.49 The limitations stated above are standard limitations associated with atmospheric dispersion modelling assessments. Based on the controls and assumptions detailed above it is considered that the assessment is both robust in its conclusions and completed in line with current industry standard practice.

Baseline Conditions

7.50 Existing air quality conditions in the vicinity of the Development were identified in order to provide a baseline for assessment. These are detailed in the following sections.

Local Air Quality Management

7.51 As required by the Environment Act (1995), RBKuT has undertaken Review and Assessment of air quality within their area of administration. This process concluded that concentrations of pollutants considered within the AQS are currently above the relevant AQOs and as such one AQMA has been designated within RBKuT.

- *"Kingston-upon-Thames AQMA – the whole borough."*

7.52 The Site is located within the Kingston-upon-Thames AQMA. Subsequently, there is the potential for the Development to introduce future Site users to an area experiencing elevated pollutant concentrations, as well as cause adverse impacts to air quality within this sensitive area. This has been considered within this chapter.

Air Quality Monitoring

7.53 RBKuT monitors pollutant concentrations using continuous methods throughout their area of administration. There are three automatic analysers operated by RBKuT, the closest of which

is Cromwell Road, located within 1km north west of the Site. The location is shown in Figure 7.2. Monitoring results for NO_2 are shown in Table 7. for the most recent ratified and published data. Exceedances of the AQO are shown in **bold.**

Table 7.7: NO_2 Automatic Monitoring Results

Site ID	Site Name	Type	NGR (m)		Annual Mean NO_2 Concentration (µg/m^3)	
			X	Y	2017	2018
KT5	Cromwell Road	Roadside	518562	169519	N/A	**57**

7.54 As indicated above there was an exceedance of the annual mean AQO for NO_2 at the monitoring site in recent years, possibly due to its roadside location within an AQMA.

7.55 RBKuT also utilises passive diffusion tubes to monitor NO_2 concentrations throughout their borough. A review of the most recent available Annual Status Report (ASR)[xiv] indicates that there are 11 suitable diffusion tubes located within the vicinity of the Site. The most recent ratified and published data are presented in Table 7.8. Exceedance are shown in **bold**.

Table 7.8: RBKuT Diffusion Tube Monitoring Results

Site Name		Type	NGR (m)		Annual Mean NO_2 Concentration (µg/m^3)	
			X	Y	2017	2018
1	Guildhall Complex	Kerbside	517951	169029	21.6	21.6
2	17-19 Penrhyn Road	Roadside	518067	168672	40.3	**44.0**
23	40 Fife Road	Kerbside	518147	169455	31.1	39.6
24	14-16 Cromwell Road	Roadside	518467	169509	84.5	**75.9**
25	Queen Elizabeth Rd/London Rd	Kerbside	518533	169348	43.1	**40.0**
26	Richmond Road / Kings Road	Roadside	518199	170056	35.5	34.7
28	41 Kingston Hill	Kerbside	519353	169895	51.0	**49.6**
36	38 Coombe Lane West near A3 junction	Roadside	520047	169651	35.0	32.2
38	Kingston Road (Carpet Right)	Roadside	520503	168388	32.9	36.1
39	Cambridge Rd/Gloucester Rd	Kerbside	519372	169098	48.3	**46.8**
40	Cambridge Rd/Hawks Rd	Roadside	519064	169244	43.6	**42.3**

7.56 As indicated in Table 7.8, the annual AQO for NO_2 was exceeded at several diffusion tube monitoring locations in recent years. Reference should be made to Figure 7.2 for geographical representation of the monitoring locations.

7.57 The Cromwell Road automatic monitoring location also monitors annual mean PM_{10} concentrations. Recent Monitoring results for PM_{10} are shown in Table 7.9.

Table 7.9: PM_{10} Automatic Analyser Monitoring Results

Site ID	Site Name	Type	NGR (m)		Annual Mean PM_{10} Concentration (µg/m^3)	
			X	Y	2017	2018
KT5	Cromwell Road	Roadside	518562	169519	N/A	30

7.58 As indicated in Table 7.9, the annual mean AQO for PM_{10} was not exceeded during recent years at the Cromwell Road automatic monitoring location.

Background Pollutant Concentrations

7.59 Predictions of background pollutant concentrations on a 1km by 1km grid basis have been produced by DEFRA for the entire of the UK to assist Local Authorities in their review and assessment of air quality. The Site is located across two grid squares at NGR:519500, 169500 and 519500, 168500. Data for this location was downloaded from the DEFRA[xv] website for the purpose of this assessment for the verification year (2018), and the predicted Development opening year. The average of the concentrations for both grid squares was calculated and are summarised in Table 7.10. It should be noted that the DEFRA website only provides future background pollutant concentrations up until 2030. As such, 2030 concentrations were utilised in the absence any future predictions data. It should be noted that 2018 background concentrations have been used for all future modelled scenarios to maintain conservative approach with 2030 data only presented for completeness.

Table 7.10: Predicted Background Pollutant Concentrations

Pollutant	Predicted Background Concentration (µg/m^3)	
	2018	2030
NOx	31.42	21.17
NO_2	21.40	15.19
PM_{10}	16.81	15.11
$PM_{2.5}$	11.45	10.27

7.60 As shown in Table 7.10 background concentrations do not exceed the relevant AQOs. Comparison with the NO_2 monitoring results indicates the impact that vehicle exhaust emissions from the highway network have on pollutant concentrations at roadside locations.

Future Baseline

7.61 If the Development were not to go ahead it is anticipated that the Site would remain unchanged in its current form and there would be no additional emissions from the Site. Local air quality is however predicted to improve in future years, due to improved emissions standards associated with a shift towards 'greener' vehicle fleet compositions, as well as the influences of local discouragement of high emitting vehicles such as the expansion of the Ultra-Low Emission Zone in 2021. The approach for the assessment however, in order to be robust, is to maintain background pollutant concentrations for the latest ratified monitoring year (2018) as well as to maintain the vehicle fleet composition and emission rates at present values (2018) in preference to predicting any future improvements. This allows for a conservative assumption and therefore for the benefit of the assessment the baseline is not

predicted to evolve irrespective of the Development progressing and the Baseline scenarios for 'Without Development' remain unchanged.

Likely Significant Effects

Construction Phase

7.62 Any vehicle movements associated with construction phase of the Development, will generate exhaust emissions, such as NO_2 and PM_{10}, on the local and regional road networks.

7.63 Although specific numbers of HDV movements during the construction phase are not known, it is not anticipated that the Development will not result in an AADT flows of more than 25 HDV movements per day (refer to ES chapter 5).

7.64 As such, potential air quality impacts associated with construction phase road vehicle exhaust emissions are predicted to be not-significant.

Step 1 - Screening

7.65 The undertaking of activities such as demolition, excavation, ground works, cutting, construction, concrete batching and storage of materials has the potential to result in fugitive dust emissions throughout the construction phase of the Development. Vehicle movements both on-site and on the local road network also have the potential to result in the re-suspension of dust from haul road and highway surfaces.

7.66 The desk-study identified a number of sensitive human receptors within 350m of the Site boundary. This includes occupants on the initial phases of the Development as later phases are being completed and those within 50m of the anticipated trackout routes. As such, a detailed assessment of potential dust impacts was required, and summarised in the below sections.

7.67 There are no ecological receptors within 50m of the Site or trackout boundary. As such, construction phase impacts relating to ecological impacts have not been assessed further within this chapter.

Step 2A – Identification of Magnitude

7.68 The scale and nature of the works was determined to assess the magnitude of dust arising from each construction phase activity. The determination of magnitude was based upon GLA

guidance and summarised below.

Earthworks

7.69 Earthworks will primarily involve excavating material, haulage, tipping and stockpiling, as well as Site levelling and landscaping. Information on soil type was not available for the purpose of this assessment. As such, the soil type was considered to be potentially dusty in order to provide a worst-case scenario. The Site, at approximately 8.9 ha has a total area greater than 10,000m^2. In accordance with the GLA criteria, the magnitude of potential dust emissions from earthworks is therefore major.

Construction

7.70 The Development comprises the construction of up to 2,170 dwellings and up to 2,935 m^2 of non-residential floorspace therefore the total building volume is likely to be greater than 100,000m^3 the guidance banding relating to a 'major' magnitude from potential dust emissions related to construction activities.

Trackout

7.71 Based on the Site area, it is anticipated that the unpaved road length is likely to be greater than 100m. The magnitude of potential dust emissions from trackout is therefore major.

Table 7.11: Dust Emission Magnitude

Magnitude of Activity		
Earthworks	**Construction**	**Trackout**
Major	Major	Major

Step 2B – Identification of Magnitude

7.72 The next step (Step 2B) is to determine the sensitivity of the surrounding area, based on general principles such as amenity and aesthetics, as well as human exposure sensitivity.

Dust Soiling

7.73 A desk top study indicated that there are approximately 10-100 sensitive receptors within 20m of the Development boundary and the anticipated trackout route. Based on GLA assessment criteria the sensitivity of the receiving environment to potential dust soiling impacts was considered to be high for all construction activities. This is because the Site is situated in a predominantly residential area and the people or property would reasonably be

expected to be present for extended periods of time.

Human Health

7.74 The annual mean concentration of PM_{10} is 16.81µg/m^3 as detailed in Table 7.0. Based on GLA assessment criteria and given the presence of 10 - 100 sensitive receptors within 20m of the Development boundary and the anticipated trackout route, the area is considered to be of minor sensitivity for all construction phase activities.

7.75 The sensitivity of the receiving environment to specific potential dust impacts is summarised in Table 7.12.

Table 7.12: Sensitivity of the Surrounding Area

Potential Impact	Sensitivity of the Surrounding Area		
	Earthworks	Construction	Trackout
Dust Soiling	Major	Major	Major
Human Health	Minor	Minor	Minor

Step 2C – Risk

7.76 Both the magnitude and sensitivity factors are combined in Step 2C to determine the risk of dust impacts without the application of best practice mitigation measures.

7.77 It should be noted that the potential for impacts depends significantly on the distance between the dust generating activity and receptor location. Risk was predicted based on a worst-case scenario of works being undertaken at the Site boundary closest to each sensitive area. Therefore, actual risk may be lower than that predicted during the majority of the construction phase. A summary of the risk from each dust generating activity is provided in Table 7.13.

Table 7.13: Summary of Potential Unmitigated Dust Risks

Potential Impact	Risk		
	Earthworks	Construction	Trackout
Dust Soiling	Major	Major	Major
Human Health	Minor	Minor	Minor

Step 3 – Mitigation

7.78 The GLA guidance provides a number of potential mitigation measures to reduce effects during

the construction phase. These measures have been adapted for the Site and presented later on in this assessment in Table 7.26.

Operational Phase Assessment

Future Year Scenario

Nitrogen Dioxide

Predicted Concentrations at the Site

7.79 The Development will introduce several areas of sensitive land uses including residential units and amenity areas. To provide a worst-case scenario the results of the road traffic model are combined with the on-site emissions of the proposed energy centre.

7.80 A screening exercise was undertaken to allow a focus on the worst-case potential exposure to air quality, which was determined to be within proximity of Cambridge Road / A2043 (the dominate emission source in the area) at Blocks C and K of the Development. In order to determine potential future exposure at these locations, the lowest floor level of the Development (Level 00 represented by height of 1.5m) was measured across the Site where road traffic impacts will be the greatest with the additional first floor level (level 01 represented by height of 1.5m) modelled to determine where, if necessary, mitigation would be required.

7.81 In addition, future exposure from on-site energy centre related emissions have also been modelled at a height of 1.5m and 26.23m to represent worst case exposure across ground floor level and top floor levels of adjacent building, respectively.

7.82 Figure 7.7, Figure 7.8 and Figure 7.11 and 7.12 display the contour plots for the predicted annual mean NO_2 concentrations for the DS scenario.

7.83 Predicted annual mean NO_2 concentrations across Block C, Block K and Block E during the DS scenario are summarised in Table 7.14.

Table 7.14 Predicted Annual Mean NO_2 Concentrations at the Site

Floor	Predicted DS Annual Mean NO_2 Concentration Range (µg/m^3)	APEC Category
Block C - Ground (1.5m)	29.08 – **43.06**	A - C
Block C - First (4.5m)	28.06 – 33.85	A
Block K - Ground (1.5m)	26.34 – 33.73	A

Floor	Predicted DS Annual Mean NO_2 Concentration Range (µg/m^3)	APEC Category
Block K - First (4.5m)	25.97 – 28.74	A

7.84 The predicted concentrations shown in Table 7.14 indicates that there were exceedances of the AQO over the ground floor of Block C, and is categorised as APEC C. However, there are no sensitive uses proposed across the ground floor level of Block C. Predicted concentrations did not exceed the AQO at any sensitive uses across the Development at first floor level.

7.85 It is generally regarded that background NO_2 levels are likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above first floor level are considered to be acceptable and have not been assessed further.

7.86 The maximum annual on-site NO_2 concentrations as a result of energy emissions from the Development (at any Development Block in the south west of the Site) at ground and top floor level are predicted to be 23.0µg/m^3, and 23.5µg/m^3. Considering the annual mean background concentration 21.4µg/m^3, the overall NO_2 on the ground and top floor level at anywhere on the south west of the Site, is well below the AQO of 40 µg/m^3.

7.87 Based on the results of the dispersion modelling assessment, the Site is considered to be suitable for the proposed end-use without the implementation of mitigation measures to protect future users from elevated NO_2 concentrations.

7.88 Predictions of 1-hour NO_2 concentrations were not produced as part of the dispersion modelling assessment for Block C or K. However as stated in LAQM (TG16)[xiii], if annual mean NO_2 concentrations are below 60µg/m^3 then it is unlikely that the 1-hour AQO will be exceeded. As such, based on the results in Table 7.14 it is not predicted that concentrations will exceed the 1 hour mean AQO across the Site.

7.89 Based on the results of the dispersion modelling assessment, the Site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect future Site users from elevated 1-hour mean NO_2 concentrations.

Predicted Concentrations at Off-site Sensitive Receptors

7.90 Annual mean NO_2 concentrations were predicted for the DM and DS scenarios and are summarised in Table 7.15.

Table 7.15: Predicted Annual Mean NO_2 Concentrations at Off-site Sensitive Receptors

Sensitive Receptor		Predicted Annual Mean NO_2 Concentration ($\mu g/m^3$)				
		Without Development (DM)	With Development Roads Impacts	With Development Energy Impacts	Combined Development Impacts (DS)	Change (DS-DM)
R1	Residential - Springfield Place	31.03	0.20	0.01	31.23	0.21
R2	Residential - Kingston Road	37.05	0.30	0.01	37.35	0.31
R3	Residential - Kingston Road	26.62	0.12	0.02	26.74	0.14
R4	Educational - King Oak Primary School	24.57	0.08	0.02	24.65	0.10
R5	Residential - Kingston Road	35.38	0.28	0.02	35.66	0.30
R6	Residential - Kingston Road	31.59	0.21	0.02	31.80	0.23
R7	Residential - Kingston Road	33.18	0.24	0.03	33.42	0.27
R8	Residential - Cambridge Road	31.35	0.20	0.05	31.55	0.25
R9	Residential - Cambridge Road	31.07	0.20	0.07	31.27	0.27
R10	Residential - Cambridge Road	**43.56**	0.26	0.13	**43.82**	0.39
R10a	Residential - Cambridge Road	34.78	0.15	0.13	34.93	0.28
R11	Residential - Cambridge Road	**42.73**	0.21	0.08	**42.94**	0.29
R11a	Residential - Cambridge Road	36.60	0.13	0.08	36.73	0.21
R12	Medical - Kingston Hospital	25.60	0.05	0.02	25.65	0.07
R13	Medical - Kingston Hospital	31.14	0.08	0.02	31.22	0.10
R14	Residential - Kingston Hill	33.29	0.10	0.03	33.39	0.13
R15	Residential - Kingston Hill	35.62	0.11	0.03	35.73	0.14
R16	Residential - Kingston Hill	29.54	0.09	0.02	29.63	0.11
R17	Residential - Hawks Road	**40.09**	0.12	0.13	**40.21**	0.25
R17a	Residential - Hawks Road	34.43	0.10	0.13	34.53	0.23
R18	Residential - London Road	39.02	0.13	0.05	39.15	0.18
R19	Residential - London Road	**42.71**	0.17	0.05	**42.88**	0.22
R20	Residential - Hawks Road	**40.45**	0.10	0.08	**40.55**	0.18
R21	Educational - St Joseph's Catholic Nursery School	30.30	0.04	0.05	30.34	0.09
R22	Residential - Orchard Road	35.07	0.07	0.02	35.14	0.09
R23	Leisure - Tiffin Sports Centre	32.69	0.06	0.04	32.75	0.10
R24	Educational - Kingston Grammar School	**51.26**	0.11	0.02	**51.37**	0.13
R25	Educational - Tiffin School	37.23	0.04	0.02	37.27	0.06
R26	Educational - Kingston Grammar School	**49.59**	0.15	0.03	**49.74**	0.18
R27	Residential - Cambridge Road	30.34	0.14	0.29	30.48	0.43
R27a	Residential - Cambridge Road	25.15	0.03	0.30	25.18	0.33
R28	Residential - Cambridge Road	30.90	0.15	0.17	31.05	0.32
R28a	Residential - Cambridge Road	26.31	0.06	0.17	26.37	0.23
R29	Residential - Portman Road	31.11	0.06	0.15	31.17	0.21
R29a	Residential - Portman Road	30.67	0.06	0.15	30.73	0.21
R30	Residential - Somerset Road	28.52	0.04	0.10	28.56	0.14
R30a	Residential - Somerset Road	28.42	0.04	0.10	28.46	0.14
R31	Residential - Somerset Road	28.12	0.03	0.17	28.15	0.20
R31a	Residential - Somerset Road	28.04	0.03	0.17	28.07	0.20
R32	Residential - Rowlls Road	22.99	0.02	0.35	23.01	0.37
R32a	Residential - Rowlls Road	22.95	0.02	0.35	22.97	0.37
R33	Residential - Piper Road	22.81	0.02	0.19	22.83	0.21
R33a	Residential - Piper Road	22.77	0.03	0.20	22.80	0.23
R34	Residential - Cambridge Grove Road	22.98	0.04	0.21	23.02	0.25
R34a	Residential - Cambridge Grove Road	22.84	0.04	0.21	22.88	0.25

7.91 The predicted annual mean NO_2 concentrations exceeded the AQO at 7 sensitive receptor

locations for both the DM and DS scenarios. Critically, no new exceedances of the annual mean AQO for NO_2 are predicted to occur as a result of the Development.

7.92 Predicted impacts on annual mean NO_2 concentrations are summarised in Table 7.16.

Table 7.16: Predicted NO_2 Impacts at Off-site Sensitive Receptors

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Springfield Place	0.53	76-94% of the AQO	Negligible
R2	Residential - Kingston Road	0.79	76-94% of the AQO	Negligible
R3	Residential - Kingston Road	0.34	75% or Less of the AQO	Negligible
R4	Educational - King Oak Primary School	0.25	75% or Less of the AQO	Negligible
R5	Residential - Kingston Road	0.75	76-94% of the AQO	Negligible
R6	Residential - Kingston Road	0.58	76-94% of the AQO	Negligible
R7	Residential - Kingston Road	0.67	76-94% of the AQO	Negligible
R8	Residential - Cambridge Road	0.64	76-94% of the AQO	Negligible
R9	Residential - Cambridge Road	0.67	76-94% of the AQO	Negligible
R10	Residential - Cambridge Road	0.97	110+ of the AQO	*Moderate*
R10a	Residential - Cambridge Road	0.69	76-94% of the AQO	Negligible
R11	Residential - Cambridge Road	0.74	103-109% of the AQO	*Moderate*
R11a	Residential - Cambridge Road	0.54	76-94% of the AQO	Negligible
R12	Medical - Kingston Hospital	0.17	75% or Less of the AQO	Negligible
R13	Medical - Kingston Hospital	0.26	76-94% of the AQO	Negligible
R14	Residential - Kingston Hill	0.32	76-94% of the AQO	Negligible
R15	Residential - Kingston Hill	0.35	76-94% of the AQO	Negligible
R16	Residential - Kingston Hill	0.27	75% or Less of the AQO	Negligible
R17	Residential - Hawks Road	0.63	95-102% of the AQO	*Minor*
R17a	Residential - Hawks Road	0.58	76-94% of the AQO	Negligible
R18	Residential - London Road	0.45	95-102% of the AQO	Negligible
R19	Residential - London Road	0.56	103-109% of the AQO	*Moderate*
R20	Residential - Hawks Road	0.44	95-102% of the AQO	Negligible
R21	Educational - St Joseph's Catholic Nursery School	0.22	75% or Less of the AQO	Negligible
R22	Residential - Orchard Road	0.22	76-94% of the AQO	Negligible
R23	Leisure - Tiffin Sports Centre	0.25	76-94% of the AQO	Negligible
R24	Educational - Kingston Grammar School	0.33	110+ of the AQO	Negligible
R25	Educational - Tiffin School	0.16	76-94% of the AQO	Negligible
R26	Educational - Kingston Grammar School	0.44	110+ of the AQO	Negligible
R27	Residential - Cambridge Road	1.07	76-94% of the AQO	Negligible
R27a	Residential - Cambridge Road	0.83	75% or Less of the AQO	Negligible
R28	Residential - Cambridge Road	0.80	76-94% of the AQO	Negligible
R28a	Residential - Cambridge Road	0.58	75% or Less of the AQO	Negligible
R29	Residential - Portman Road	0.53	76-94% of the AQO	Negligible
R29a	Residential - Portman Road	0.53	76-94% of the AQO	Negligible
R30	Residential - Somerset Road	0.34	75% or Less of the AQO	Negligible
R30a	Residential - Somerset Road	0.35	75% or Less of the AQO	Negligible
R31	Residential - Somerset Road	0.49	75% or Less of the AQO	Negligible
R31a	Residential - Somerset Road	0.50	75% or Less of the AQO	Negligible
R32	Residential - Rowlls Road	0.92	75% or Less of the AQO	Negligible
R32a	Residential - Rowlls Road	0.93	75% or Less of the AQO	Negligible
R33	Residential - Piper Road	0.53	75% or Less of the AQO	Negligible
R33a	Residential - Piper Road	0.57	75% or Less of the AQO	Negligible
R34	Residential - Cambridge Grove Road	0.63	75% or Less of the AQO	Negligible

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R34a	Residential - Cambridge Grove Road	0.64	75% or Less of the AQO	Negligible

7.93 As indicated in Table 7.16, impacts on annual mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the Development were predicted to be moderate adverse at three sensitive receptor locations, minor at one sensitive receptor location and negligible at 41 sensitive receptor locations.

7.94 The moderate adverse locations represent a group of residential properties located on Cambridge Road within a junction with Hawks Road. Additionally, there are no new exceedances as a result of the Development and the magnitude of change at these locations is not considered significant.

7.95 It should also be noted that the use of DS traffic data and 2018 emission factors is considered to provide a worst-case scenario, which may lead to overestimations of actual pollutant concentrations during the operation of the Development. With that considered, the overall significance of operational phase road traffic emission impacts related to the Development upon annual mean NO_2 concentration was determined to be negligible. Further justification on the overall significance is provided in Table 7.25.

1 Hour Mean NO_2

Nitrogen Dioxide

Predicted Concentrations at the Site

7.96 Predicted 99.79th percentile of hourly mean NO_2 concentrations were modelled across the Development at ground floor level (1.5m) and top floor level (26.23m) of the proposed building located in the north east of the Development for the DS scenario, as shown in Figures 7.13 and 7.14. The maximum 1-hour on-site NO_2 concentrations (at any Development Block) at ground and top floor level are predicted to be 50µg/m^3, and 54.5µg/m^3. Considering a background concentration as twice the annual background concentration (42.8µg/m^3), the overall NO_2 on the ground floor and top floor level at anywhere on the Site, is well below the AQO of 200 µg/m^3.

7.97 Based on the results of the dispersion modelling assessment, the Development is considered to be suitable for the proposed use without the implementation of mitigation techniques to

protect future Site users from elevated 1-hour mean NO_2 concentrations.

Predicted Concentrations at Off-site Sensitive Receptors

7.98 In order to predict the 1-hour mean background NO_2 concentration, the advice provided within the EA guidance[xvi] was followed, which advises that an estimate of the maximum combined pollutant concentration can be obtained by adding the maximum predicted short-term concentration due to emissions from the source to twice the annual mean baseline concentration. The 1-hour mean background NO_2 concentration was therefore assumed to be twice the annual mean background NO_2 concentration.

7.99 1-hour mean NO_2 concentrations were predicted for the DM and DS scenarios and are summarised in Table 7.18.

Table 7.18: Predicted 1-Hour Mean NO_2 Concentrations at Off-site Sensitive Receptors

Sensitive Receptor		Predicted 1-Hour Mean NO_2 Concentration (µg/m^3)				
		Without Development (DM)	With Development Roads Impacts	With Development Energy Impacts	Combined Development Impacts (DS)	Change (DS-DM)
R1	Residential - Springfield Place	73.83	0.58	0.53	74.94	1.11
R2	Residential - Kingston Road	90.39	0.98	0.54	91.92	1.53
R3	Residential - Kingston Road	66.51	0.39	0.62	67.53	1.02
R4	Educational - King Oak Primary School	55.57	0.23	0.77	56.57	1.00
R5	Residential - Kingston Road	83.62	0.72	0.75	85.09	1.47
R6	Residential - Kingston Road	74.76	0.65	0.83	76.25	1.48
R7	Residential - Kingston Road	76.51	0.61	0.92	78.04	1.53
R8	Residential - Cambridge Road	74.85	0.55	1.44	76.84	1.99
R9	Residential - Cambridge Road	73.86	0.59	1.72	76.17	2.31
R10	Residential - Cambridge Road	105.11	0.90	3.27	109.28	4.17
R10a	Residential - Cambridge Road	81.70	0.34	3.28	85.33	3.62
R11	Residential - Cambridge Road	103.33	0.57	2.89	106.79	3.46
R11a	Residential - Cambridge Road	91.00	0.37	2.89	94.26	3.26
R12	Medical - Kingston Hospital	57.71	0.13	0.56	58.40	0.69
R13	Medical - Kingston Hospital	67.75	0.18	0.66	68.59	0.84
R14	Residential - Kingston Hill	80.92	0.30	0.84	82.06	1.14
R15	Residential - Kingston Hill	80.83	0.27	0.89	81.98	1.15
R16	Residential - Kingston Hill	69.80	0.27	0.48	70.55	0.75
R17	Residential - Hawks Road	87.86	0.41	3.97	92.24	4.38
R17a	Residential - Hawks Road	74.57	0.27	3.97	78.80	4.24
R18	Residential - London Road	92.03	0.43	1.77	94.23	2.20
R19	Residential - London Road	112.61	0.69	2.06	115.36	2.75
R20	Residential - Hawks Road	97.33	0.27	2.81	100.41	3.08
R21	Educational - St Joseph's Catholic Nursery School	65.25	0.08	1.78	67.11	1.86
R22	Residential - Orchard Road	87.89	0.20	0.81	88.90	1.01
R23	Leisure - Tiffin Sports Centre	77.35	0.34	1.64	79.32	1.98
R24	Educational - Kingston Grammar School	151.62	0.42	1.00	153.03	1.42
R25	Educational - Tiffin School	94.21	0.10	1.20	95.50	1.30

Sensitive Receptor		Predicted 1-Hour Mean NO_2 Concentration (µg/m³)				
		Without Development (DM)	With Development Roads Impacts	With Development Energy Impacts	Combined Development Impacts (DS)	Change (DS-DM)
R26	Educational - Kingston Grammar School	145.36	0.42	1.26	147.04	1.68
R27	Residential - Cambridge Road	78.55	0.47	4.17	83.19	4.64
R27a	Residential - Cambridge Road	62.43	0.16	5.06	67.65	5.22
R28	Residential - Cambridge Road	78.66	0.53	3.08	82.27	3.61
R28a	Residential - Cambridge Road	65.13	0.25	3.07	68.45	3.32
R29	Residential - Portman Road	70.88	0.10	4.45	75.43	4.55
R29a	Residential - Portman Road	69.63	0.12	4.53	74.28	4.65
R30	Residential - Somerset Road	64.67	0.07	4.71	69.45	4.78
R30a	Residential - Somerset Road	64.23	0.06	4.77	69.06	4.84
R31	Residential - Somerset Road	64.00	0.04	3.56	67.60	3.61
R31a	Residential - Somerset Road	63.62	0.05	3.55	67.22	3.60
R32	Residential - Rowlls Road	52.71	0.04	7.08	59.83	7.12
R32a	Residential - Rowlls Road	52.43	0.04	7.08	59.54	7.12
R33	Residential - Piper Road	52.09	0.04	6.44	58.57	6.48
R33a	Residential - Piper Road	51.92	0.04	6.49	58.44	6.52
R34	Residential - Cambridge Grove Road	52.23	0.10	5.78	58.11	5.88
R34a	Residential - Cambridge Grove Road	51.92	0.08	5.80	57.80	5.88

7.100 The predicted 1-hour mean NO_2 concentrations were below the AQO at all sensitive receptor locations for both the DM and DS scenarios.

7.101 Predicted impacts on 1-hour mean NO_2 concentrations at the sensitive receptor locations are summarised in Table 7.19.

Table 7.19: Predicted NO_2 Impacts at Off-site Sensitive Receptors

Sensitive Receptor		% Change in Concentration Relative to AQO	Impact
R1	Residential - Springfield Place	0.55	Negligible
R2	Residential - Kingston Road	0.76	Negligible
R3	Residential - Kingston Road	0.51	Negligible
R4	Educational - King Oak Primary School	0.50	Negligible
R5	Residential - Kingston Road	0.73	Negligible
R6	Residential - Kingston Road	0.74	Negligible
R7	Residential - Kingston Road	0.77	Negligible
R8	Residential - Cambridge Road	1.00	Negligible
R9	Residential - Cambridge Road	1.15	Negligible
R10	Residential - Cambridge Road	2.09	Negligible
R10a	Residential - Cambridge Road	1.81	Negligible
R11	Residential - Cambridge Road	1.73	Negligible
R11a	Residential - Cambridge Road	1.63	Negligible
R12	Medical - Kingston Hospital	0.34	Negligible
R13	Medical - Kingston Hospital	0.42	Negligible
R14	Residential - Kingston Hill	0.57	Negligible
R15	Residential - Kingston Hill	0.58	Negligible
R16	Residential - Kingston Hill	0.38	Negligible
R17	Residential - Hawks Road	2.19	Negligible
R17a	Residential - Hawks Road	2.12	Negligible

Sensitive Receptor		% Change in Concentration Relative to AQO	Impact
R18	Residential - London Road	1.10	Negligible
R19	Residential - London Road	1.37	Negligible
R20	Residential - Hawks Road	1.54	Negligible
R21	Educational - St Joseph's Catholic Nursery School	0.93	Negligible
R22	Residential - Orchard Road	0.51	Negligible
R23	Leisure - Tiffin Sports Centre	0.99	Negligible
R24	Educational - Kingston Grammar School	0.71	Negligible
R25	Educational - Tiffin School	0.65	Negligible
R26	Educational - Kingston Grammar School	0.84	Negligible
R27	Residential - Cambridge Road	2.32	Negligible
R27a	Residential - Cambridge Road	2.61	Negligible
R28	Residential - Cambridge Road	1.81	Negligible
R28a	Residential - Cambridge Road	1.66	Negligible
R29	Residential - Portman Road	2.28	Negligible
R29a	Residential - Portman Road	2.32	Negligible
R30	Residential - Somerset Road	2.39	Negligible
R30a	Residential - Somerset Road	2.42	Negligible
R31	Residential - Somerset Road	1.80	Negligible
R31a	Residential - Somerset Road	1.80	Negligible
R32	Residential - Rowlls Road	3.56	Negligible
R32a	Residential - Rowlls Road	3.56	Negligible
R33	Residential - Piper Road	3.24	Negligible
R33a	Residential - Piper Road	3.26	Negligible
R34	Residential - Cambridge Grove Road	2.94	Negligible
R34a	Residential - Cambridge Grove Road	2.94	Negligible

7.102 As indicated in Table 7.19, impacts on 1-hour mean NO_2 concentrations as a result of road vehicle exhaust emissions associated with the Development were predicted to be negligible at all sensitive receptor locations.

7.103 It should also be noted that the use of DS traffic data and 2018 emission factors is considered to provide a worst-case scenario, which may lead to overestimations of actual pollutant concentrations during the operation of the Development. With that considered, the overall significance of operational phase road traffic emission impacts related to the Development upon 1-hour mean NO_2 concentration was determined to be negligible.

Particulate Matter

Predicted Concentrations at the Site

7.104 Annual mean PM concentrations were predicted across the Development for the DM and DS scenarios at 1.5m to represent exposure across the ground floor level, as shown in Figures 7.9 and 7.10.

7.105 Predicted annual mean PM concentrations across the Site during the DS scenario are

summarised in Table 7.20.

Table 7.20: Predicted Annual Mean PM_{10} Concentrations at the Site

Floor	Predicted DS Annual Mean PM_{10} Concentration Range ($\mu g/m^3$)	APEC Category	Predicted DS Annual Mean $PM_{2.5}$ Concentration Range ($\mu g/m^3$)	APEC Category
Block C - Ground (1.5m)	17.67 – 19.05	A	11.99 – 12.91	A
Block K - Ground (1.5m)	17.40 – 18.40	A	11.82 – 12.43	A

7.106 The predicted concentrations shown in Table 7.20 indicate that there were no exceedances of the AQO throughout the modelling area and are categorised as APEC A. As such, there is predicted to be no risk of exceedance of the annual mean AQO for PM at sensitive locations across the Development.

7.107 Similar to NO_2 background concentrations, it should be noted that background PM levels are also likely to be lower at elevated heights due to increased distance from emission sources, such as roads. Therefore, predicted concentrations at heights above ground floor level are considered to be acceptable and have not been assessed further.

7.108 Based on the results of the dispersion modelling assessment, the Site is considered to be suitable for the proposed use without the implementation of mitigation techniques to protect future users from elevated PM_{10} concentrations.

Predicted Concentrations at Off-site Sensitive Receptors

7.109 Annual mean PM_{10} concentrations were predicted for the DM and DS scenarios and are summarised in Table 7.21.

Table 7.21: Predicted Annual Mean PM_{10} Concentrations at Off-site Sensitive Receptors

Sensitive Receptor		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Springfield Place	26.70	26.73	0.03
R2	Residential - Kingston Road	27.55	27.59	0.04
R3	Residential - Kingston Road	26.12	26.13	0.01
R4	Educational - King Oak Primary School	24.76	24.77	0.01
R5	Residential - Kingston Road	27.30	27.34	0.04
R6	Residential - Kingston Road	25.68	25.71	0.03
R7	Residential - Kingston Road	25.90	25.93	0.03
R8	Residential - Cambridge Road	25.65	25.67	0.02
R9	Residential - Cambridge Road	25.61	25.64	0.03
R10	Residential - Cambridge Road	28.08	28.12	0.04
R10a	Residential - Cambridge Road	26.92	26.94	0.02
R11	Residential - Cambridge Road	28.66	28.70	0.04
R11a	Residential - Cambridge Road	27.75	27.76	0.01
R12	Medical - Kingston Hospital	25.10	25.11	0.01

Sensitive Receptor		Predicted Annual Mean PM_{10} Concentration ($\mu g/m^3$)		
		DM	DS	Change
R13	Medical - Kingston Hospital	26.55	26.56	0.01
R14	Residential - Kingston Hill	26.82	26.83	0.01
R15	Residential - Kingston Hill	27.12	27.14	0.02
R16	Residential - Kingston Hill	25.60	25.61	0.01
R17	Residential - Hawks Road	28.37	28.39	0.02
R17a	Residential - Hawks Road	27.51	27.52	0.01
R18	Residential - London Road	28.12	28.14	0.02
R19	Residential - London Road	28.25	28.27	0.02
R20	Residential - Hawks Road	28.50	28.51	0.01
R21	Educational - St Joseph's Catholic Nursery School	26.96	26.96	0.00
R22	Residential - Orchard Road	27.65	27.66	0.01
R23	Leisure - Tiffin Sports Centre	27.25	27.25	0.00
R24	Educational - Kingston Grammar School	29.17	29.18	0.01
R25	Educational - Tiffin School	27.67	27.67	0.00
R26	Educational - Kingston Grammar School	29.55	29.57	0.02
R27	Residential - Cambridge Road	26.42	26.44	0.02
R27a	Residential - Cambridge Road	25.77	25.78	0.01
R28	Residential - Cambridge Road	26.48	26.50	0.02
R28a	Residential - Cambridge Road	25.92	25.93	0.01
R29	Residential - Portman Road	27.07	27.07	0.00
R29a	Residential - Portman Road	27.01	27.01	0.00
R30	Residential - Somerset Road	26.73	26.74	0.01
R30a	Residential - Somerset Road	26.72	26.72	0.00
R31	Residential - Somerset Road	26.69	26.69	0.00
R31a	Residential - Somerset Road	26.68	26.68	0.00
R32	Residential - Rowlls Road	24.56	24.56	0.00
R32a	Residential - Rowlls Road	24.56	24.56	0.00
R33	Residential - Piper Road	24.54	24.54	0.00
R33a	Residential - Piper Road	24.53	24.54	0.01
R34	Residential - Cambridge Grove Road	24.56	24.57	0.01
R34a	Residential - Cambridge Grove Road	24.54	24.55	0.01

7.110 The predicted annual mean PM_{10} concentrations were below the relevant AQO at all sensitive receptor locations. Critically, no new exceedances have been predicted as a result of the Development.

7.111 Predicted impacts on annual mean PM_{10} concentrations are summarised in Table 7.22.

Table 7.22: Predicted PM_{10} Impacts at Off-site Sensitive Receptors

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Springfield Place	0.08	75% or Less of the AQO	Negligible
R2	Residential - Kingston Road	0.10	75% or Less of the AQO	Negligible
R3	Residential - Kingston Road	0.02	75% or Less of the AQO	Negligible
R4	Educational - King Oak Primary School	0.02	75% or Less of the AQO	Negligible
R5	Residential - Kingston Road	0.10	75% or Less of the AQO	Negligible
R6	Residential - Kingston Road	0.08	75% or Less of the AQO	Negligible
R7	Residential - Kingston Road	0.08	75% or Less of the AQO	Negligible
R8	Residential - Cambridge Road	0.05	75% or Less of the AQO	Negligible
R9	Residential - Cambridge Road	0.08	75% or Less of the AQO	Negligible

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R10	Residential - Cambridge Road	0.10	75% or Less of the AQO	Negligible
R10a	Residential - Cambridge Road	0.05	75% or Less of the AQO	Negligible
R11	Residential - Cambridge Road	0.10	75% or Less of the AQO	Negligible
R11a	Residential - Cambridge Road	0.03	75% or Less of the AQO	Negligible
R12	Medical - Kingston Hospital	0.02	75% or Less of the AQO	Negligible
R13	Medical - Kingston Hospital	0.02	75% or Less of the AQO	Negligible
R14	Residential - Kingston Hill	0.02	75% or Less of the AQO	Negligible
R15	Residential - Kingston Hill	0.05	75% or Less of the AQO	Negligible
R16	Residential - Kingston Hill	0.02	75% or Less of the AQO	Negligible
R17	Residential - Hawks Road	0.05	75% or Less of the AQO	Negligible
R17a	Residential - Hawks Road	0.02	75% or Less of the AQO	Negligible
R18	Residential - London Road	0.05	75% or Less of the AQO	Negligible
R19	Residential - London Road	0.05	75% or Less of the AQO	Negligible
R20	Residential - Hawks Road	0.03	75% or Less of the AQO	Negligible
R21	Educational - St Joseph's Catholic Nursery School	0.00	75% or Less of the AQO	Negligible
R22	Residential - Orchard Road	0.03	75% or Less of the AQO	Negligible
R23	Leisure - Tiffin Sports Centre	0.00	75% or Less of the AQO	Negligible
R24	Educational - Kingston Grammar School	0.02	75% or Less of the AQO	Negligible
R25	Educational - Tiffin School	0.00	75% or Less of the AQO	Negligible
R26	Educational - Kingston Grammar School	0.05	75% or Less of the AQO	Negligible
R27	Residential - Cambridge Road	0.05	75% or Less of the AQO	Negligible
R27a	Residential - Cambridge Road	0.03	75% or Less of the AQO	Negligible
R28	Residential - Cambridge Road	0.05	75% or Less of the AQO	Negligible
R28a	Residential - Cambridge Road	0.02	75% or Less of the AQO	Negligible
R29	Residential - Portman Road	0.00	75% or Less of the AQO	Negligible
R29a	Residential - Portman Road	0.00	75% or Less of the AQO	Negligible
R30	Residential - Somerset Road	0.02	75% or Less of the AQO	Negligible
R30a	Residential - Somerset Road	0.00	75% or Less of the AQO	Negligible
R31	Residential - Somerset Road	0.00	75% or Less of the AQO	Negligible
R31a	Residential - Somerset Road	0.00	75% or Less of the AQO	Negligible
R32	Residential - Rowlls Road	0.00	75% or Less of the AQO	Negligible
R32a	Residential - Rowlls Road	0.00	75% or Less of the AQO	Negligible
R33	Residential - Piper Road	0.00	75% or Less of the AQO	Negligible
R33a	Residential - Piper Road	0.02	75% or Less of the AQO	Negligible
R34	Residential - Cambridge Grove Road	0.03	75% or Less of the AQO	Negligible
R34a	Residential - Cambridge Grove Road	0.03	75% or Less of the AQO	Negligible

7.112 As indicated in Table 7.22, impacts on annual mean PM_{10} concentrations as a result of road vehicle exhaust emissions associated with the Development were predicted to be negligible at all sensitive receptor locations. It is therefore considered that the overall balance of impacts as a result of the Development is not significant. Further justification is provided in Table 7.23.

7.113 Annual mean $PM_{2.5}$ concentrations were predicted for the DM and DS scenarios and are summarised in Table 7.23.

Table 7.23: Predicted Annual Mean $PM_{2.5}$ Concentrations at Off-site Sensitive Receptors

Sensitive Receptor		Predicted Annual Mean $PM_{2.5}$ Concentration ($\mu g/m^3$)		
		DM	DS	Change
R1	Residential - Springfield Place	18.20	18.22	0.02
R2	Residential - Kingston Road	18.73	18.76	0.03
R3	Residential - Kingston Road	17.84	17.85	0.01
R4	Educational - King Oak Primary School	16.93	16.94	0.01
R5	Residential - Kingston Road	18.58	18.60	0.02
R6	Residential - Kingston Road	17.50	17.52	0.02
R7	Residential - Kingston Road	17.64	17.66	0.02
R8	Residential - Cambridge Road	17.48	17.50	0.02
R9	Residential - Cambridge Road	17.46	17.47	0.01
R10	Residential - Cambridge Road	18.90	18.93	0.03
R10a	Residential - Cambridge Road	18.17	18.18	0.01
R11	Residential - Cambridge Road	19.13	19.15	0.02
R11a	Residential - Cambridge Road	18.56	18.57	0.01
R12	Medical - Kingston Hospital	17.06	17.06	0.00
R13	Medical - Kingston Hospital	17.93	17.94	0.01
R14	Residential - Kingston Hill	18.10	18.11	0.01
R15	Residential - Kingston Hill	18.29	18.30	0.01
R16	Residential - Kingston Hill	17.37	17.38	0.01
R17	Residential - Hawks Road	18.95	18.96	0.01
R17a	Residential - Hawks Road	18.41	18.42	0.01
R18	Residential - London Road	18.79	18.80	0.01
R19	Residential - London Road	18.89	18.91	0.02
R20	Residential - Hawks Road	19.02	19.03	0.01
R21	Educational - St Joseph's Catholic Nursery School	18.06	18.07	0.01
R22	Residential - Orchard Road	18.50	18.50	0.00
R23	Leisure - Tiffin Sports Centre	18.24	18.25	0.01
R24	Educational - Kingston Grammar School	19.49	19.50	0.01
R25	Educational - Tiffin School	18.52	18.52	0.00
R26	Educational - Kingston Grammar School	19.68	19.70	0.02
R27	Residential - Cambridge Road	17.85	17.86	0.01
R27a	Residential - Cambridge Road	17.44	17.45	0.01
R28	Residential - Cambridge Road	17.88	17.90	0.02
R28a	Residential - Cambridge Road	17.54	17.54	0.00
R29	Residential - Portman Road	18.13	18.14	0.01
R29a	Residential - Portman Road	18.10	18.10	0.00
R30	Residential - Somerset Road	17.92	17.93	0.01
R30a	Residential - Somerset Road	17.91	17.92	0.01
R31	Residential - Somerset Road	17.89	17.90	0.01
R31a	Residential - Somerset Road	17.89	17.89	0.00
R32	Residential - Rowlls Road	16.81	16.81	0.00
R32a	Residential - Rowlls Road	16.80	16.81	0.01
R33	Residential - Piper Road	16.79	16.80	0.01
R33a	Residential - Piper Road	16.79	16.79	0.00
R34	Residential - Cambridge Grove Road	16.81	16.81	0.00
R34a	Residential - Cambridge Grove Road	16.80	16.80	0.00

7.114 The predicted annual mean $PM_{2.5}$ concentrations were below the relevant AQO at all sensitive receptor locations. Critically, no new exceedances have been predicted as a result of the Development.

7.115 Predicted impacts on annual mean $PM_{2.5}$ concentrations are summarised in Table 7.24.

Table 7.24: Predicted $PM_{2.5}$ Impacts at Off-site Sensitive Receptors

Sensitive Receptor		% Change in Concentration Relative to AQO	Long Term Average Concentration	Impact
R1	Residential - Springfield Place	0.08	75% or Less of the AQO	Negligible
R2	Residential - Kingston Road	0.12	75% or Less of the AQO	Negligible
R3	Residential - Kingston Road	0.04	75% or Less of the AQO	Negligible
R4	Educational - King Oak Primary School	0.04	75% or Less of the AQO	Negligible
R5	Residential - Kingston Road	0.08	75% or Less of the AQO	Negligible
R6	Residential - Kingston Road	0.08	75% or Less of the AQO	Negligible
R7	Residential - Kingston Road	0.08	75% or Less of the AQO	Negligible
R8	Residential - Cambridge Road	0.08	75% or Less of the AQO	Negligible
R9	Residential - Cambridge Road	0.04	75% or Less of the AQO	Negligible
R10	Residential - Cambridge Road	0.12	75% or Less of the AQO	Negligible
R10a	Residential - Cambridge Road	0.04	75% or Less of the AQO	Negligible
R11	Residential - Cambridge Road	0.08	75% or Less of the AQO	Negligible
R11a	Residential - Cambridge Road	0.04	75% or Less of the AQO	Negligible
R12	Medical - Kingston Hospital	0.00	75% or Less of the AQO	Negligible
R13	Medical - Kingston Hospital	0.04	75% or Less of the AQO	Negligible
R14	Residential - Kingston Hill	0.04	75% or Less of the AQO	Negligible
R15	Residential - Kingston Hill	0.04	75% or Less of the AQO	Negligible
R16	Residential - Kingston Hill	0.04	75% or Less of the AQO	Negligible
R17	Residential - Hawks Road	0.04	75% or Less of the AQO	Negligible
R17a	Residential - Hawks Road	0.04	75% or Less of the AQO	Negligible
R18	Residential - London Road	0.04	75% or Less of the AQO	Negligible
R19	Residential - London Road	0.08	75% or Less of the AQO	Negligible
R20	Residential - Hawks Road	0.04	75% or Less of the AQO	Negligible
R21	Educational - St Joseph's Catholic Nursery School	0.04	75% or Less of the AQO	Negligible
R22	Residential - Orchard Road	0.00	75% or Less of the AQO	Negligible
R23	Leisure - Tiffin Sports Centre	0.04	75% or Less of the AQO	Negligible
R24	Educational - Kingston Grammar School	0.04	75% or Less of the AQO	Negligible
R25	Educational - Tiffin School	0.00	75% or Less of the AQO	Negligible
R26	Educational - Kingston Grammar School	0.08	75% or Less of the AQO	Negligible
R27	Residential - Cambridge Road	0.04	75% or Less of the AQO	Negligible
R27a	Residential - Cambridge Road	0.04	75% or Less of the AQO	Negligible
R28	Residential - Cambridge Road	0.08	75% or Less of the AQO	Negligible
R28a	Residential - Cambridge Road	0.00	75% or Less of the AQO	Negligible
R29	Residential - Portman Road	0.04	75% or Less of the AQO	Negligible
R29a	Residential - Portman Road	0.00	75% or Less of the AQO	Negligible
R30	Residential - Somerset Road	0.04	75% or Less of the AQO	Negligible
R30a	Residential - Somerset Road	0.04	75% or Less of the AQO	Negligible
R31	Residential - Somerset Road	0.04	75% or Less of the AQO	Negligible
R31a	Residential - Somerset Road	0.00	75% or Less of the AQO	Negligible
R32	Residential - Rowlls Road	0.00	75% or Less of the AQO	Negligible
R32a	Residential - Rowlls Road	0.04	75% or Less of the AQO	Negligible
R33	Residential - Piper Road	0.04	75% or Less of the AQO	Negligible
R33a	Residential - Piper Road	0.00	75% or Less of the AQO	Negligible
R34	Residential - Cambridge Grove Road	0.00	75% or Less of the AQO	Negligible
R34a	Residential - Cambridge Grove Road	0.00	75% or Less of the AQO	Negligible

7.116 As indicated in Table 7.24, impacts on annual mean $PM_{2.5}$ concentrations as a result of road

vehicle exhaust emissions associated with the Development were predicted to be negligible at all sensitive receptor locations. It is therefore considered that the overall balance of impacts as a result of the Development is not significant. Further justification isprovided in Table 7.25.

Overall Significance of Effects

7.117 The overall significance of operational phase road traffic emissions was determined as negligible (not significant). This was based on the predicted impacts at discrete receptor locations and the considerations outlined in the methodology section. Further justification is provided in Table 7.25.

7.118 It should also be noted that the use of DS traffic data and 2018 emission factors is considered to provide a worst-case scenario, which may lead to overestimations of actual pollutant concentrations during the operation of the Development.

Table 7.25: Overall Road Traffic Exhaust Emission Significance of Effects

Guidance	Comment
Number of properties affected by slight, moderate or substantial air quality impacts and a judgement on the overall balance.	Impacts on annual mean NO_2, were predicted to be negligible at 41 sensitive receptors and moderate at 3 sensitive receptors and minor at 1 sensitive receptor locations. In regards to the moderate effects at R10,R11 and R19 these locations represent a group of properties at a busy junction on Cambridge Road. These moderate effects reflect the elevated pollutant concentrations within the future DM scenario level, and cannot be directly accounted to the operation of the Development. Negligible affected properties represent all remaining sensitive receptor locations in the assessment extents. 1-hour mean NO_2, annual mean PM_{10} and $PM_{2.5}$, concentrations were predicted to be negligible at all sensitive receptors considered. These represent worst-case locations and therefore it is unlikely that any other receptors would be significantly affected by the Development.
Where new exposure is introduced into an existing area of poor air quality, then the number of people exposed to levels above the objective or limit value will be relevant.	Although there were areas of the ground floor classified as APEC -C in accordance with the London Councils Air Quality and Planning Guidance[v], there were no proposed uses that would be sensitive to long term pollutant concentrations, such as residential units. As a result, exposure to annual mean NO_2 concentrations on this floor level is not applicable as in accordance with the guidance provided in LLAQM (TG16)[iii].

Guidance	Comment
The percentage change in concentration relative to the objective and the descriptions of the impacts at the receptors.	The change in concentration relative to the AQO was predicted to range from: • 0.34% to 3.56% for 1-hour mean NO_2 • 0.16% to 1.07% for annual mean NO_2; • <0.01% to 0.10% for PM_{10}; and • <0.01% to 0.12% for $PM_{2.5}$. It should be noted that the moderately affected locations R10, R11 and R19 were predicted to have changes of 0.97%, 0.74% and 0.56% respectively. This indicates there were minor changes in magnitude of NO_2 from the DM to DS scenario. As such, the moderate impacts cannot be directly accounted to the Development and are more related to the future baseline or DM scenario. Impacts upon 1-hour mean NO_2 annual mean PM_{10} $PM_{2.5}$ concentrations were deemed negligible at all locations. Resulting impacts were therefore deemed not-significant.
Whether or not an exceedance of an objective is predicted to arise or be removed in the study area due to a substantial increase or decrease.	There were exceedances of the annual mean AQO for NO_2; at sensitive receptor locations throughout the modelling extents. The area of exceedance was not predicted to substantially increase or decrease as a result of the Development. Critically, no new exceedances were predicted as a result of the Development. There were no exceedances of the 1-hour mean AQO for NO_2 or annual mean AQO for PM_{10} or $PM_{2.5}$ within the modelling extents.
The extent to which an objective is exceeded e.g. an annual mean NO_2 concentration of 41µg/m^3 should attract less significance than an annual mean of 51µg/m^3.	There were exceedances of the AQO for NO_2 at to receptor locations, with exceedances of 41µg/m^3 and 51µg/m^3. Critically, these exceedances were predicted during the DM and DS scenarios and therefore cannot be directly accounted to the operation of the Development. There were no exceedances of the 1-hour mean AQO for NO_2 or annual mean AQO for PM_{10} or $PM_{2.5}$ at any sensitive receptor location within the modelling extents.

Mitigation Measures

7.119 There are a number of air quality mitigation options available to ensure negligible air quality impacts are maintained as result of the Development. Measures relevant to the operation and construction of the Development are outlined in the following sections.

Construction Phase

7.120 The Site has been classified as high risk for construction phase activities, without any

mitigation measures in place in regards to the potential of dust soiling which would corelate to a moderate adverse effect. This risk is typical of a development of this scale within an urban environment and mitigation and construction management measures in line with the GLA guidance will need to be adopted to reduce the associated risk to an acceptable level and reduce effects to a minor adverse effect considered to be not significant. Mitigation and management measures for the Development are summarised in Table 7.26. It will be a requirement to review these measures prior to the commencement of construction works and incorporated into existing strategies and management plans.

Table 7.26: Fugitive Dust Mitigation Measures

Issue	Control Measure
Communications	• Display the name and contact details of person(s) accountable for air quality and dust issues on the Site boundary; • Develop and implement a stakeholder communications plan that includes community engagement; • Display the head or regional office contact information; and • Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions
Site Management	• Record all dusty and air quality complaints and make the complaints log available to RBKuT when asked; • Record any exceptional incidents that cause dust/or air emissions, and the action taken to resolve the situation; • Make complaints log available to RBKuT when asked; and • Hold regular liaison meetings with other high risk construction sites that are within 500m of the Site boundary. Ensuring plans are co-ordinated and dust and particulate matter emission are minimised.
Monitoring	• Undertake daily on-site and off-site inspection where receptors are nearby to monitor dust; • Carry out regular Site inspections to monitor compliance with the DMP; and • Increase frequency of Site inspections when activities with a high potential to produce dust are being carried out.
Preparing and Maintaining the Site	• Plan Site layout so that machinery and dust causing activities are located away from receptors; • Fully enclose Site or specific operations where there is a high potential for dust production and the Site as activities for an extensive period; • Avoid Site runoff of water or mud; • Keep Site fencing, barriers and scaffolding clean using wet methods; • Remove materials that have a potential to produce dust from the Site as soon as possible; and • Cover, seed or fence stockpiles to prevent wind whipping Use water as dust suppressant where applicable.
Operating Vehicle/ Machinery and Sustainable Travel	• Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone and the London NRRM standards; • All vehicles to switch off engines - no idling vehicles; • Avoid the use of diesel or petrol powered generators where practicable; • Impose and signpost a maximum-speed-limit of 15mph on surfaced and 10mph in unsurfaced haul roads; • Produce a Construction Logistics Plan (CLP) to manage sustainable deliveries; and • Implement a Travel Plan that supports and encourages sustainable travel.

Issue	Control Measure
Operations	• Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction; • Ensure adequate water supply on the Site for effective dust/particulate matter suppression/mitigation; • Use enclosed chutes and covered skips; • Minimise drop heights; and • Ensure equipment is readily available on-site to clean any spillages.
Waste Management	• No bonfires
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; • Avoid explosive blasting, using appropriate manual or mechanical alternatives; and • Bag and remove any biological debris or damp down such material before demolition.
Earthworks and Construction	• Re-vegetate earthworks and exposed areas; • Use Hessian, mulches or trackifiers where it is not possible to re-vegetate; • Only remove the cover in small areas during work and not all at once; • Avoid scabbling; • Ensure sand and other aggregates are stored and not able to dry out, unless it is required for a specific process; • Ensure bulk cement and other fine powder materials are delivered and stored to prevent escape; and • For smaller supplies of fine powder materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	• Use water-assisted dust sweepers on the access and local roads; • Avoid dry sweeping of large areas; • Ensure vehicles entering and leaving sites are covered to prevent escape of materials; • Inspect on-site routes for integrity, instigate necessary repairs and record in Site log book; • Install hard surfaced haul routes which are regularly damped down; • Implement a wheel washing system at a suitable location near Site exit; • Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the Site exit, wherever Site size and layout permits; and • Access gates to be located at least 10m from receptors, where possible.

7.121 The mitigation measures outlined in Table 7.26 will be included as part of the Construction Environmental Management Plan (CEMP), which will be implemented prior to each phase of the Development and secured by planning condition.

Operational Phase

7.122 Overall, the Development is considered to be suitable for the proposed end-use and there would be no likely significant effects arising without the implementation of mitigation measures.

7.123 While off-site associated impacts are considered negligible, principles of good practice techniques will be implemented, which comply with national and local policies. These good

practice measures include:

- Provision of Electric Vehicle Charging Points or instruction provision for all parking bays;
- Provision of secure cycle storage infrastructure;
- Implementation of Travel Plans; and
- Provision of measures to support sustainable transport modes including features to encourage sustainable travel methods e.g. cycle path links, pedestrian links, bus stops, etc.

Residual Effects

Construction Phase

7.124 Assuming the relevant mitigation measures outlined in Table 7.26 are implemented, the moderate adverse risk from construction phase activities would be reduced and the residual effect from all dust generating activities is predicted to be a minor effect which is considered not significant.

Operational Phase

7.125 Predicted impacts on NO_2, PM_{10} and $PM_{2.5}$ concentrations as a result of the operational phase of the Development were predicted to be not significant at all modelled sensitive receptor locations. Consequently, the residual effects resulting from road vehicle exhaust emissions associated with traffic generated by the Development and energy emissions associated with the Development are predicted to be negligible (not significant).

Cumulative Effects

7.126 The list of cumulative schemes which have been considered within this assessment and the approach to the cumulative assessment is outlined within Chapter 2.

Construction Phase

7.127 As discussed previously, there is the potential for cumulative effects on construction dust impacts from other major developments in the vicinity of the Site should the construction phases overlap for each scheme, as well as agricultural dust generating activity in the area. A review of those sites identified within Chapter 2 (Table 2.5), which alongside the Development could potentially result in significant adverse cumulative effects for air quality,

has been undertaken.

7.128 Due to the size and nature of the surrounding committed development, there is a likelihood for cumulative effects as a result of concurrent dust generating activity should the construction phases overlap. However, the implementation of the individual schemes' mitigation measures, in line with GLA best practice guidance document[xii] suggested in Table 7.26 will ensure that any cumulative effects at the Development will be minimised.

7.129 Additionally, in accordance with GLA guidance, it is considered that with the incorporation of proactive mitigation measures through site management the combined cumulative interactions of neighbouring construction sites should be considered to be not significant

7.130 Given these considerations and the mitigation measures proposed, the assessment of cumulative construction dust impacts is therefore considered to be negligible (not significant).

Operational Phase

7.131 The cumulative traffic impacts from other relevant cumulative developments in the area have been included in the DM scenario and therefore the cumulative air quality impacts have been considered within this assessment.

Summary

7.132 This chapter of the ES assesses the likely significant effects of the Development with respect to Air Quality.

7.133 Due to the scale of the Development there is potential for air quality impacts at sensitive receptor locations across the local road network and expose future Site users into an area of poor air quality. An Air Quality Assessment was therefore required to quantify baseline conditions, consider the suitability of the Site for the proposed end-use and assess likely significant effects as a result of the Development.

Construction Phase

7.134 Likely significant construction phase air quality effects from fugitive dust emissions were assessed as a result of earthworks, construction and trackout activities. It is considered that the use of good practice control measures would provide suitable mitigation for a Development of this size and nature and reduce potential impacts so that they are not

significant.

Operational Phase

7.135 Dispersion modelling was undertaken in order to quantify pollutant concentrations at the Site and assess potential exposure of future users. There were exceedances of the annual mean AQO for NO_2 across the Development at the ground floor level at Block C. However, the ground floor does not include any uses that are sensitive to long term pollutant concentrations and as such, assessment of annual mean NO_2 concentrations is not applicable to this floor level. Predicted NO_2 concentrations were classified as APEC A on the third floor and top floor levels. There were no exceedances of the 1-hour mean NO_2 AQO, the annual mean PM_{10} and $PM_{2.5}$ AQO at any location.

7.136 Predicted impacts on annual mean and 1-hour mean NO_2 concentrations, annual mean PM_{10} and $PM_{2.5}$ concentrations as a result of operational phase emissions were predicted to be not significant at all sensitive receptor locations. The overall significance of potential impacts was determined to be not significant, in accordance with the EPUK and IAQM guidance.

Air Quality Neutral

7.137 The GLA states that new developments must be considered Air Quality Neutral. Pollutant emissions associated with anticipated traffic flow and energy consumption within the Development were compared to relevant benchmarks. This indicated that NOx emissions from the proposals were below the TEB and BEB and as such, no further action has been recommended to tackle excess NOx associated with energy consumption. The assessment is included as Appendix 7.3.

7.138 Table 7.27 contains a summary of the likely significant effects of the Development.

Table 7.27: Table of Significance – Air Quality

Potential Effect	Nature of Effect (Permanent/Temporary)	Significance (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)	Mitigation / Enhancement Measures	Geographical Importance*							Residual Effects (Major/Moderate/Minor) (Beneficial/Adverse/Negligible)
				I	UK	E	R	C	B	L	
Construction											
Dust Soiling	Temporary	Moderate Adverse	Recommended Dust Controls (see Table 7.26) including but not limited to; • Development of a DMP; • Daily on-site and off-site inspection where receptors are nearby to monitor dust; • Cover any stockpiles to prevent wind whipping; • Plan Site layout so that machinery and dust causing activities are located away from receptors; • Avoid Idling Vehicles; • Water suppression equipment; and • Hard surface haul routes ad wheel wash facilitates.							X	Minor Adverse
Impacts on Human Health	Temporary	Minor Adverse								X	Negligible
Trackout	Temporary	Moderate Adverse								X	Minor Adverse
Completed Development											
On-site Human Exposure	Permanent	Negligible	None Required							X	Negligible

Existing Human Receptors	Permanent	Negligible	• Provision of Electric Vehicle Charging Points or instruction provision for al parking bays; • Provision of secure cycle storage infrastructure; • Implementation of Travel Plans; and • Provision of measures to support sustainable transport modes including features to encourage sustainable travel methods e.g. cycle path links, pedestrian links, bus stops, etc.						X		Negligible
Cumulative Effects											
Construction											
Existing Human Receptors	Permanent	Negligible	Recommended GLA Dust Controls (see Table 7.26) including but not limited to; • Development of a DMP; • Daily on-site and off-site inspection where receptors are nearby to monitor dust; • Cover any stockpiles to prevent wind whipping; • Plan Site layout so that machinery and dust causing activities are located away from receptors; • Avoid Idling Vehicles; • Water suppression equipment; and • Hard surface haul routes ad wheel wash facilitates.						X		Negligible
Operation											
On-site Human Exposure	Permanent	Negligible	Not required							X	Negligible
Existing Human Receptors	Permanent	Moderate	Implementation of travel plan						X		Negligible

REFERENCES

[i] CLG (February 2019) *National Planning Policy Framework*
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viii The European Parliament and the Council of the European Union (2008) Directive 2008/50/EC of the European Parliament and of the Council
[ix] The Environment Act 1997
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[xii] The Control of Dust and Emissions During Construction and Demolition Supplementary Planning Guidance, GLA, 2016
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[xiv] Kingston upon Thames Borough Council, Air Quality Annual Status Report, 2019
xv http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html.
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