

The background image shows a modern, multi-story brick building with a courtyard. The courtyard features a stone retaining wall, a gravel path, and various plants including tall grasses, white flowers, and purple flowers. There are also wooden benches and a small circular garden bed. The building has large windows and balconies.

Gas Holder Site, Reading

Air Quality Assessment

April 2019

**Gas Holder Site at
Alexander Turner Close,
Reading**

**Prepared for
Danescroft (Kenavon Drive
Project Management) LLP**

by

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CONTENTS

SECTIONS

	PAGE
1.0 INTRODUCTION	1
2.0 LEGISLATION AND PLANNING POLICY CONTEXT	6
3.0 METHODOLOGY AND ASSESSMENT CRITERIA	13
4.0 BASELINE CONDITIONS	25
5.0 AIR QUALITY ASSESSMENT	31
6.0 MITIGATION	40
7.0 SUMMARY AND CONCLUSIONS	44

TABLES

Table 3.1:	Sensitivity of the area to dust soiling effects on people and property
Table 3.2 :	Sensitivity of the area to human health impacts
Table 3.3 :	Sensitivity of the area to ecological impacts
Table 3.4:	Risk of Dust Impacts – Demolition
Table 3.5:	Risk of Dust Impacts – Earthworks and Construction
Table 3.6:	Risk of Dust Impacts – Trackout
Table 3.7:	Descriptors for the magnitude in changes in annual mean concentrations of NO ₂ and PM ₁₀ and the number of days with PM ₁₀ concentrations greater than 50 µg m ⁻³
Table 3.8:	Impact descriptors for changes to annual mean concentrations of NO ₂ and PM ₁₀ and the number of days with PM ₁₀ concentrations greater than 50 µg m ⁻³
Table 3.9:	Traffic flow data (no development generated traffic)
Table 3.10:	Train Frequencies
Table 3.11 :	Background pollutant concentrations for 2019 and 2024
Table 3.12 :	Measured background pollutant concentrations for 2017
Table 4.1:	Measured Annual Mean NO ₂ Concentrations (µg/m ³)
Table 4.2:	Comparison of the monitored (AMS and DT) and modelled (ADMS) concentrations of NO ₂
Table 4.3:	Predicted air quality concentrations at sensitive receptors 2019
Table 5.1:	Outcome of Defining the Sensitivity of an Area



T A B L E S (C o n t i n u e d)

Table 5.2:	Summary Dust Risk Table to Define Site-Specific Mitigation
Table 5.3:	Changes in traffic flow “with” and “without” the development in 2024
Table 5.4:	Predicted air quality concentrations at sensitive receptors in 2024 “Do Nothing”
Table 5.5:	Predicted air quality concentrations at sensitive receptors in 2024 “Do Something”
Table 5.6:	Predicted change in air quality concentrations at sensitive receptors in 2024 “Do Something”
Table 5.7:	NO₂ – Significance of change in annual mean concentrations following the completion of the proposed development in 2024
Table 5.8:	PM₁₀ – Significance of change in annual mean concentrations following the completion of the proposed development in 2024

F I G U R E S

Figure 1.1	Site Location Plan
Figure 3.1	Sensitivity to Dust Soiling Effects on People and Property
Figure 3.2	Sensitivity of the Area to Human Health Impacts
Figure 3.3	Sensitivity of the Area to Ecological Impacts
Figure 4.1	Trends in Annual Mean NO₂ Concentrations
Figure 4.2	Trends in Annual Mean PM₁₀ Concentrations
Figure 4.3	Receptor Location Plan

A P P E N D I C E S

Appendix 1	Site Layout
Appendix 2	Reading AQMA
Appendix 3	National Air Quality Objectives (NAQO)
Appendix 4	Wind Rose – 2017
Appendix 5	Contour plots at 1.5m, 7m, 13m, 16m and 19.5m above ground level – NO₂



ACRONYMS AND ABBREVIATIONS

ADMS-Roads	Atmospheric Dispersion Modelling System (ADMS) Air Quality Management System Version 4.0.1
ATC	Automated Traffic Count
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
DEV	Development generated traffic
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
g/km/s	grams per kilometre per second
ha	Hectares - a unit of measure equal to 2.471 acres or 10,000 m ³
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Managements
MCC	Manual Classified Traffic Count
ms ⁻¹	wind speed in meters per second
NAQO	National Air Quality Objectives (2002)
NSCA	National Society for Clean Air
NO ₂	Nitrogen Dioxide
NO _x	Oxides of Nitrogen
NTM	National Transport Model
PM ₁₀	Particulate matter with an aerodynamic diameter less than 10 microns
RBC	Reading Borough Council
SDPD	Sites and Detailed Policies Document
SMA	Stuart Michael Associates Limited
µgm ⁻³	Micrograms per cubic meter



1.0 INTRODUCTION

1.1 Stuart Michael Associates (SMA), Consulting Engineers, has been appointed by Danescroft (Kenavon Drive Project Management) LLP (the Applicant) to undertake an Air Quality Assessment for the proposed development at the former Gas Holder Site at Alexander Turner Close, Reading (refer to **Figure 1.1** for the site location). The development site is situated within the area administered by Reading Borough Council (RBC).

1.2 Proposals for the site are the “demolition of existing buildings and Gas Holder and the erection of new buildings ranging between 2 and 9 storeys in height, providing 130 residential units (Class C3) with associated access, car parking, landscaping and open space”. Refer to **Appendix 1** for a copy of the proposed Site Layout.

Site Description

1.3 The site occupies a triangular piece of land which is bounded to the south and southeast by the River Kennet, to the west by an existing residential area and to the north by a railway line which crosses over the river adjacent to the site.

1.4 Vehicular access to the proposed development will be from Robert Parker Road which is to the west of the site. Wider vehicular access to the site is from Kenavon Drive and the A329 Forbury Road.

1.5 Pedestrian access to the site will be from Robert Parker Road (town centre and the train station via existing pedestrian links) and the footbridge over the river (via existing pedestrian links from the south).

1.6 The northern part of the proposed development is located within the Reading Borough Council's (RBC's) Air Quality Management Area (AQMA). Refer to **Appendix 2** for the location of the AQMA. All the major roads and a large area of Reading Town Centre were declared an AQMA in 2009, after a “Further Assessment” found that annual mean nitrogen dioxide levels were predicted to exceed the National Air Quality Objective (NAQO) levels in 2015. Refer to **Appendix 3** for the NAQO.



Pre-Application Consultation

- 1.7 Pre-application consultation was undertaken with Jodie Wilson, Environmental Health Officer (EHO) at RBC on 11th May 2018. The following advice was provided regarding air quality impacts on development:

"Air Quality - Increased exposure"

The proposed development is located within an air quality management area that we [RBC] have identified with monitoring as being a pollution hot-spot (likely to breach the EU limit value for NO₂) and introduces new exposure / receptors. An assessment and/or mitigation measures should be provided as part of the application.

The applicant will need to demonstrate sufficient mitigation measures are implemented to protect the residents from the effects of poor air quality.

Where the development involves converting an existing building and allowing a buffer zone is not an option then it may be that other mitigation can be applied. In the first instance this would be to implement measures to reduce the level at the facade of the property by creating a barrier between the property and the carriageway, such as close boarded fencing or planting vegetation.

If this is not possible then locating habitable rooms away from the source of pollution or the use of mechanical ventilation with the inlet on the clean side of the property may be acceptable. This list of potential measures is by no means an exhaustive list.

Mitigation against increased exposure:

Mechanical ventilation – inlets from the 'clean' side of the development, long term maintenance needs to be addressed

Buffer zones – consider increasing distance of the building façade from very busy roads

Habitable rooms – consider placing stairwells, corridors and bathrooms on the façade fronting pollution source

Mixed use – locate any sensitive uses on higher floors, allowing commercial use on lower elevations

Balconies – consider avoiding use in areas of exceedence, especially on ground and first floor level



Non-opening front windows – this should only be considered in certain circumstances, needs to be balanced against loss of freedom for future occupants

Reading Borough Council's Air Quality Policy DM19 requires that developments have regard to the need to improve air quality and reduce the effects of poor air quality through design, mitigation and where required planning obligations to be used to help improve local air quality.

An assessment or mitigation plan is recommended to be submitted with the application to determine whether the proposed development is appropriate for the proposed location.

Air Quality - Increased emissions

Reading has declared a significant area of the borough as an Air Quality Management Area (AQMA) for the exceedance of both the hourly and annual mean objectives for nitrogen dioxide. In addition to this recent epidemiologic studies have shown that there is no safe level for the exposure to particulate matter PM₁₀.

The proposed development is located within or adjacent to an air quality management area and has the potential to increase emissions. An assessment and/or mitigation measures should be provided as part of the application.

Mitigation against increased emissions:

Travel Plans – a travel plan is a set of measures aimed at reducing single occupancy car use, it is important that the effectiveness of the plan is considered

Mitigation through design, improved air flow around development, alternative plant

Parking – consider reducing number of parking spaces, graduated permit schemes based on euro standards, allocated parking for car clubs / low emission vehicles

Provision of electric charging bays or low emission fuelling points

Development / promotion of car clubs

Provision of cycling facilities / residents cycles Improvements to local public transport



It may be appropriate in some circumstances for the developer to fund mitigating measures elsewhere to offset any increase in local pollutant emissions as a consequence of the proposed development. This may be achieved through the use of a s.106 agreement, which may in some circumstances involve the direct funding of a specific scheme or measure, however, it is likely that in most cases to be in the form of a contribution to the costs of the monitoring network and / or air quality action plan.

If a worsening of local air quality resulting from the development is predicted then a mitigation plan will also be required to show how the developer intends to reduce the impact of the proposed development.”.

Assessment Methodology

- 1.8 The report addresses the effects of air pollutant emissions from road traffic using the adjacent roads, rail traffic on the adjacent railway line and the way they impact the site and surrounding area. Also considered are the emissions associated with the construction of the Proposed Development.
- 1.9 The report has been split into two parts; the first part assesses the impact of the development on surrounding sensitive receptors and the second part assesses the constraints on the development (i.e. how the existing environment will impact on the development).
- 1.10 Road traffic flows on the local highway network have been provided by the Transport Consultants (SMA) and were collected using Automatic Traffic Counts (ATC) and Manual Classified Counts (MCC). On the broader highway network data was obtained from permanent ATC. Where necessary, the collected traffic flows have been growthed to the assessment years using local committed development and NTM (refer to the SMA Transport Assessment).
- 1.11 The dispersion modelling software ADMS-Roads (Version 4.1.1) has been used to determine the concentrations of pollutants at the development site and assess the likely changes in the concentrations of pollutants. Background concentrations of pollutants have been obtained from the Department for Environment Food and Rural Affairs (DEFRA) website.
- 1.12 Construction dust impacts on local receptors have been assessed using the method detailed in the Institute of Air Quality Management (IAQM) publication “Guidance on the assessment of dust from demolition and construction” (2014).



Report Outline

- 1.13 The report assess the overall levels of oxides of nitrogen (NO_x), nitrogen dioxide (NO_2) and particulate matter with an aerodynamic diameter of less than 10 microns (PM_{10}) within the development site and at four sensitive receptor locations. The base year for the air quality assessment is 2019 and the future year of assessment is 2024, which is five years after registration of the planning application. Verification of the pollution modelling has been undertaken for 2017.



2.0 LEGISLATION AND PLANNING POLICY CONTEXT

Introduction

- 2.1 Poor air quality is the largest environmental risk to public health. Over recent years, UK air quality has improved significantly as a result of concerted action. Total UK emissions of nitrogen oxides (NO_x) have fallen by 72% since 1970. There was a 3.4% reduction in 2017 when compared to 2016 emissions. Between 1990 and 2017 there was an annual reduction of 4.6% which demonstrates that there is a downward trend in NO_x emissions in the UK (DEFRA National Statistics Release: Emissions of air pollutants in the UK, 1970 to 2017 – Statistical Release: 15 February 2019).

National Air Quality Strategy

- 2.2 In 1997 the United Kingdom National Air Quality Strategy (NAQS) was published and for the first time in history this document set out an analysis of the magnitude and potential health and environmental problems associated with, amongst other things, air pollutant emissions resulting from road traffic.
- 2.3 It proposed a schedule of air quality objectives which were to be met in the years up to 2005. In setting these objectives, health and socio-economic cost-benefit factors were taken into account, together with consideration of the practical and pragmatic aspects of whether targets would be achievable. Whilst it was identified in the NAQS that the objectives for benzene, 1,3-butadiene, lead (Pb) and carbon monoxide (CO) could be achieved as a result of improvement measures already put in place, complying with targets for NO₂ and PM₁₀ would be more difficult.

- 2.4 Considering the additional measures that would have to be introduced to counter these apparent shortfalls, the Government voiced the following thought:

“Changes in planning and transport policies (are needed) which would reduce the need to travel and reliance on the car” .With regard to the necessity for encouraging a shift away from private car usage, the Strategy commented, in terms of the new package approach to transport funding:

“As a general rule, traffic demand management and restraint measures should be included and this, together with proposals to promote and enhance other modes of transport, should aim to achieve modal shifts away from the private car.”



- 2.5 The Environment Act 1995 sections 82-84 requires that Local Authorities shall carry out reviews of air quality within their administrative areas and, where it is assessed that the air quality objectives may not be complied with in the future, an Air Quality Management Area (AQMA) must be declared. The Local Authority must then formulate an Action Plan, setting out the measures that will be employed to achieve compliance with the objectives.
- 2.6 A review of the UK Air Quality Strategy was undertaken in 1998 and a consultation document was published in January 1999 which outlined proposals for amending the Strategy. In August 1999, in response to the consultation, the Government then published a draft Air Quality Strategy for England, Scotland, Wales and Northern Ireland. The Air Quality Regulations (England) 2000 were enacted in April 2000, and the Air Quality (England) (Amendment) Regulations 2002 gives legal force to the air quality standards set out in the Strategy. A new strategy was released in July 2007 with various amendments to the air quality objectives. The proposals, in brief, consisted of recommendations to adopt the provisions of the EU Air Quality Daughter Directives. The National Air Quality Objectives (NAQO's) included in the Regulations are set out in Appendix 3.
- 2.7 Given the significant influence that motor vehicle exhausts exert on air quality in the UK and the apparent links between elevated levels of certain air pollutants and premature mortality, it is clear that current and emerging Government policy is geared towards several essential objectives, which are:
- continued action to reduce pollutant emissions from vehicles across the EU, which can be exemplified by the plethora of Directives concerning limitation of motor vehicle emissions since the 1970's and specific targeted initiatives such as the Auto-Oil Study programme;
 - concerted action at a National level to reduce private car trips in urban and inter-urban uses and encourage use of alternative forms of transportation;
 - action at a local level to manage transportation and air quality in order to reduce the number of car trips in urban areas specifically and to aim for compliance with the NAQS by the appointed dates;
 - and



to ensure that Local Authorities in the execution of their development control responsibilities take account of the consequent air quality impacts.

2.8 It is evident that continued growth in private car ownership and usage will result in further deterioration of air quality in urban areas and increasing emissions of greenhouse gases. Whilst current technological improvements will extend the reduction in emissions, additional measures will be required in order to prevent re-growth of emissions, both to meet ambient air quality targets in urban areas and to offer an alternative to the car for urban journeys. Consequently, where new development can be located in relatively close proximity to public transport and local services, a contribution to the UK's target of reducing emissions will have been made.

2.9 Levels of lead (Pb) and sulphur dioxide (SO₂) are also controlled by the NAQO. Lead levels reduced significantly following its reduced use as a fuel additive, and the abolition of four-star petrol in January 2000 means that the amount of Pb in petrol is reduced to a negligible level. SO₂ is predominantly associated with emissions from industrial processes and when assessing the effects of traffic, neither SO₂ nor Pb need be assessed.

2.10 Planning policy at the national and local level and its relevance to environmental design and assessment is discussed in **Chapter 4 'Planning Policy Context'**. Specific policies relevant to air quality are discussed below.

National Planning Policy Framework

2.11 Paragraphs 181 to 183 of the NPPF (**Ref. 8.7**) is considered relevant to this assessment:

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



applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

183. The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.”.

Planning Practice Guidance (PPG)

- 2.12 The Planning Practice Guidance (PPG) (**Ref. 8.8**) provides guidance on the policy governing Environmental Impact Assessment of air quality and the process by which Environmental Impact Assessment is carried out. The PPG states:
- 2.13 “Action to manage and improve air quality is largely driven by EU legislation. The 2008 Ambient Air Quality Directive sets legally binding limits for concentrations in outdoor air of major air pollutants that impact public health.....”

Additional Guidance

- 2.14 The Local Air Quality Management Technical Guidance LAQM.TG(16) is designed to support local authorities in carrying out their duties under the Environment Act 1995. These duties require local authorities to periodically review and assess air quality in their area.



2.15 The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (AQS, 2007) sets out air quality objectives and policy options to further improve air quality in the UK. It provides options which are intended to provide important benefits to UK Air Quality. At the time of writing this report, the latest UK Air Quality Strategy is out for consultation and we await a final version. The UK Government released an Air Quality Plan for tackling roadside NO₂ concentrations in 2017.

2.16 The effects of dust generation from construction will be assessed in accordance with the methodology presented in the Institute of Air Quality Management (IAQM) publication "Guidance on the assessment of dust from demolition and construction" (2017).

Local Council Policy

2.17 The current local policy for Reading Borough Council is the Local Development Framework (LDF) which includes the Core Strategy, Reading Central Area Action Plan, and, Sites and Detailed Policies Documents (SDPD) which are under review with the aim of drawing up a Local Plan for the Borough. Following the declaration of the AQMA in 2008 an Air Quality Action Plan (AQAP) was implemented in 2009 with the aim of tackling the problem of poor air quality in Reading.

2.18 Within the Core Strategy, Policy CS34: Pollution and Water Quality deals specifically with pollution and water quality with regard to development and states:

"Development will only be permitted where it would not be damaging to the environment through air, land, noise or light pollution; where it would preserve or ideally enhance ground and surface water quality; and where existing water resources, sewerage and wastewater treatment infrastructure are adequate to support the proposed development.

Proposals for development that are sensitive to the effects of air, noise or light pollution will only be permitted in areas where they will not be subject to high levels of such pollution, unless adequate mitigation measures are provided to minimise the impact of such pollution.



Development will be permitted on land affected by contamination where it can be demonstrated, to the satisfaction of the LPA, that the contamination can be satisfactorily remediated so that it is suitable for the proposed end use.”

- 2.19 The Reading Central Area Action Plan is one of RBC's Development Plan Documents (DPD) and should be read in conjunction with other LDF documents. Policy RC9: Living in the Centre presents criteria which proposed development in the centre of Reading should be assessed against. The policy covers a number of criteria and with regard to air quality states that:

“Proposals for residential development within the central area will be assessed against the following criteria:

ii. Proposals for new residential development within the central area will be required to demonstrate how the issue of potential noise disturbance from neighbouring land uses and other sources, and air quality implications of residential development, have been considered and if necessary, mitigated. New residential development should not be located next to existing town centre uses where those uses would give rise to unacceptable levels of noise and disturbance to the occupiers of the new scheme, unless this can be mitigated.”

- 2.20 The SDPD Section 9.2 Air Quality identifies that air quality is a key issues within Reading and Policy DM19: Air Quality identifies what development should have regard to the need to improve air quality. DM19 states that:

“Development should have regard to the need to improve air quality and reduce the effects of poor air quality.

i. Development that would detrimentally affect air quality will not be permitted unless the effect is to be mitigated. The following criteria should be taken into account:

Whether the proposal, including when combined with the cumulative effect of other developments already permitted, would significantly reduce air quality;

Whether the development is within, or accessed via, an Air Quality Management Area; and



Whether it can be demonstrated that a local reduction in air quality would be offset by an overall improvement in air quality, for instance through reduction in the need to travel.

ii. Where a development would introduce sensitive uses (such as residential, schools and nurseries, hospitals, care facilities) into, or intensify such uses within, an Air Quality Management Area, detrimental effects on that use will be mitigated. Mitigation measures should be detailed in any planning application.

iii. Where required, planning obligations will be used to secure contributions to measures to tackle poor air quality or for air quality monitoring.”



3.0 METHODOLOGY AND ASSESSMENT CRITERIA

Assessment of the Prevailing Air Quality

- 3.1 This section summarises the methodology used to consider whether there are “Significant” air pollution impacts on sensitive receptors or constraints on development. In order to determine the extent to which air quality issues will affect the sensitive receptors, the study has considered the following:

Any air quality measurements carried out in Reading Borough
(which are in the public domain);

The Review and Assessment of air quality carried out by RBC for
the area, as submitted to the Department for the Environment, Food
and Rural Affairs (DEFRA);

Predictions of air pollutant concentrations adjacent to the site and
within the Reading AQMA. The predictions have been carried out
utilising the ADMS Roads (version 4.1.1) dispersion modelling
program.

Assessment Criteria

- 3.2 The NAQO levels are derived from air quality standards set to protect health. The objectives address social and economic factors as well as the health standards.
- 3.3 For the purposes of this development proposal, the NAQO will form the basis of the air quality assessment. The NAQO levels are based on an assessment of the effects of each pollutant on public health. Therefore, they are a good indicator in assessing whether the air quality in the vicinity of a road is likely to be detrimental to human health. In determining whether air pollutant levels may constrain development, the results of the study have been compared against the acceptability criteria.
- 3.4 The effects of dust generation from construction have been undertaken following the methodology presented in the Institute of Air Quality Management (IAQM) publication “Guidance on the assessment of dust from demolition and construction” (2014).
- 3.5 In determining whether air pollutant levels may constrain development, the results of the study have been compared against the acceptability criteria.



Impact Magnitude and Impact Descriptors (Significance) – Air Quality Assessments

Construction Phase

- 3.6 During the construction phase, there will be a number of activities undertaken that have the potential to generate and/or re-suspend dust and PM₁₀. At the time of assessment the exact activities to be undertaken during construction are unknown. However, in order to evaluate the magnitude and extent of potential adverse impacts likely to result from the proposed development, the following construction activities have been assumed:

- site clearance and preparation;
- storage of materials;
- laying of hard surfaces;
- construction of buildings;
- vehicle movements to and from the Site.

- 3.7 The magnitude of the potential impacts of a construction site on air quality is mainly determined by its size, the range of activities undertaken across the site, proximity to sensitive receptors, complexity of terrain and any barriers between sources and receptors.

- 3.8 A qualitative assessment of the potential impacts during construction has been undertaken using information in guidance documents produced by IAQM.

- 3.9 According to this guidance; a human receptor refers to any location where a person may experience the annoyance effects of airborne dust or dust soiling, or exposure to PM₁₀ over a time period relevant to the air quality objectives. In terms of annoyance effects, this will most commonly relate to residential dwellings and schools.

- 3.10 Activities on construction sites can be divided into four types to reflect their different potential impacts, with the potential for dust emissions to be assessed only for each activity taking place:

- demolition;
- earthworks;
- construction; and
- trackout.



3.11 The assessment methodology considers three separate dust effects:

annoyance due to soiling;
harm to ecological receptors; and
the risk of health effects due to a significant increase in exposure to PM₁₀.

3.12 Account is also to be taken of the distance of the receptors that may experience these effects. The assessment procedure assumes no mitigation measures are applied except those required by legislation.

3.13 The potential dust emission magnitude for the proposed Development Site is determined for the four construction activities using the criteria presented in IAQM guidelines. The magnitude is based on the scale of the anticipated works and classified as “Small”, “Medium” or “Large”.

3.14 The “Sensitivity of an Area” to dust soiling effects on people and property is determined by using the criteria presented in **Table 3.1**. The “Sensitivity of an Area” to human health impacts is presented in **Table 3.2**. The “Sensitivity of an Area” and to ecological impacts is presented in **Table 3.3**.

Table 3.1: Sensitivity of the area to dust soiling effects on people and property

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



Table 3.2 : Sensitivity of the area to human health impacts

Receptor Sensitivity	Annual Mean PM ₁₀ conc.	Number of Receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 μgm^{-3} (>18 μgm^{-3} in Scotland)	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 μgm^{-3} (16-18 μgm^{-3} in Scotland)	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 μgm^{-3} (14-16 μgm^{-3} in Scotland)	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 μgm^{-3} (<14 μgm^{-3} in Scotland)	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table 3.3 : Sensitivity of the area to ecological impacts

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

3.15 **Figure 3.1** and **Figure 3.2** demonstrate that there are dust sensitive receptors within the vicinity of the site boundary. To the south east of the site is the River Kennet which has also been included in the assessment and is presented on **Figure 3.3**.

Figure 3.1: Sensitivity to Dust Soiling Effects on People and Property



Figure 3.2: Sensitivity of the Area to Human Health Impacts



Figure 3.3: Sensitivity of the Area to Ecological Impacts



3.16 As the potential dust emissions magnitude and the sensitivity of the area have been determined the results can be combined to define the risks of impact using the criteria in the following tables.

Table 3.4: Risk of Dust Impacts – Demolition

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

Table 3.5: Risk of Dust Impacts – Earthworks and Construction

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



Table 3.6: Risk of Dust Impacts – Trackout

Sensitivity of Area	Dust Emission Magnitude		
	<i>Large</i>	<i>Medium</i>	<i>Small</i>
<i>High</i>	High Risk	Medium Risk	Medium Risk
<i>Medium</i>	Medium Risk	Low Risk	Low Risk
<i>Low</i>	Medium Risk	Low Risk	Negligible

- 3.17 The proposed development's site specific results and significance of these tables are discussed in Section 5 of this Report.

Operational Phase

- 3.18 The impact of local traffic growth, development generated traffic and other potential sources of air pollution have been assessed for the magnitude of change and for the extent to which change in air quality from existing to future levels would be significant.
- 3.19 Descriptors for the magnitude of change in annual mean concentrations of NO₂ and PM₁₀ and the number of days with PM₁₀ concentrations greater than 50 µgm⁻³ are presented in **Table 3.7**.

Table 3.7: Descriptors for the magnitude in changes in annual mean concentrations of NO₂ and PM₁₀ and the number of days with PM₁₀ concentrations greater than 50 µgm⁻³

Magnitude of Change	Annual Mean NO ₂ /PM ₁₀	Days PM ₁₀ >50 µgm ⁻³
Large	Increase/decrease >4 µgm ⁻³	Increase/decrease >4 days
Medium	Increase/decrease 2 - 4 µgm ⁻³	Increase/decrease 2 - 4 days
Small	Increase/decrease 0.4 - 2 µgm ⁻³	Increase/decrease 1 - 2 days
Imperceptible	Increase/decrease <0.4 µgm ⁻³	Increase/decrease <1 day

- 3.20 Following on from the determination of the magnitudes of the impact of change of NO₂ and PM₁₀ levels, the assessment of the significance of the impact with reference to the NAQO Levels can be undertaken. Descriptors of the changes to annual mean concentrations of NO₂ and PM₁₀ and the number of days with PM₁₀ concentrations greater than 50 µgm⁻³ are presented in **Table 3.8**.



Table 3.8: Impact descriptors for changes to annual mean concentrations of NO₂ and PM₁₀ and the number of days with PM₁₀ concentrations greater than 50 µgm⁻³

<i>Absolute Concentration in Relation to Objective/Limit Value</i>	Change in Concentration /Number of Days		
	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Increase with Scheme			
Above Objective/Limit Value With Scheme (>40 µgm ⁻³ / >35 days)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value With Scheme (36-40 µgm ⁻³ / >32-35 days)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value With Scheme (30-36 µgm ⁻³ / >26-32 days)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value With Scheme (<30 µgm ⁻³ / <26 days)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value Without Scheme (>40 µgm ⁻³ / >35 days)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value Without Scheme (36-40 µgm ⁻³ / >32-35 days)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value Without Scheme (30-36 µgm ⁻³ / >26-32 days)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value Without Scheme (<30 µgm ⁻³ / <26 days)	Negligible	Negligible	Slight Beneficial
Note – an “Imperceptible” change would be described as “Negligible”			

3.21 Table 3.7 and Table 3.8 detail the magnitude and “Significance” of changes in NO₂ and PM₁₀ levels. The tables have been extracted from the Environmental Protection UK (formerly National Society for Clean Air (NSCA)) publication “*Development Control: Planning for Air Quality (2010 Update) – Table 5 and Appendix 3*”.

Traffic Data

Road Traffic

3.22 The future concentrations of NO_x, NO₂ and PM₁₀ at representative sensitive receptors and at the locations of four diffusion tubes the continuous air quality monitor (RDG 4 Con Mon) have been predicted using the ADMS - Roads (Version 4.1.1) dispersion model based on forecast traffic flows for the local road network.



- 3.23 Two “Base” (Do Nothing) and one “Future” (Do Something) scenarios have been assessed along with a 2017 scenario for the verification of the model. The base scenarios are 2019, 2024 + Committed Development and the future scenario is 2024 + Committed Development + Development.
- 3.24 Road traffic data was provided by SMA and collected using the permanent ATC’s on A329 Forbury Road, A329 Caversham Road and the A4155 Caversham Road and has been obtained from the Department for Transport (DfT) website.
- 3.25 The collected traffic flows have been growthed from the base year to the assessment years using local committed development and NTM. Committed development generated traffic has been added to the base year traffic flows to provide a “Future” year scenario. Where 24hr AADT flows were not available, existing traffic proportions on the highway network have been used to growth the available traffic data.
- 3.26 The “Base” scenario vehicle flows on the local highway network used in the assessment are detailed in **Table 3.9**.

Table 3.9: Traffic flow data (no development generated traffic)

Link	Base	
	AADT	%HGV
Oscar Wilde Road/Robert Parker Road	310	2.6
Kennet Walk	188	0.0
Kenavon Drive (E of Gas Works Road)	519	6.6
Kenavon Drive	8108	3.9
A329 Forbury Road (West of Roundabout)	21391	2.9
A329 Vastern Road (under the railway line)	42146	4.8
King’s Meadow Road/Napier Road	7827	2.0
A329 Forbury Road (South of Roundabout)	18917	2.9
King’s Road	21859	5.0
Queen’s Road	20115	1.8
A4 London Road (E of Cemetery Junction)	24551	4.5
A3290	31553	3.7



- 3.27 The local highway network has been modelled as distinctive links where vehicle speeds change, width of roads change and at roundabout junctions. Also included are changes in vehicle speed due to pedestrian crossings and traffic lights.

Rail Traffic

- 3.28 The Great Western Main Line is currently undergoing electrification and new electric trains are being introduced on the line from 2019. Once complete, the electric trains will emit significantly less air pollutants into the atmosphere.
- 3.29 There are three train companies which have routes that pass through Reading Station. The operators are Great Western Railway (*formerly First Great Western*), South West Trains and Cross Country. Passenger train numbers starting, terminating and passing through Reading Station have been calculated from publically available train time tables.
- 3.30 Rail freight train frequencies through Reading Station have been approximated using the data available from the subscription website "Freightmaster online". The website is run by rail enthusiasts and covers the entire rail network in the UK.
- 3.31 Within the timetables it is approximated that 21 freight trains pass through Reading Station on an average day. Night time freight trains have been approximated from local observations and an average of two trains has been used in the model.
- 3.32 Adjacent to the development site there are currently three sets of two railway lines (six lines in total). The southern two lines terminate to the west of the site and for this model have been combined into one line. Whilst out on site it was observed which type of train uses which line and in what direction, which resulted in the observation that SWT uses the southern lines and GWR "Regional" trains use the four remaining lines. GWR "Intercity" trains were observed to use the two middle lines and the second from the top. Freight trains were observed to use the middle two lines. This may change in the future, but the current line usage has been incorporated into the model.
- 3.33 The results from the on-site observations and scrutiny of the train timetables are presented in **Table 3.10**.



Table 3.10: Train Frequencies

Train Lines	Approximate distance from the site to the train line (metres)	Train Type (Intercity, Regional or Freight)	Daytime (0700 – 2300)	Night Time (2300 – 0700)
North	17	Regional	233	43
	22 EB	Intercity, Regional	220	30
Middle	32 WB	Intercity, Regional, Freight	85	3
	35	Intercity, Regional	86	10
South	42	Regional	74	11

3.34 The pollutants from three train types has been taken from the Network Rail – Reading Station Area Redevelopment ES – 2010 and originally sourced from the National Atmospheric Emissions Inventory (NAEI). The emission factors (gkm^{-1}) used in the modelling are:

Intercity: $\text{NO}_x = 103.4 \text{ gkm}^{-1}$; $\text{PM}_{10} = 8.42 \text{ gkm}^{-1}$

Regional: $\text{NO}_x = 22 \text{ gkm}^{-1}$; $\text{PM}_{10} = 0.122 \text{ gkm}^{-1}$

Freight: $\text{NO}_x = 107.2 \text{ gkm}^{-1}$; $\text{PM}_{10} = 5.0 \text{ gkm}^{-1}$

Background Concentrations of Air Pollutants

3.35 Background concentrations of air pollutants for the dispersion modelling were obtained from the UK National Air Quality Information Archive (DEFRA website), in accordance with Local Air Quality Management Technical Guidance TG(16). Data sets for 2015 have been published by DEFRA and the 2019 and 2024 background concentrations have been obtained. Presented in **Table 3.11** are the background concentrations of NO_x , NO_2 , PM_{10} and $\text{PM}_{2.5}$ in the grid squares covering the Development Site and the air quality assessment area.

Table 3.11 : Background pollutant concentrations for 2019 and 2024

Grid Reference		2019				2024			
<i>Eastings</i>	<i>Northing</i>	<i>NO_x</i>	<i>NO₂</i>	<i>PM₁₀</i>	<i>PM_{2.5}</i>	<i>NO_x</i>	<i>NO₂</i>	<i>PM₁₀</i>	<i>PM_{2.5}</i>
472500	173500	34.32	22.82	14.72	9.32	28.46	19.46	14.40	9.00
473500	173500	31.56	21.30	14.68	9.27	26.27	18.18	14.37	8.97



3.36 Concentrations of Ozone (O_3) are recorded at the Cemetery Junction automatic monitoring site as part of the Automatic Urban and Rural Network (AURN). As well as the concentrations of O_3 , the AURN records background concentrations of NO_x , NO_2 , PM_{10} and $PM_{2.5}$. Presented in **Table 3.12** are the measured concentrations for 2017.

Table 3.12 : Measured background pollutant concentrations for 2017

Site ID	Site Type	Grid Reference		2017				
		<i>Easting</i>	<i>Northing</i>	<i>NO_x</i>	<i>NO₂</i>	<i>PM₁₀</i>	<i>PM_{2.5}</i>	<i>O₃</i>
AURN	Urban Background	473441	173198	44.07	28.70	11.97	9.67	39.00

3.37 The above concentrations, when compared to the concentrations for grid square 473500, 173500, are higher except for PM_{10} . Therefore, the measured local background concentrations have been used for the assessment.

3.38 The background concentrations of NO_x are source apportioned enabling removal of different sources of NO_x to avoid double counting. Road traffic sources for the “Primary ‘A’ Roads” and Non-Road sources for the “Railway Line” have been removed from the background concentrations of NO_x . Once removed, the resulting NO_2 concentrations need to be recalculated. This has been undertaken using the “ NO_2 Adjustment for NO_x Sector Removal Tool – v6.0”.



4.0 BASELINE CONDITIONS

Air Quality Review and Assessment

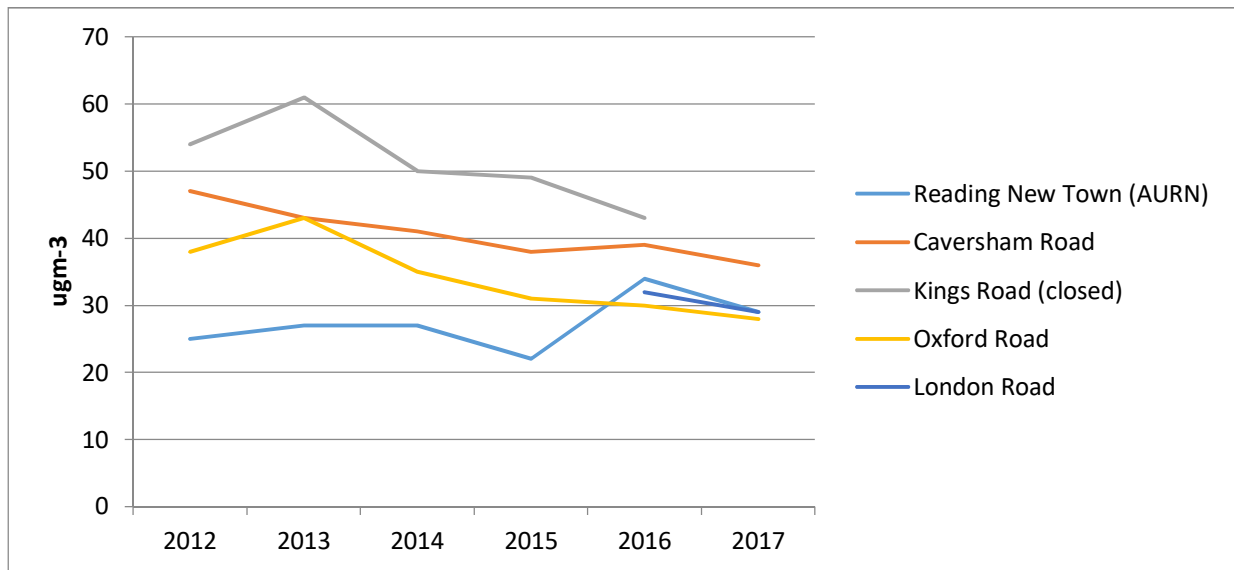
- 4.1 As previously indicated, Local Authorities have been required to carry out a review of local air quality within their boundaries to assess areas that may fail to achieve the NAQO. In areas where these objectives are unlikely to be achieved, local authorities must designate these areas as Air Quality Management Areas (AQMA's) and prepare a written Action Plan to achieve the NAQO.
- 4.2 The review of air quality takes on several prescribed stages, of which each stage is reported. The review and assessment of air quality is the responsibility of Reading Borough Council (RBC).
- 4.3 From the Annual Status Report undertaken in June 2017 by RBC, it can be seen that the development site is located in an AQMA. Refer to Appendix 2 for the Reading AQMA plan.

Air Quality Monitoring

- 4.4 RBC currently operates three roadside continuous monitoring sites within their administrative boundary. A fourth monitoring site measures background concentrations as part of the Automatic Urban and Rural Network (AURN). The monitoring sites are at Reading New Town (Cemetery Junction) (AURN), Caversham Road (RD1), Oxford Road (RD3) and London Road (RD4). The closest site, AURN, is approximately 650 metres from the south eastern side of the development site. RBC withdrew an automatic monitoring site at Kings Road (RD2) in February 2016.
- 4.5 Presented in **Figure 4.1** are the trends in annual mean concentrations of NO₂ in area administrative by RBC.



Figure 4.1: Trends in Annual Mean NO₂ Concentrations



4.6 From Figure 4.1 it can be seen that concentrations for the past six years at the AURN and the last two years at RD4 have been well below the NAQO level of 40 µg/m³.

4.7 RBC operates a network of non-automatic monitoring sites and at the end of 2017 there were 38 active sites monitoring NO₂ via diffusion tube (DT).

4.8 The closest DTs to the development site are all to the south and are at Kings Oak Flats, Queen's Road (DT01), 162 London Road (DT07), 419 London Road (DT08) and 276 Kings Road (DT09). The four DTs and RD4 have been used to verify the ADMS model. Presented in **Table 4.1** are recorded concentrations of NO₂ available for 2012 to 2017 and where concentrations are at or above the NAQO level the cells have been shaded light grey.

Table 4.1: Measured Annual Mean NO₂ Concentrations (µg/m³)

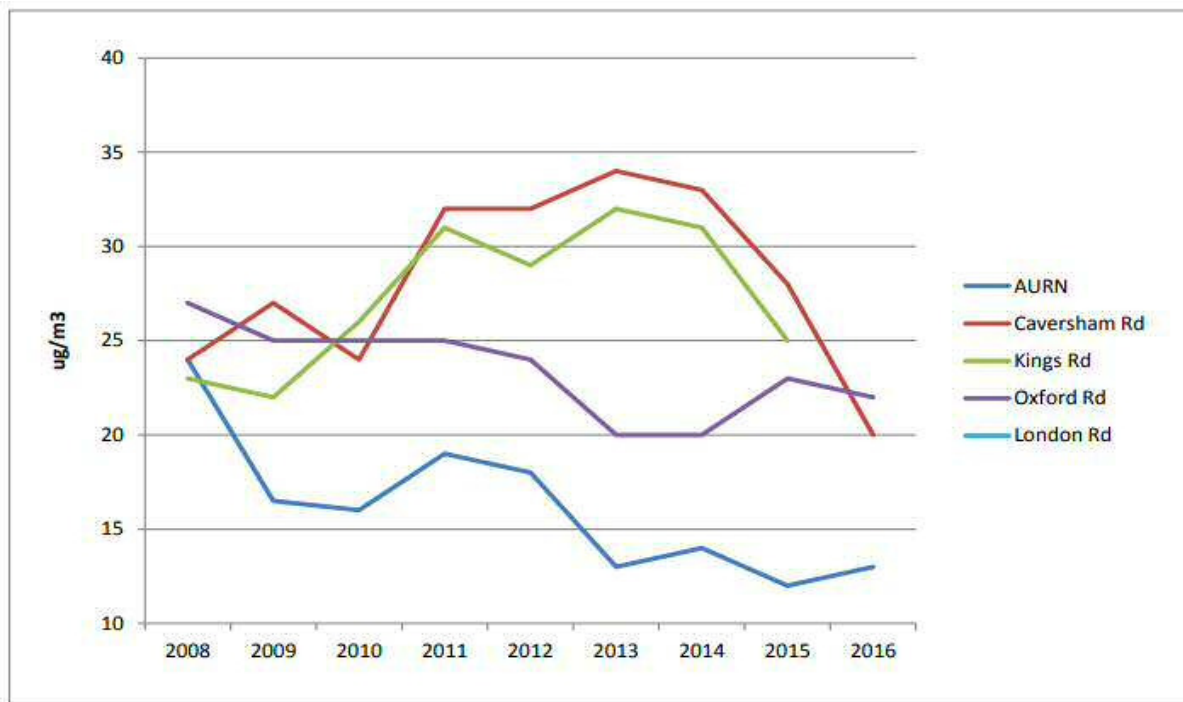
Site ID	Location	Within AQMA?	Annual mean concentrations (µg/m ³)					
			2012	2013	2014	2015	2016	2017
AURN	Reading New Town	N	25	27	27	22	34	29
RD4	London Road	Y	-	-	-	-	32	29
DT01	Kings Oak Flats, Queen's Road	Y	37	39	38	33	33	31
DT07	162 London Road	Y	46	48	50	48	42	43
DT08	419 London Road	Y	47	49	46	43	42	44
DT09	276 Kings Road	Y	36	34	37	33	32	32

4.9 From Table 4.1 it can be seen that at the AURN, RD4, DT01 and at DT09, annual mean concentrations of NO₂ were below the NAQO level of 40 µg/m³.



- 4.10 Concentrations of PM₁₀ are recorded at the AURN using TEOM FDMS and at RD4 using Beta-Attenuation Mass (BAM) analysers.
- 4.11 Presented in **Figure 4.2** are the trends in annual mean concentrations of PM₁₀ in area administrative by RBC.

Figure 4.2: Trends in Annual Mean PM₁₀ Concentrations



- 4.12 From Figure 4.2 it can be seen that concentrations are below the current NAQO level of 40 μgm^{-3} for PM₁₀ however they are not below the proposed NAQO level of 20 μgm^{-3} except at RD4 London Road.

Dispersion Modelling – ADMS-Roads

- 4.13 The existing and future concentrations of pollutants within the assessment area for all scenarios have been modelled using the Atmospheric Dispersion Modelling System software ADMS-Roads (Version 4.1.1). The software is PC based and models the release of pollutants from road and industrial sources into the atmosphere.



- 4.14 ADMS-Roads is designed to allow the modelling of simple scenarios such as single carriageway roads up to complex scenarios such multiple lane roads and junctions. Allowance is made in the model for initial release of pollutants which are affected by vehicle wake, traffic induced turbulence and street canyons. Boundary layer structure based on the Monin-Obukhov length and the boundary layer height are incorporated in the model which allows for a realistic representation of the changing characteristics of dispersion with height.
- 4.15 Multiple road traffic sources were used in the model to represent the changing concentration of traffic, the different speeds of traffic and the changing road geometry. Also included were rail traffic sources representing the railway line to the south of the proposed site.
- 4.16 Meteorological data for 2017 was obtained from the MET Office. The best representative observation station for the development site is a weather station located at Heathrow Airport. The MET data has been used for the verification of the model, base modelling and future years and a wind rose for 2017 is presented in **Appendix 4**.
- 4.17 Background pollutant concentrations for the kilometre squares covering the assessment area were obtained from the DEFRA website and the concentrations for 2019 and 2024 are presented in Table 3.11. Ozone and background concentrations of NO_x, NO₂, PM₁₀ and PM_{2.5} are recorded in Reading at the AURN site and concentrations for 2017 are presented in Table 3.12. As stated in paragraph 3.37 the background concentrations recorded at the AURN have been used in the modelling.
- 4.18 Specific receptors were modelled adjacent to the development site, the continuous monitor RD4 and DTs 01, 07, 08, and 09. RD3 was modelled at 1.5 metres above ground level, the DTs were modelled at 2.5 metres above ground level and multiple heights above ground level were modelled within the development site.
- 4.19 Copies of the model inputs are available on request.



Model Verification

- 4.20 Model verification has been undertaken using the guidance provided in LAQM.TG(16). The process requires the comparison of the monitored roadside contribution of NO₂ with the modelled roadside contribution of NO₂.
- 4.21 Within the assessment area there are two automatic monitoring site and four diffusion tubes (refer to previous paragraphs). ADMS-Roads has been used to calculate NO_x, NO₂, PM₁₀ and PM_{2.5} concentrations for 2017. The concentrations of NO₂ have been verified against the recorded NO₂ levels at RD4, DT 01, 07, 08 and 09 for 2017. The results from the monitoring and the ADMS-Roads modelling are presented in **Table 4.2**.

Table 4.2: Comparison of the monitored (AMS and DT) and modelled (ADMS) concentrations of NO₂

Site ID	Monitor Type	Site Type	Site Description	Background NO ₂	Monitored NO ₂	Modelled NO ₂	Difference [(monitored - modelled)/monitored] x100 (%)
RD4	AMS	R	Urban	28.70	29.00	36.95	21.52
01	DT	R	Urban	28.70	31.37	34.59	9.32
07	DT	R	Urban	28.70	42.63	40.66	-4.85
08	DT	R	Urban	28.70	44.13	40.93	-7.80
09	DT	R	Urban	28.70	32.12	37.10	13.43

- 4.22 It is evident from Table 4.2 that the dispersion modelling is not consistently over or under predicting the NO₂ concentrations at the monitoring locations. At the four DT locations the model is showing good correlation between the monitored and modelled concentrations of NO₂. However, the model is also over predicting concentrations of NO₂ at the AMS by 21.52%.
- 4.23 Within TG(16) there is guidance on how to undertake an initial comparison of modelled and monitored total NO₂ concentrations. Using the TG(16) "Box 7.14" method, the modelled road contribution NO_x shows no systematic under or over prediction and the results are within 25% (as a minimum – preferably 10%) of the monitored concentrations.
- 4.24 Therefore no correction factor has been applied to the model.



Pollutant Concentrations

4.25 To characterise the air pollutant concentrations adjacent to the roads that would be affected by the proposed development traffic, predictions have been made at a sensitive receptor adjacent to the site and at the AMS and four DT for the base year 2019 using ADMS-Roads dispersion modelling. The locations of the receptors are illustrated on **Figure 4.3** and the results of the predictions are presented in **Table 4.3**.

Table 4.3: Predicted air quality concentrations at sensitive receptors 2019

Receptor Number and Name		NO _x	NO ₂	PM ₁₀	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
RD4	London Road	50.36	36.75	12.42	0.87
DT01	Kings Oak Flats, Queen's Road	49.60	34.39	12.39	0.88
DT07	162 London Road	62.62	39.92	13.61	0.29
DT08	419 London Road	63.43	40.21	13.62	0.29
DT09	276 Kings Road	53.33	36.74	12.67	0.71
R1	Robert Parker Road	62.37	41.03	12.91	0.58
R2	Oscar Wilde Road	55.83	38.67	12.64	0.73
NAQO	-	-	40	40	35

4.26 If the pollutant concentrations in Table 4.3 are compared to the NAQO, it can be seen that concentrations of NO₂ are predicted to be below the NAQO level of 40 μgm^{-3} at DT01 and DT09, close to the level at DT07, RD4 and R2 and at or above the level at DT08 and R1. However, the predicted concentrations of PM₁₀ are well below the NAQO level of 40 μgm^{-3} and the number of days when the concentration of PM₁₀ is greater than 50 μgm^{-3} is well below the Air Quality Objective level of 35 days.



5.0 AIR QUALITY ASSESSMENT

- 5.1 The assessment has been split into two parts, the potential “Impacts” of development generated traffic and construction activities and the “Constraints” on the development.
- 5.2 The “Impact” section of the assessment assesses whether development generated traffic flows on the highway network are likely to result in a significant change in annual mean concentration of NO₂ and PM₁₀ at sensitive off-site receptors. Also assessed are the potential dust impacts and PM₁₀ changes on sensitive receptors.
- 5.3 The “Constraints” part of the assessment compares the predicted concentration of NO₂ and PM₁₀ within the development site against NAQO levels and assesses whether predicted levels within the site are above the objective levels.

Impacts

Dust Assessment: Predicted Construction Impacts

- 5.4 The main sources of dust and PM₁₀ during construction activities are:
- Haulage routes, vehicles and construction traffic;
 - Materials handling, storage, stockpiling, potential spillage and disposal;
 - Exhaust emissions from site plant;
 - Site preparation;
 - Construction and fabrication processes; and
 - Internal and external finishing and refurbishment.
- 5.5 The majority of the releases are likely to occur during the typical “working-week”. The construction impact assessment has been split into two sections. The first deals with the potential impacts from dust soiling and changes in PM₁₀ concentrations due to on-site works and the second deals with the effect of emissions from construction traffic.
- Dust soiling and changes in PM₁₀ concentrations*
- 5.6 The site will require demolition, earthworks, construction and trackout of vehicles associated with all phases of the Site. The resulting dust emission magnitudes are:



Demolition – **Medium** (Total site area between 2,500 m² and 10,000 m², moderately dusty soil type, 5-10 heavy earth moving vehicles active at any one time, total material moved 20,000 -100,000 tonnes),

Earthworks – **Medium** - Total site area between 2,500 m² and 10,000 m², moderately dusty soil type, 5-10 heavy earth moving vehicles active at any one time, total material moved 20,000 - 100,000 tonnes),

Construction – **Large** (Total building volume is greater than 100,000 m³, on site concrete batching),

Trackout – **Medium** (10-50 HGV outward movements in any one day, moderately dusty surface material).

- 5.7 Using the information presented in Section 3 and the criteria presented in Table 3.1, Table 3.2 and Table 3.3, the sensitivity of the construction for the proposed development can be defined. The results of defining the sensitivity of the area are presented in **Table 5.1**.

Table 5.1: Outcome of Defining the Sensitivity of an Area

Potential Impact	Sensitivity of the Surrounding Area			
	<i>Demolition</i>	<i>Earthworks</i>	<i>Construction</i>	<i>Trackout</i>
<i>Dust Soiling</i>	Medium	Medium	Medium	Low
<i>Human Health</i>	Medium	Medium	Medium	Low
<i>Ecological</i>	Low	Low	Medium	Low

- 5.8 From Table 5.1 it can be seen that the predicted sensitivity of the surrounding area to dust soiling is “Low” during trackout and “Medium” during demolition, earthworks and construction phases. The sensitivity of the surrounding area to changes in PM₁₀ affecting human health is “Low” during trackout and “Medium” during demolition, earthworks and construction phases. The Kennet and Avon Canal is adjacent to the site and sensitivity of the surrounding area to ecological impacts is “Low” during demolition and earthworks phases and trackout and “Medium” during the construction phase.



- 5.9 The dust emission magnitude determined in paragraph 5.6 is combined with the sensitivity of the area summarised in Table 5.1 to determine the risk of impacts with no mitigation applied. The risk of impacts are summarised in **Table 5.2**.

Table 5.2: Summary Dust Risk Table to Define Site-Specific Mitigation

Potential Impact	Risk			
	<i>Demolition</i>	<i>Earthworks</i>	<i>Construction</i>	<i>Trackout</i>
<i>Dust Soiling</i>	Medium Risk	Medium Risk	Medium Risk	Low Risk
<i>Human Health</i>	Medium Risk	Medium Risk	Medium Risk	Low Risk
<i>Ecological</i>	Low Risk	Low Risk	Medium Risk	Low Risk

- 5.10 During the Demolition and Earthworks phases of development, there is a Medium Risk of annoyance caused by dust soiling, a Medium Risk of health effects due to increase exposure in PM₁₀ and a Low Risk of ecological impacts. Therefore, mitigation may be required.
- 5.11 During the Construction phase of development, it has been assessed that there is a Medium Risk of potential annoyance to people and property caused by dust soiling and, health effects due to an increase exposure in PM₁₀ and potential ecological impacts. Therefore, mitigation may be required.
- 5.12 Throughout the Trackout processes, there is a Low Risk of dust soiling, human health effects due to an increase exposure in PM₁₀ and potential ecological impacts.

Predicted Operational Impacts

- 5.13 The air quality impact of the proposed development on the surrounding area has been assessed by considering the changes in traffic flows which will occur on the existing highway network with the development in place.
- 5.14 Potential impacts from the proposed development would occur following the predicted completion of the proposed development in 2024. Therefore, the year of assessment is 2024 “Do Nothing” and “Do Something”. For this development a Transport Assessment (TA) has been undertaken and part of the assessment was the collection and analysis of road traffic data from manual classified traffic counts (MCC), automated traffic counts (ATC), and the proposed development.



Traffic Generation –2024 with development

5.15 Traffic data was collected using permanent ATC on A329 Forbury Road, A329 Caversham Road and the A4155 Caversham Road. The “Base” traffic flows have been growthed using local committed development and NTM. Development generated traffic has then been added to the 2024 traffic flows and a summary is presented in **Table 5.3**.

Table 5.3: Changes in traffic flow “with” and “without” the development in 2024

Link	2024 “do nothing”		2024 “do something”		Change	
	AADT	%HGV	AADT	%HGV	Number	%
Oscar Wilde Road/Robert Parker Road	310	2.6	540	1.5	230	74.2
Kennet Walk	188	0.0	186	0.0	0	0.0
Kenavon Drive (E of Gas Works Road)	519	6.6	749	4.5	230	44.3
Kenavon Drive	8513	3.9	8743	3.6	230	2.7
A329 Forbury Road (West of Roundabout)	22460	2.9	22502	2.7	42	0.2
A329 Vastern Road (under the railway line)	44252	4.8	44295	4.8	43	0.1
King’s Meadow Road/Napier Road	8218	2.0	8145	2.0	0	0.0
A329 Forbury Road (South of Roundabout)	19862	2.9	20050	2.7	188	0.9
King’s Road	22952	5.0	23069	4.9	117	0.5
Queen’s Road	21120	1.8	21191	1.8	71	0.3
A4 London Road (E of Cemetery Junction)	25778	4.5	25836	4.5	58	0.2
A3290	33130	3.7	33188	3.7	58	0.2

Background Concentrations – 2024

5.16 From Table 4.1, it can be seen that although there has been a slight reduction in measured concentrations of NO₂ in the past five years it is not considered significant enough to warrant using DEFRA future concentrations in the modelling. Therefore, the background concentrations in NO_x, NO₂ and PM₁₀ for 2019 have been used for the future 2024 assessment of NO_x, NO₂ and PM₁₀.



Screening Assessment – 2024 with development

5.17 Sensitive receptors adjacent to the development site and where there is predicted to be an impact from the development have been assessed for the two scenarios, “Do Nothing” and “Do Something”. The results from the assessment are presented in **Table 5.4** and **Table 5.5**.

Table 5.4: Predicted air quality concentrations at sensitive receptors in 2024 “Do Nothing”

Receptor Number and Name		NO _x	NO ₂	PM ₁₀	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
RD4	London Road	49.09	36.15	12.41	0.87
DT01	Kings Oak Flats, Queen's Road	48.37	33.85	12.39	0.88
DT07	162 London Road	56.77	38.04	13.60	0.29
DT08	419 London Road	57.57	38.25	13.60	0.29
DT09	276 Kings Road	50.87	35.85	12.66	0.71
R1	Robert Parker Road	62.00	40.85	12.91	0.58
R2	Oscar Wilde Road	55.32	38.44	12.64	0.73
NAQO	-	-	40	40	35

Table 5.5: Predicted air quality concentrations at sensitive receptors in 2024 “Do Something”

Receptor Number and Name		NO _x	NO ₂	PM ₁₀	
		Annual mean μgm^{-3}	Annual mean μgm^{-3}	Annual mean μgm^{-3}	Days >50 μgm^{-3}
RD4	London Road	49.10	36.15	12.41	0.87
DT01	Kings Oak Flats, Queen's Road	48.37	33.86	12.39	0.88
DT07	162 London Road	56.79	38.05	13.61	0.29
DT08	419 London Road	57.59	38.26	13.61	0.29
DT09	276 Kings Road	50.89	35.85	12.67	0.71
R1	Robert Parker Road	62.10	40.88	12.92	0.58
R2	Oscar Wilde Road	55.42	38.44	12.65	0.73
NAQO	-	-	40	40	35



5.18 Presented in **Table 5.6** are the predicted change in concentrations of NO₂ and PM₁₀ and the change in the number of days where concentrations of PM₁₀ are greater than 50 µgm⁻³.

Table 5.6: Predicted change in air quality concentrations at sensitive receptors in 2024 “Do Something”

Receptor Number and Name		NO _x	NO ₂	PM ₁₀	
		Change in annual mean µgm ⁻³ (%)	Change in annual mean µgm ⁻³ (%)	Change in annual mean µgm ⁻³ (%)	Change in days >50 µgm ⁻³ (%)
RD4	London Road	0.01 (0.02)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
DT01	Kings Oak Flats, Queen's Road	0.01 (0.02)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
DT07	162 London Road	0.02 (0.04)	0.01 (0.03)	0.00 (0.00)	0.00 (0.00)
DT08	419 London Road	0.02 (0.03)	0.01 (0.03)	0.00 (0.00)	0.00 (0.00)
DT09	276 Kings Road	0.02 (0.04)	0.01 (0.03)	0.00 (0.00)	0.00 (0.00)
R1	Robert Parker Road	0.10 (0.16)	0.02 (0.05)	0.01 (0.08)	0.00 (0.00)
R2	Oscar Wilde Road	0.10 (0.18)	0.00 (0.00)	0.01 (0.08)	0.00 (0.00)

5.19 From Table 5.6 it can be seen that changes in concentration of NO₂ are predicted to be 0.02 µgm⁻³ or less and changes in concentration of PM₁₀ are predicted to be 0.01 µgm⁻³ or less. It can also be seen that the change in the number of days where the concentration of PM₁₀ is predicted to be more than 50 µgm⁻³ will be 0 (zero) days.

Magnitude of Change – 2024 with development

5.20 Comparing the results in Table 5.6 with the magnitude of change in Table 3.7 it can be seen that all the receptors are predicted to experience a change in annual mean NO₂ concentrations which is “Imperceptible” (<0.4 µgm⁻³) or “No Change”.

5.21 It can also be seen that all the receptors are predicted to experience a change in annual mean PM₁₀ concentrations which is “Imperceptible” (<0.4 µgm⁻³) or “No Change” and “No Change” in the number of days where PM₁₀ levels are greater than 50 µgm⁻³.

“Significance” of Change – 2024 with development

5.22 The “Significance” of the predicted changes in NO₂ and PM₁₀ annual mean concentrations are presented in **Table 5.7**.



Table 5.7: NO₂ – Significance of change in annual mean concentrations following the completion of the proposed development in 2024

Receptor Number and Name		NO ₂		
		Change in annual mean (µgm ⁻³)	Magnitude of change	“Significance” of change
RD4	London Road	0.00	No Change	Not Significant
DT01	Kings Oak Flats, Queen's Road	0.00	No Change	Not Significant
DT07	162 London Road	0.01	Imperceptible	Negligible
DT08	419 London Road	0.01	Imperceptible	Negligible
DT09	276 Kings Road	0.01	Imperceptible	Negligible
R1	Robert Parker Road	0.02	Imperceptible	Negligible
R2	Oscar Wilde Road	0.00	No Change	Not Significant

5.23 With reference to the overall concentration of NO₂ presented in Table 5.5 being close to the NAQO level of 40 µgm⁻³ and the magnitude of change being “No Change” or “Imperceptible” the “Significance” of change in NO₂ concentrations is considered “Not Significant” or of “Negligible” significance.

Table 5.8: PM₁₀ – Significance of change in annual mean concentrations following the completion of the proposed development in 2024

Receptor Number and Name		PM ₁₀		
		Change in annual mean (µgm ⁻³)	Magnitude of change	“Significance” of change
RD4	London Road	0.00	No Change	Not Significant
DT01	Kings Oak Flats, Queen's Road	0.00	No Change	Not Significant
DT07	162 London Road	0.00	No Change	Not Significant
DT08	419 London Road	0.00	No Change	Not Significant
DT09	276 Kings Road	0.00	No Change	Not Significant
R1	Robert Parker Road	0.01	Imperceptible	Negligible
R2	Oscar Wilde Road	0.01	Imperceptible	Negligible



- 5.24 With reference to the overall concentrations of PM₁₀ presented in Table 5.5 being well below the objective level of 40 µgm⁻³ and the magnitude of change presented in Table 5.8 being “No Change” or “Imperceptible”, the “Significance” of change in PM₁₀ concentration is considered to be “Not Significant” or of “Negligible” significance.

Constraints

- 5.25 The concentrations of NO₂ and PM₁₀ have been modelled within the development site using ADMS-Roads. Sources include the railway line to the north of the site and the local highway network. The railway line has been modelled as an elevated source due to the railway tracks being on embankment. The same parameters used in the model for the verification of the model have been used in the modelling of the concentrations in the site.
- 5.26 Proposals for the development are for three blocks (Block A, Block and Block C) of multi-storey buildings consisting of ground and first floor level parking and third floor roof terraces in the northern block. The proposed residential dwellings in Block B are located approximately 7m and above ground level and this is the level of the roof terraces.
- 5.27 Five different heights have been modelled at the development site. The first height is one and a half metres above ground level and represents the modelled concentrations at head height. The second height is seven metres above ground level and represents the roof terraces of Block B and the second floor balconies of Block A and Block C. The third height is at 13 metres above ground level and represents the fourth floor balconies of Blocks B and the top floor balconies of Block A. The fourth height is at 16 metres above ground level and represents the fifth floor balconies of Block B and the fifth height is at 19.5 metres above ground level and represents the sixth floor balconies of Block B.
- 5.28 The results from the ADMS-Roads model are presented in **Appendix 5** as contour plots at 1.5m, 7m, 13m, 16m and 19.5m above ground level.
- 5.29 With reference to Appendix 5, concentrations of NO₂ at ground level are approximately 41 µgm⁻³ at the north western site boundary and decrease steadily in a southerly direction across the site. It should be noted that approximately half of the site including Block B and Block C is predicted to experience NO₂ concentrations above the NAQO level of 40 µgm⁻³ at 1.5 metres above ground level.



- 5.30 At seven metres above ground level the northern and southern roof terraces of Block B are predicted to experience concentrations of NO₂ above the NAQO level of 40 µgm⁻³.
- 5.31 At 13 metres above ground level the northern balconies of Block B are predicted to experience concentrations of NO₂ above the NAQO level of 40 µgm⁻³.
- 5.32 At 16 metres above ground level, at the fifth floor level of apartments in Block B, concentrations are predicted to be below 40 µgm⁻³ across the development site.
- 5.33 As previously mentioned, NO_x emissions in the local area are expected to significantly decrease as a result of the electrification of the Great Western Main Line, and the associated introduction of a new fleet of electrified trains in 2019. However, due to the significant variabilities involved in the electrification project, it was not deemed appropriate to attempt to predict and quantify the associated air quality benefits of the project. In any case, whilst air quality levels are predicted to be below NAQO levels at 16 metres above ground level at the year of opening, the assessment has assumed no benefit arising from the electrification project to assess a worst-case scenario.
- 5.34 In summary, concentrations of NO₂ are predicted to be above the NAQO of 40 µgm⁻³ at ground level in the northern half of the site up to a height of 16 metres above ground level. Mitigation measures are explored in Chapter 6 of the Assessment.



6.0 MITIGATION

Construction Phase

6.1 Monitoring during the construction phase should be considered in the management of operations to ensure that the nuisance thresholds are not exceeded at nearby sensitive locations. However, it is important to note that such limits are subjective (as “nuisance” caused by dust does not currently have a statutory limit applied to it).

6.2 Monitoring of dust could be achieved using a variety of sampling techniques, for example deposit (“Frisbee”) gauges, glass slides or high-volume air samplers located around the site perimeter and at the sensitive locations up to 400 metres from the site boundary.

6.3 In addition, there are a number of Best Practice mitigation measures that can be used by contractors to ensure that the impacts experienced in close proximity to the construction site are minimal. Sample mitigation:

6.4 Specific to demolition:

Ensure effective water suppression is used during demolition operations;

Avoid explosive blasting, using appropriate manual or mechanical alternatives

Bag and remove any biological debris or damp down such material before demolition

6.5 Effective site planning:

Erect solid barriers to site boundary;

Dust generating activities to be located away from sensitive receptors;

All site personnel will be fully trained;

There will be a trained and responsible manager on site during working times to maintain a logbook and carry out site inspections

There will be no run off of mud or water from the site;

Relevant legislation and guidance will be adhered to; and

6.6 Construction Traffic

All vehicles to switch off engines (no idling);



On road vehicles will comply to set emission standards;
Effective vehicle cleaning and specific wheel-washing on leaving site;
All loads entering site must be covered;
All non-road mobile machinery (NRMM) should use ultra-low sulphur diesel where available; and

6.7 Site Activities

Minimise dust generating activities where possible;
Use water as a dust suppressant where applicable;
Stockpiles will be covered, enclosed, seeded or kept them sheeted;
and
If applicable, any concrete crushers/batchers will have the required permits.

6.8 It is recommended that liaison with Reading Borough Council (RBC) Environmental Health Department (EHD) be maintained throughout the construction process. In addition, the main contractor should nominate a representative (possibly the site manager) to act as a point of contact with the Council, the construction team and the local community to ensure that any air quality related issues that occur during the construction period can be dealt with efficiently, effectively and promptly.

6.9 All other site sub-contractors should also nominate or appoint a suitable team member responsible for liaison with the lead contractor's representative and to ensure that sub-contractor construction activities are managed effectively.

6.10 Details of the proposed methodology for achieving this and procedures to follow should be set out in a Construction Environmental Management Plan (CEMP). This would be held on-site and would include relevant contact names, details, lines of communication and mitigation action plans. The document should be available to all site personnel and RBC EHD who should be made aware of its existence and provide an undertaking that they will adhere to the guidance provided therein.

6.11 The mitigation of PM₁₀ releases due to material disturbance will be achieved in the same manner as the control of dust releases. By achieving effective control of sources of dust release, PM₁₀ releases can be minimized.



- 6.12 The most effective control of particulate releases from site plant will be achieved by ensuring that it is maintained in good working order, and is of the appropriate capacity and specification for the job being carried out. It should also be located away from the site perimeter, thereby maximizing the distance between source and receptor.
- 6.13 There may be occasions where breakdown of site plant could cause short-term releases of excess particulate matter (smoke) and odour. Short-term releases may also occur during start up (of diesel engines, etc). Regular visual checks and routine maintenance should be applied in accordance with the plant specification, to ensure that these releases are minimised. Faulty site plant should be decommissioned until repairs have been carried out and have been tested and found to be operating satisfactorily.
- 6.14 Detailed mitigation measures to control construction traffic should be discussed with officers from Reading Borough Council, in order to establish the most suitable access routes for the site traffic and service vehicles. The most effective mitigation will be achieved by ensuring that construction traffic vehicles are kept clean and sheeted when on public highways (through the use of wheel washers) and avoid using sensitive roads. Timing of large-scale vehicle movements to avoid peak hours on the local road network would also be beneficial. Clear signposting to the site access for construction traffic should also be provided and direct traffic along routes agreed with the Council.
- 6.15 Early morning delivery vehicles, which may arrive prior to the site opening, should be prevented from waiting on the approach roads to the site. If site deliveries arrive prior to the site opening, they should wait at a suitable location, and if possible, turn the engine off.
- 6.16 With the implementation of the appropriate mitigation measures detailed above, but not restricted to the information detailed above, the residual effects will normally be "Not Significant".

Mitigation: Operational Phase

- 6.17 Taking into account that recorded concentrations of NO₂ have not decreased significantly over the past five years (refer to Table 4.1), concentrations of NO₂ for the base year 2019 (refer to Table 4.3) are predicted to be around the NAQO level of 40 µgm⁻³. Concentrations of PM₁₀ are predicted to be below the NAQO level of 40 µgm⁻³.



- 6.18 No Change or “Negligible” increases in NO₂ concentrations and No Change or “Negligible” increases in PM₁₀ concentrations are predicted due to development generated traffic following the completion of the development. Therefore no mitigation at sensitive receptors is proposed due to development generated traffic.
- 6.19 Within the development site concentrations of NO₂ are predicted to be above the NAQO level of 40 µgm⁻³ in the northern half of the site at ground level. However, concentrations of PM₁₀ are predicted to be below the NAQO level of 40 µgm⁻³. Therefore, to protect future residents against elevated levels of NO₂, a commensurate level of mitigation is required.
- 6.20 Mitigating the pollutant at source is not practicable, however it is recommended using Mechanical Ventilation and Heat Recovery (MVHR) with proposed air inlets with sufficient height to provide “clean” to the apartments. The results from the modelling indicate that the inlets would need to be above 16 metres above ground level. A well designed mechanical ventilation system can provide clean and fresh air.
- 6.21 It is recommended that using passive ventilation be used for the car park, which will provide fresh natural air flow. As a result of the directional south-westerly winds, inlets should be on the southern façade of the development.
- 6.22 The electrification of the Great Western Main Line will improve air quality at the proposed development from 2019. The majority of trains passing on the east west lines to the north of the proposed development site will not emit diesel, reducing NO_x emissions and NO₂ levels to well below NAQO levels at the proposed development. Therefore, whilst the assessment has undertaken a worst-case scenario, it should be reiterated that air quality at the year of opening is anticipated to significantly improve.



7.0 SUMMARY AND CONCLUSIONS

- 7.1 Stuart Michael Associates has been engaged by Danescroft (Kenavon Drive Project Management) LLP to undertake an Air Quality Assessment for the proposed development at the former Gas Holder Site at Alexander Turner Close, Reading.
- 7.2 The assessment has been undertaken to demonstrate the impact on concentrations of NO₂ and PM₁₀ at sensitive receptors as a result of development generated traffic. Annual average concentrations have been compared to the National Air Quality Objective Levels and the magnitude and significance of change has also been assessed against national guidelines.
- 7.3 Constraints on development have been assessed using background concentrations, existing and future emissions from rail and road traffic at the proposed development site.
- 7.4 Also assessed are the likely impacts from the construction of the development. The impact assessment has been undertaken using the method detailed in the Institute of Air Quality Management (IAQM) publication "Guidance on the assessment of dust from demolition and construction" (2014).
- 7.5 Concentrations of NO₂ and PM₁₀ at four diffusion tube (DT) sites (01, 07, 08 and 09) and the London Road (RD4) automatic monitoring site (AMS) within the Reading AQMA have been assessed using ADMS-Roads. The 2017 NO₂ concentrations from RD1, DT 01, 07, 08 and 09 have been used to verify the results from the modelling. Background concentrations recorded at the Reading AURN have been used in the ADMS-Roads assessment.
- 7.6 Background concentrations for the future year assessments (2024) have been kept the same as the base year (2019) assessment. The reason for using the base year background concentrations is due to recorded local concentrations of NO₂ not decreasing significantly as predicted over the past five years, and a worst case scenario has therefore been modelled.

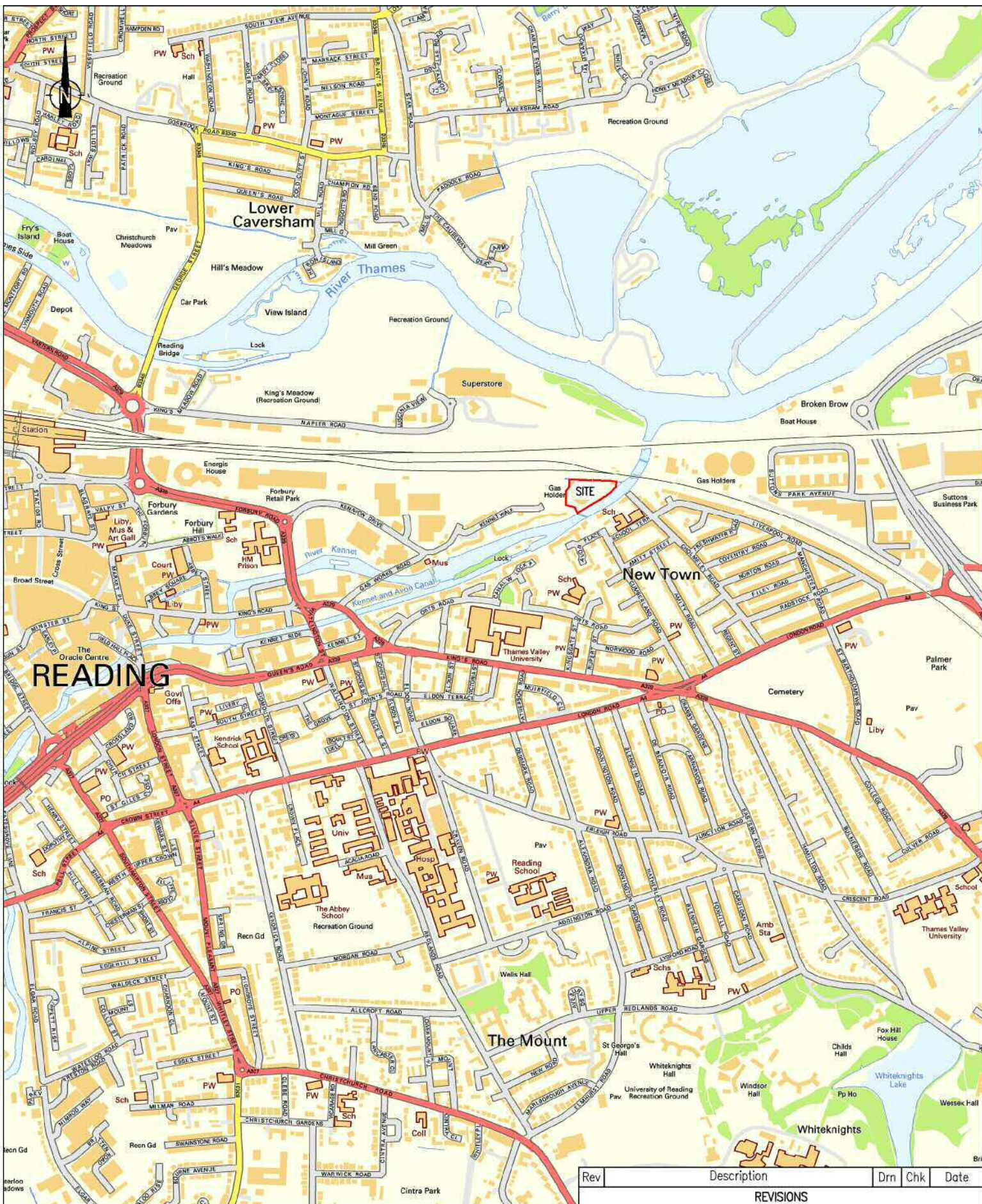


- 7.7 Base concentrations have been calculated for 2019 and two scenarios have been assessed for the future year 2024. The first is a “Do Nothing” scenario with committed development generated traffic but no development generated traffic and the second scenario is “Do Something” with committed development generated traffic and development generated traffic. The two scenarios have been assessed to gauge the magnitude of change in concentrations NO_2 and PM_{10} and the significance of those changes.
- 7.8 Road traffic data has been obtained from the SMA Transport Assessment, MCC and permanent ATC sites within the assessment area. Future traffic flows have been determined by adding Committed Development to the base year 2019 to obtain the future year 2024. Development generated traffic has been obtained from the Transport Assessment produced by SMA.
- 7.9 The concentrations of NO_2 in 2024 are predicted to be at or just below the objective level of $40 \mu\text{g m}^{-3}$. The magnitude of change in annual mean concentrations at all the receptors due to development generated traffic is predicted to be “Imperceptible” or “No Change”. Therefore the “Significance” of change is considered to be “Negligible” or “Not Significant”.
- 7.10 Concentrations of PM_{10} are predicted to be well below the objective level of $40 \mu\text{g m}^{-3}$ at the receptor locations and the magnitude of change due to development generated traffic is “Imperceptible” or “No Change”. Therefore, the significance is considered “Negligible” or “Not Significant”.
- 7.11 From the construction dust assessment: during the Demolition and Earthworks phases of development, there is a Medium Risk of annoyance caused by dust soiling, a Medium Risk of health effects due to increase exposure in PM_{10} and a Low Risk of ecological impacts. Therefore, mitigation may be required.
- 7.12 During the Construction phase of development, it has been assessed that there is a Medium Risk of potential annoyance to people and property caused by dust soiling and, health effects due to an increase exposure in PM_{10} and potential ecological impacts. Therefore, mitigation may be required.
- 7.13 Throughout the Trackout processes, there is a Low Risk of dust soiling, human health effects due to an increase exposure in PM_{10} and potential ecological impacts.



- 7.14 Within the development site concentrations of NO₂ are predicted to be above the NAQO levels 40 µgm⁻³ in the northern half of the site and mitigation measures are proposed.
- 7.15 Mitigating the pollutant at source is not practicable, however where the use of Mechanical Ventilation and Heat Recovery (MVHR) is proposed the air inlets will have to be at sufficient height to provide “clean” air to the apartments. The results from the modelling indicate that the inlets should be a minimum of 16 metres above ground level. As the electrification of the Great Western Main Line is predicted to significantly improve air quality in Reading by 2019, the 16 metre height for the air inlets provides mitigation for a worst case scenario.
- 7.16 Passive ventilation will be provided for the car park, which will provide fresh natural air flow. As a result of the directional south-westerly winds, inlets should be on the southern façade of the development.
- 7.17 Within the public amenity area concentrations are below the NAQO level, therefore no mitigation is proposed.
- 7.18 Based on the worst-case results of the AQA, it has been concluded that with appropriate mitigation, air quality concentrations are acceptable for future residents of the proposed development. Moreover, the impact of development on local sensitive receptors is predicted to be negligible during the construction phase.
- 7.19 Therefore, in terms of the planning application, the proposed Gas Holder Site development is acceptable from an air quality perspective.

FIGURES



Rev	Description	Drn	Chk	Date
REVISIONS				

JOB TITLE
GASWORKS SITE
ROBERT PARKER ROAD, READING

DRAWING TITLE
SITE LOCATION PLAN

DATE: AUGUST 2018 DRAWN: JPM CHECKED: SWA ISSUE CHECKBOX

DRAWING No. Figure 1.1 REV. SCALE 1:12,500 @ A4



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Rev	Description	Drn	Chk	Date

DATE	APRIL 2019	DRAWN	JPM	CHECKED	SWA	SCALE	NTS	©	A4
DRAWING No.	Figure 4.3	REV.							

DATE	APRIL 2019	DRAWN	JPM	CHECKED	SWA	SCALE	NTS	©	A4
DRAWING No.	Figure 4.3	REV.							

GAS HOLDER SITE
ALEXANDER TURNER CLOSE, READING

RECEPTOR LOCATION PLAN



STUART MICHAEL ASSOCIATES
CONSULTING ENGINEERS

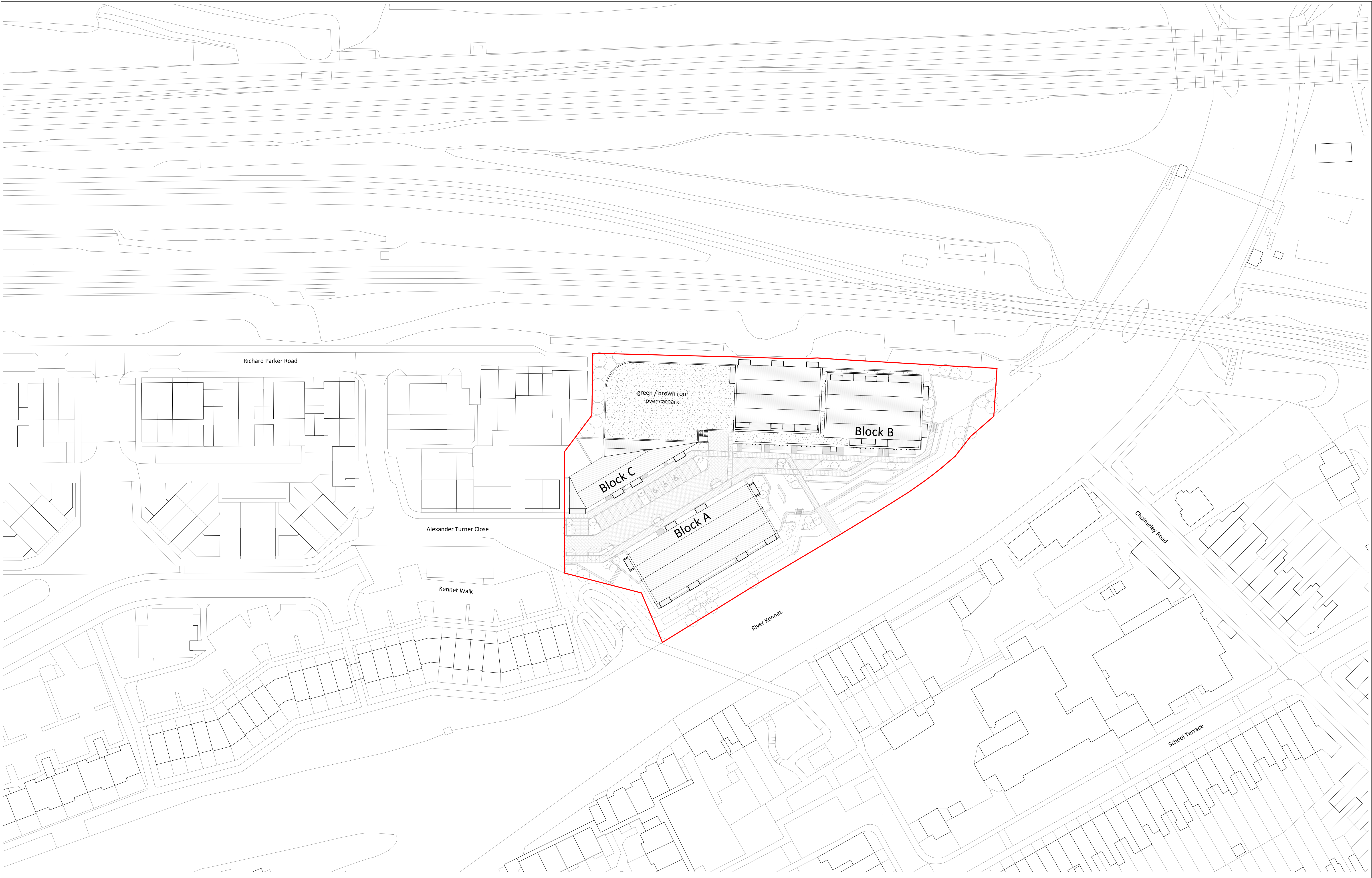
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APPENDICES

Appendix 1 – Collado Collins Architects – Proposed Site Plan – 28/03/2019

APPENDIX 1



NOTES

CONSULTANTS

- Refer to highways consultant's drawings for details
- Refer to landscape consultant's drawings for details
- Landscaping layout is indicative only

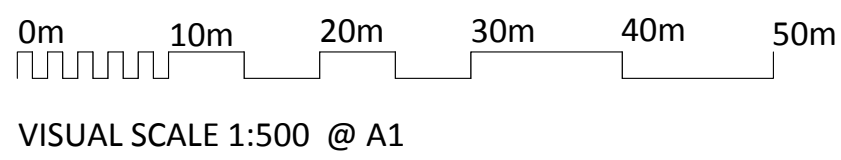
AREAS

- Refer to area schedule

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N

Rev	Notes	Date	By	Auth
P	Planning Application	28/03/19		



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Date: 28/03/19
Drawn By: LK
Checked by: RC
Scale @ A1: 1 : 500
Scale @ A3: 1 : 1000
CAD File No:

Danescroft (KDPM) LLP
Gas Holder, Reading
Proposed Site Plan

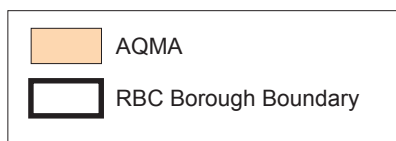
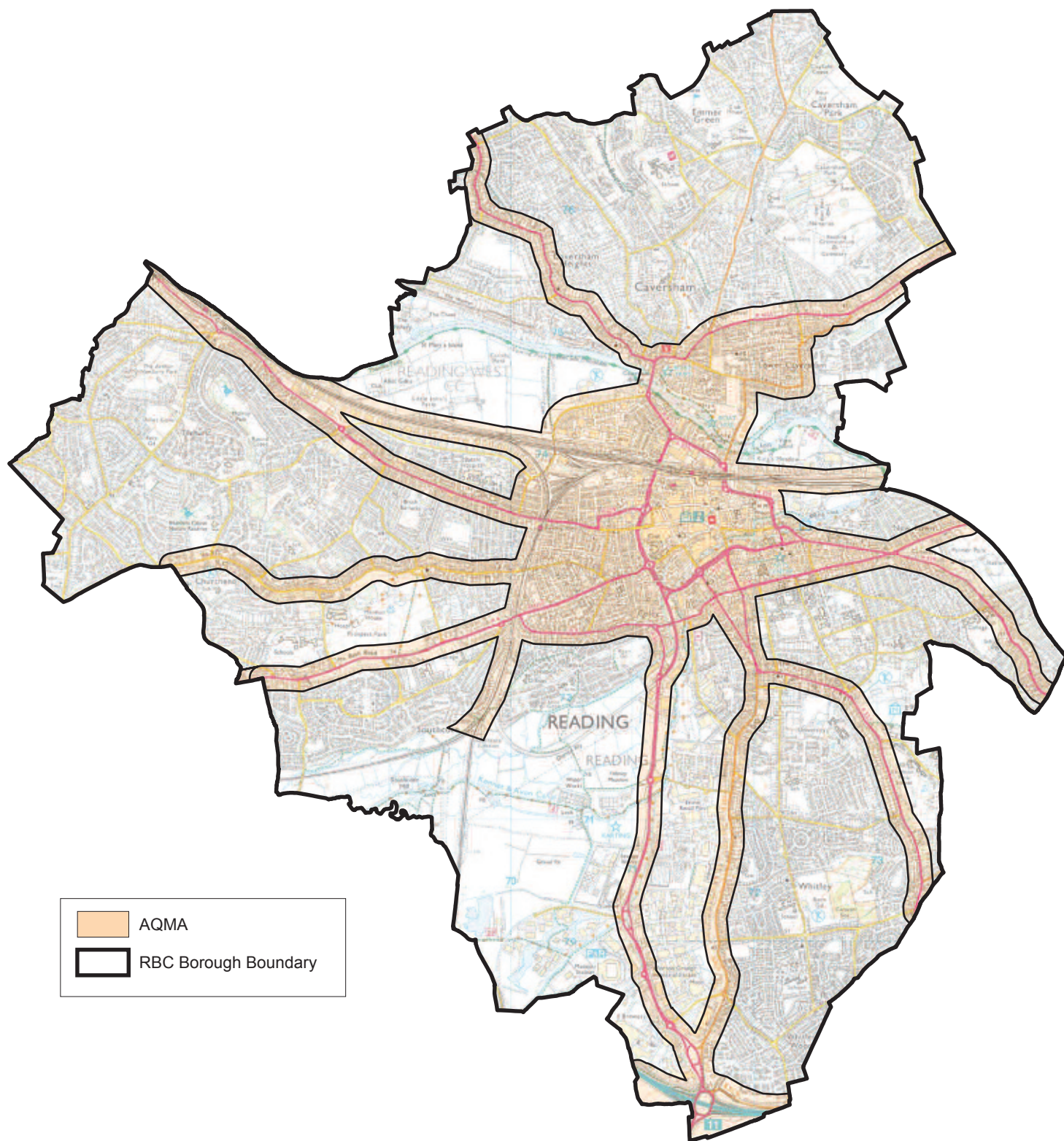
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Revision

Appendix 2 – Reading Borough Council AQMA

APPENDIX 2



Title: **Reading Air Quality Management Area**

Drg.No.:

Date: 29/04/2009 Scale at A3: 1:32000

Produced by GIS & Mapping Services

Ref: G:\AQMA A3.WOR



Appendix 3 – National Air Quality Objectives (NAQO)

APPENDIX 3

National air quality objectives and European Directive limit and target values for the protection of human health						
Pollutant	Applies	Objective	Concentration measured as ₁₀	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved (by and maintained thereafter)
Particles (PM ₁₀)	UK	50 µg/m ³ not to be exceeded more than 35 times a year	24 hour mean	31 December 2004	50 µg/m ³ not to be exceeded more than 35 times a year	1 January 2005
	UK	40 µg/m ³	annual mean	31 December 2004	40 µg/m ³	1 January 2005
	Indicative 2010 objectives for PM ₁₀ (from the 2000 strategy and Addendum) have been replaced by an exposure reduction approach for PM _{2.5} (except in Scotland – see below)					
	Scotland	50 µg/m ³ not to be exceeded more than 7 times a year	24 hour mean	31 December 2010	50 µg/m ³ not to be exceeded more than 35 times a year	1 January 2005
	Scotland	18 µg/m ³	annual mean	31 December 2010	40 µg/m ³	1 January 2005
Particles (PM _{2.5}) Exposure Reduction	UK (except Scotland)	25 µg/m ³	annual mean	2020	Target value - 25 µg/m ³	2010
	Scotland	10 µg/m ³		31 December 2020	Limit value - 25 µg/m ³	1 January 2015
	UK urban areas	Target of 15% reduction in concentrations at urban background		Between 2010 and 2020	Target of 20% reduction in concentrations at urban background.	Between 2010 and 2020

National air quality objectives and European Directive limit and target values for the protection of human health							
Pollutant	Applies	Objective	Concentration measured as ¹	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)	
Nitrogen dioxide	UK	200 µg/m ³ not to be exceeded more than 18 times a year	1 hour mean	31 December 2005	200 µg/m ³ not to be exceeded more than 18 times a year	1 January 2010	
	UK	40 µg/m ³	annual mean	31 December 2005	40 µg/m ³	1 January 2010	
Ozone	UK	100 µg/m ³ not to be exceeded more than 10 times a year	8 hour mean	31 December 2005	Target of 120 µg/m ³ not to be exceeded by more than 25 times a year averaged over 3 years	31 December 2010	
Sulphur dioxide	UK	266 µg/m ³ not to be exceeded more than 35 times a year	15 minute mean	31 December 2005	-	-	
	UK	350 µg/m ³ not to be exceeded more than 24 times a year	1 hour mean	31 December 2004	350 µg/m ³ not to be exceeded more than 24 times a year	1 January 2005	
	UK	125 µg/m ³ not to be exceeded more than 3 times a year	24 hour mean	31 December 2004	125 µg/m ³ not to be exceeded more than 3 times a year	1 January 2005	
Polycyclic Aromatic Hydrocarbons	UK	0.25 ng/m ³ B[a]P	as annual average	31 December 2012	1.0 ng/m ³	31 December 2012	

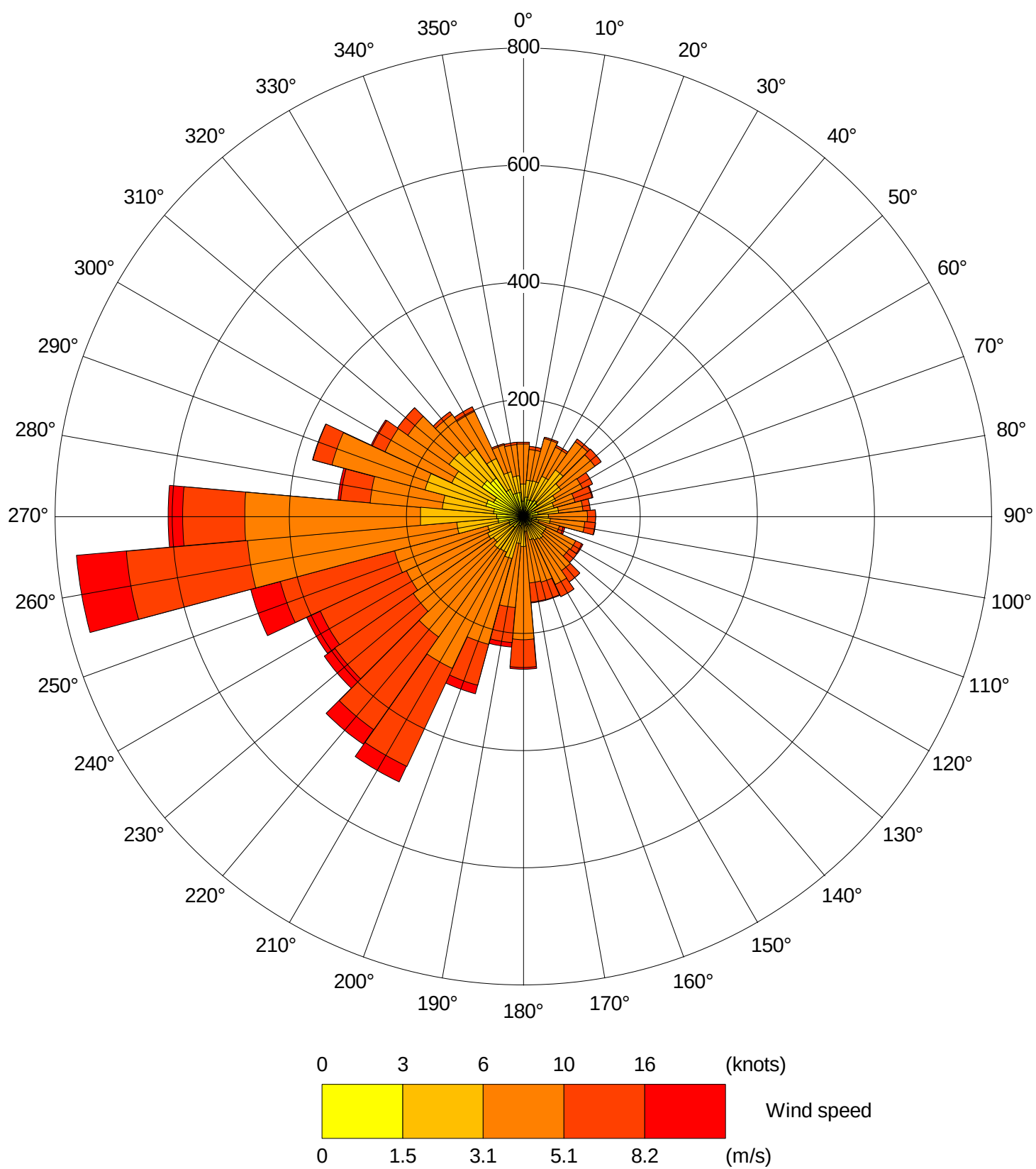
National air quality objectives and European Directive limit and target values for the protection of human health						
Pollutant	Applies	Objective	Concentration measured as ¹	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)
Benzene	UK	16.25 µg/m ³	running annual mean	31 December 2003	-	-
	England and Wales	5 µg/m ³	annual average	31 December 2010	5 µg/m ³	1 January 2010
	Scotland, Northern Ireland	3.25 µg/m ³	running annual mean	31 December 2010	-	-
1,3-butadiene	UK	2.25 µg/m ³	running annual mean	31 December 2003	-	-
Carbon monoxide	UK	10 mg/m ³	maximum daily running 8 hour mean/in Scotland as running 8 hour mean	31 December 2003	10 mg/m ³	1 January 2005
Lead	UK	0.5 µg/m ³	annual mean	31 December 2004	0.5 µg/m ³	1 January 2005
		0.25 µg/m ³	annual mean	31 December 2008	-	-

National air quality objectives and European Directive limit and target values for the protection of vegetation and ecosystems						
Pollutant	Applies	Objective	Concentration measured as ¹	Date to be achieved by (and maintained thereafter)	European Obligations	Date to be achieved by (and maintained thereafter)
Nitrogen oxides	UK	30 µg/m ³	annual mean	31 December 2000	30 µg/m ³	19 July 2001
Sulphur dioxide	UK	20 µg/m ³	annual mean	31 December 2000	20 µg/m ³	19 July 2001
	UK	20 µg/m ³	winter average	31 December 2000	20 µg/m ³	19 July 2001
Ozone: protection of vegetation and ecosystems	UK	Target value of 18,000 µg/m ³ based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	Average over 5 years	1 January 2010	Target value of 18,000 µg/m ³ based on AOT40 to be calculated from 1 hour values from May to July, and to be achieved, so far as possible, by 2010	1 January 2010

Appendix 4 – Heathrow Airport Wind Rose - 2017

APPENDIX 4

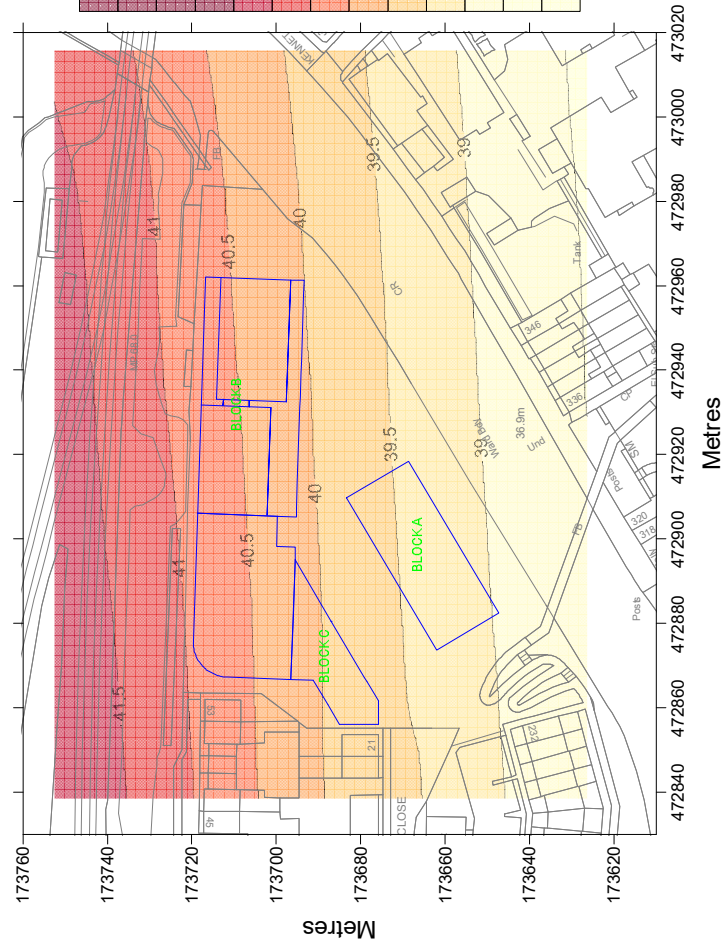
Heathrow Airport 2017



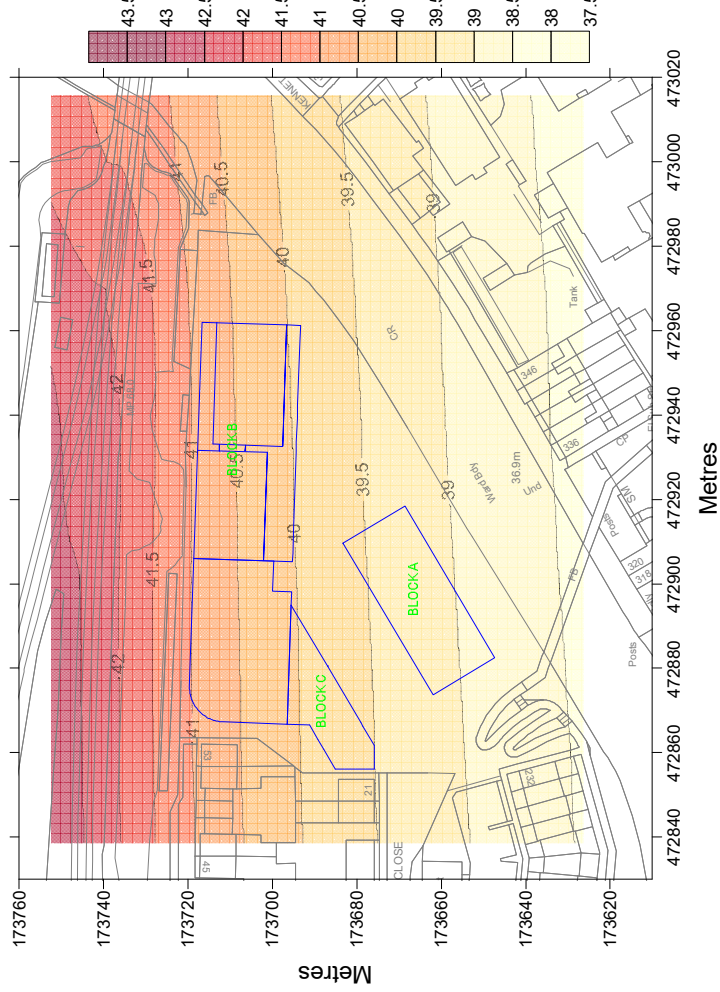
Appendix 5 – Annual Average NO₂ Contour Plots at 1.5m, 7m, 13m, 16m and 19.5m above ground level - 2024

APPENDIX 5

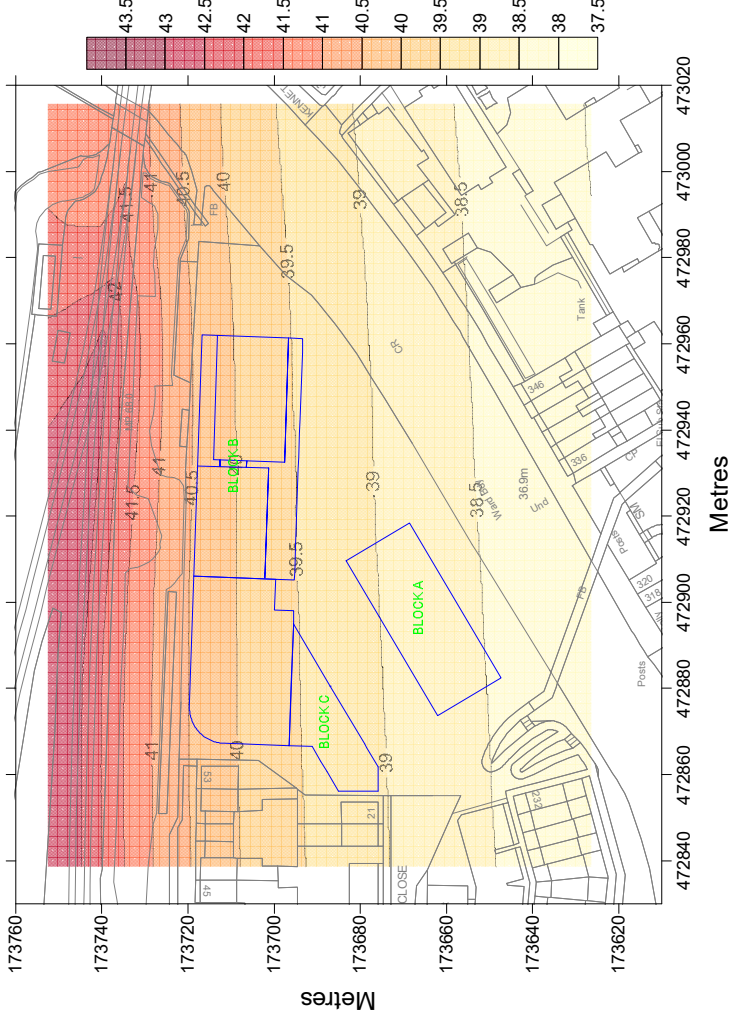
2024 NO2 concentrations ugm-3 at 1.5m above ground level



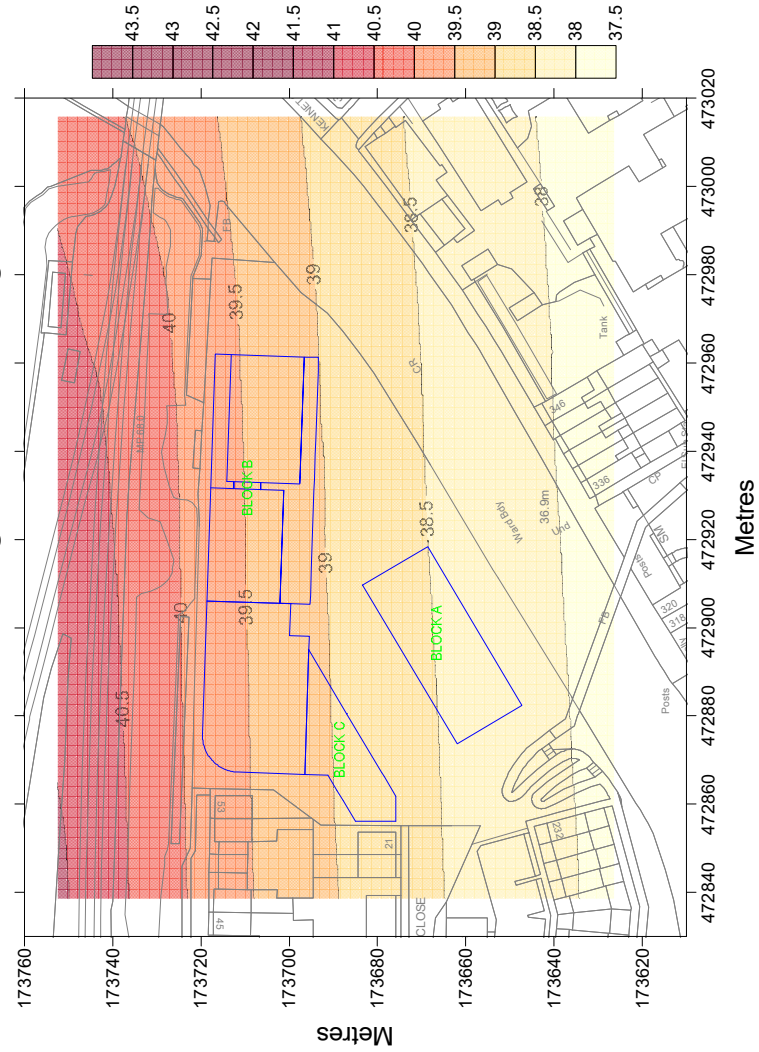
2024 NO2 Concentrations ugm-3 at 7m above ground level



2024 NO2 Concentrations ugm-3 at 13m above ground level



2024 NO2 Concentrations ugm-3 at 16m above ground level



2024 NO2 Concentrations ugm-3 at 19.5m above ground level

